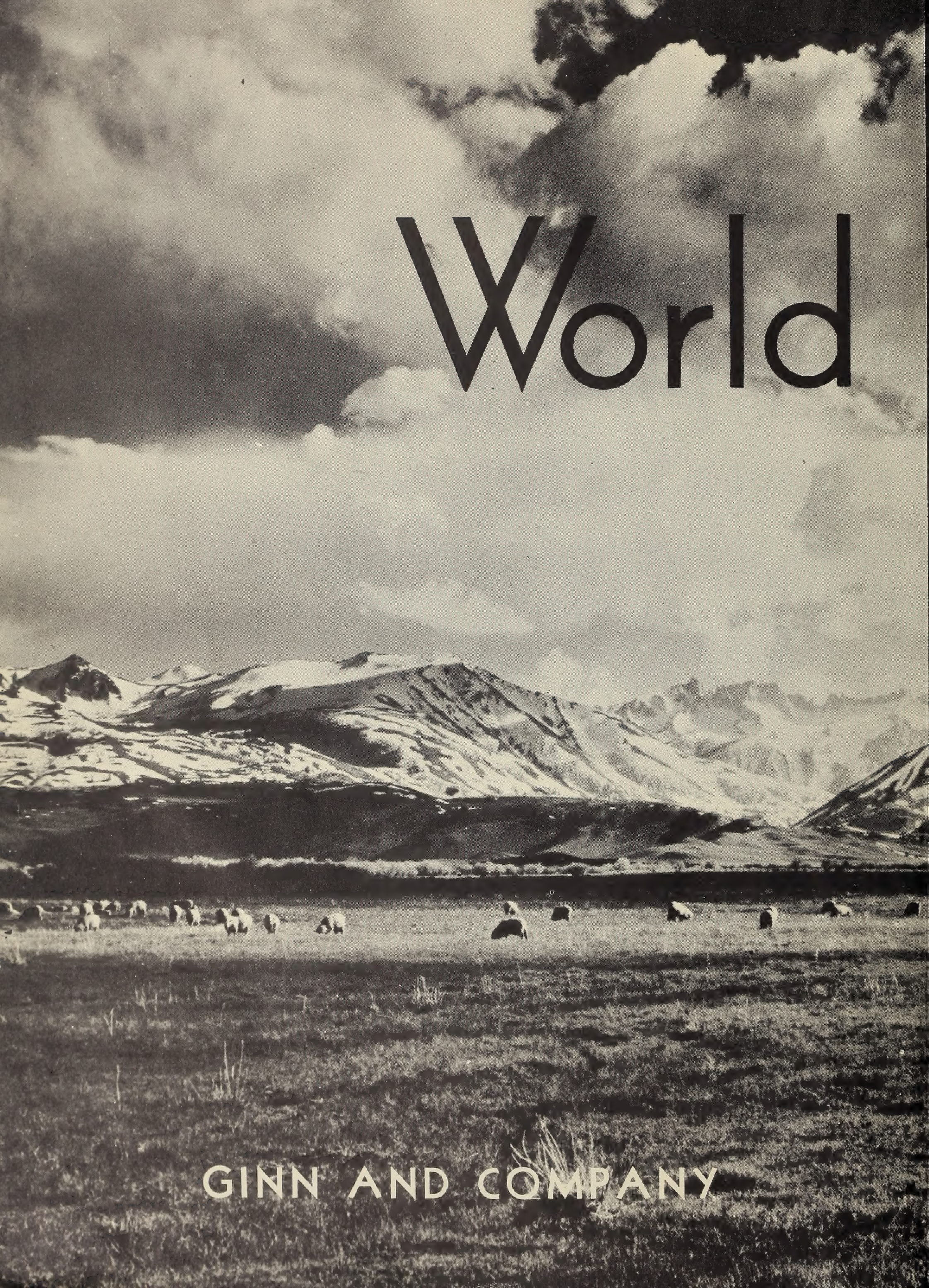
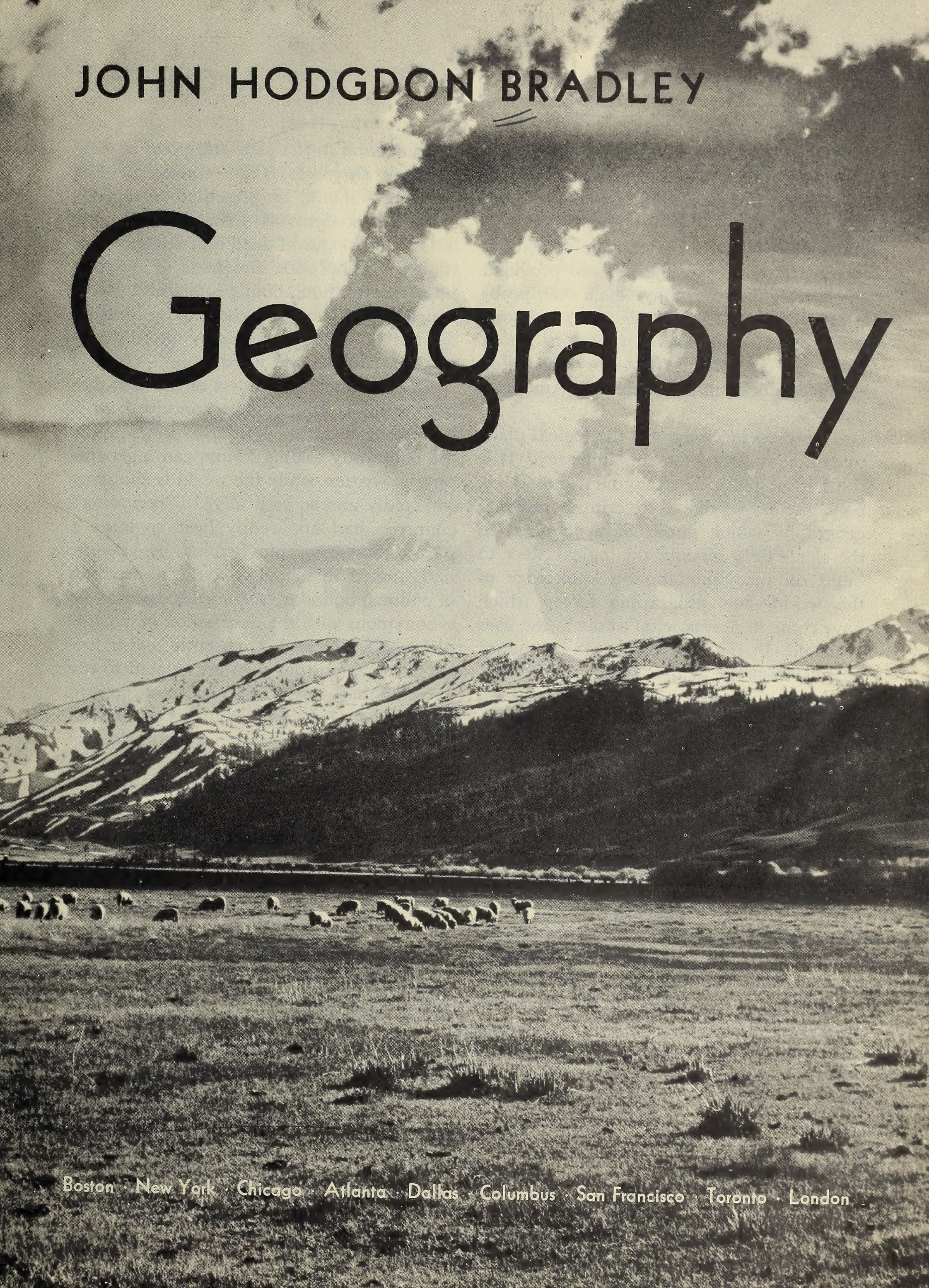
World Geography

JOHN HODGDON BRADLEY


World
GINN AND COMPANY

JOHN HODGDON BRADLEY

Geography



Boston · New York · Chicago · Atlanta · Dallas · Columbus · San Francisco · Toronto · London

A NOTE TO THE TEACHER

Many educators have come to realize that some of the most serious problems of North America are world problems with their roots in world geography. They have come to realize that American education, for all its excellence, has yet not provided the training in geography which such problems demand. They have come, in short, to feel that something must be done about what one prominent educator has called the geographic illiteracy of the American people.

The secondary school is the logical place to center an attack on this illiteracy. It is the logical place to strengthen and to expand the knowledge of descriptive regional geography which pupils have acquired in the elementary school; the logical place to build on this foundation a knowledge of the world-wide geographic forces which have come to play so vital a role in the lives of us all. In the past, American secondary schools have generally failed to do this. Where they have taught geography at all they have presented it in the severely restricted form of physical or economic geography, or as a relatively unemphasized adjunct to courses in history and current events.

A great many American educators have come to feel that geography so limited fails to meet the requirements of intelligent citizenship in the modern world. They have come to feel that a broad training in world geography should be an essential part of both the natural science and the social science programs in the American secondary school. Most heartily sharing this feeling, the author and publishers of this book offer it as the basis for a thorough, realistic, and dynamic course in world geography at the secondary school level.

Though the book itself best explains its methods and objectives, a few matters of policy should be mentioned briefly here. Fundamental to the plan and point of view of *World Geography* is the conviction that geography should be presented to secondary-school students as a living drama and not as a catalogue of dead and disconnected statistics. The odds and ends of encyclopedic information about peoples and places which have so often passed for geography do not constitute geography in any significant sense of the word.

One has daily reminders of the fact that geography is still widely conceived as a body of dead statistical information. People are constantly asking, "How can a geography be written while the world is changing so rapidly and so radically?" "Bounding" countries had apparently been so large a part of the "geography" which these people had studied in school that the destruction of political boundaries seemed to them to be synonymous with the destruction of geography itself. It had apparently never occurred to them that men are related to the earth no matter how boundaries are drawn; that the very shifting of political boundaries is in no small measure a reflection of geographic forces.

To be significant, the study of geography must lead to an understanding of these forces. It must point out the meaning and relationship of geographic facts. It must illuminate clearly the functional interdependence of all peoples and places the world around. This functional interdependence of peoples and places is the soil in which both world war and world peace grow. To understand it is the first need of world citizenship; to explain it is the first responsibility of a course in world geography.

In working out the design of this book, the author realized that to deal effectively with the larger concepts of world geography secondary-school students need more training in the use of the basic tools of geographic

T448.9

science than most of them have had. They need more training in map reading and in the interpretation of charts, graphs, and tables; more and still more knowledge of simple place geography. It was also realized that though secondary-school students are sufficiently mature to think in terms of principles, they must yet be led to an understanding of principles through an abundance of illustrations. Finally, it was realized that even in a geography of world scope the geography of North America should be emphasized.

World Geography and its accompanying workbook were carefully planned to meet these various special requirements. The trees of special requirements, however, were not allowed to obscure the forest of the main objective. That objective was to provide secondary-school students with training in the techniques of thinking geographically about world problems. With such training, Americans should be better able to cope with the world forces which are shaping—and will doubtless continue to shape—their individual and national fate.

J. H. B.

C O N T E N T S

Unit I · Geography in the Modern World

Unit II · Man and Climate

Unit III · Man and the Surface of the Lands

Unit IV · Man and the Natural Resources

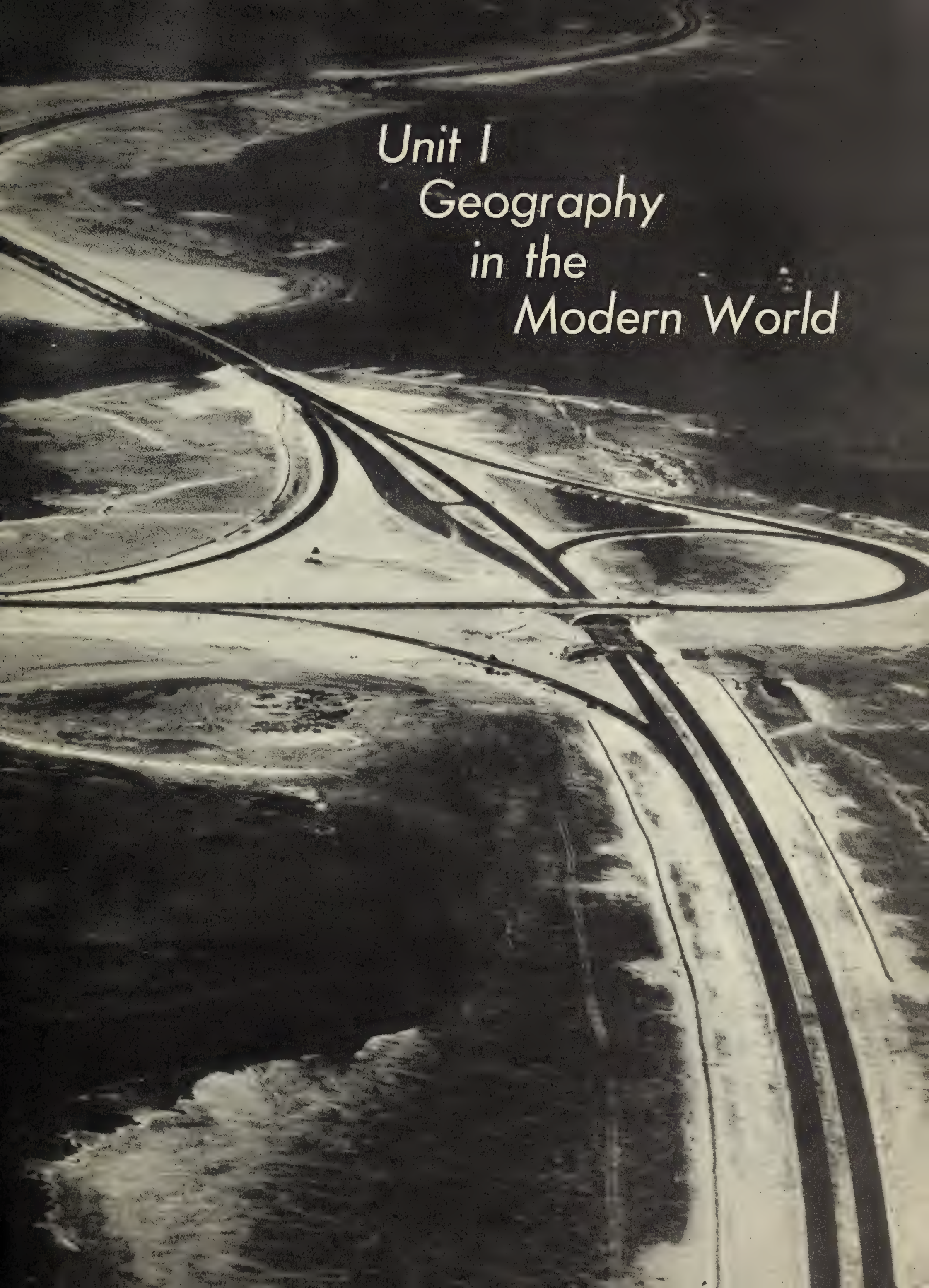
Unit V · Life Processes of Civilization

Unit VI · The Geography of Nations

ACKNOWLEDGMENTS FOR PICTURES ON TITLE PAGES

Pages ii–iii: *Soil Conservation Service*
Pages 1 and 191: *Ewing Galloway, N.Y.*
Page 23: *H. Armstrong Roberts*
Page 157: *Asheville Chamber of Commerce*
Page 251: *Keystone View Company*
Page 297: *T.W.A. Airline Photo*

Unit I Geography in the Modern World



1. WHAT IS GEOGRAPHY?

GEOGRAPHY AND ONE'S POINT OF VIEW

Geography and John Doe. If you looked in a dictionary for a definition of geography, you would probably find something like this: "Geography is the science of the relationship between the earth and its life." Geography, however, is not really so dull and so far from one's personal interests as such a definition makes it seem. It is actually a very lively and intimate matter. Every human being is in some way related to the earth, and that relationship is geography. Take, for example, the case of John Doe.

John Doe is just an ordinary citizen. Before the war he owned and operated a small truck and poultry farm on the Atlantic seaboard. He worked hard throughout the year, with little spare time for reading or unnecessary travel. He remembered little and cared less about the far-off places and peoples which he had studied in his elementary-school geography books. Geography for him had been just a heap of facts which were hard to learn but easy to forget. Busy with his farming, he comfortably forgot about geography.

Geography, however, was still very much with John Doe, though he did not realize it. If he had tried to draw a sketch of the world *strictly as it looked to him*, he would probably have produced something like the picture on page 3. This crude map of the world looks not at all like any other map of the world, but it shows some of the important relationships between John Doe and the earth. As such it shows that John did not really leave geography when he left school.

Though John Doe's map of the world seems lop-sided, limited, and silly to *you*, it contained a great deal of geographic truth for *him*. But when John joined the army and went to North Africa his map became worthless. Where once his life had been geared to the green fields and white towns of his homeland, it was now geared to the brown hills and military strongholds of Tunisia.

If John Doe had drawn a sketch of this new world strictly as he saw it, it would probably have resembled neither his old map nor any other map of the world. Like the old map, however, it would have shown elements of vital importance in John Doe's relationship to the earth. Like the old map, it would have been lop-sided and limited, but it would not have been silly so far as John Doe's life in Tunisia was concerned. This proves again that John Doe cannot possibly escape geography.

The geography of John Doe's world, of course, was much broader and more complicated than he suspected. Every time he ate his breakfast he entered into a relationship with Brazil, which gave him his coffee, and with Cuba, which sweetened it. Every time he lit his pipe he made a connection with Turkey and North Carolina, where the tobaccos of his smoking mixture were grown, and with Louisiana and Canada, which supplied the sulfur and the wood of the match. Dozens of times every day, but without realizing it, John Doe demonstrated that the geography of his life only began with the little of it which he saw and could illustrate in his own crude maps. The geography which he did not see was just as vital a part of his life as the small fraction which he did see.

Dinner plate geography. Just as John Doe's ideas of his personal world changed as his point of view changed, so have people as a whole changed their ideas of the world as a whole as their point of view has changed. Ideas of the world as a whole are the children of exploration. The word "geography" comes from the Greek words

This is John Doe's conception of the world when he was a farmer in Massachusetts.

for "earth" and "to write." The ancient Greeks, who gave us the word "geography," also gave us the first science of geography. Exploration gave the ancient Greeks the materials with which to build their science of geography.

More than three thousand years ago, venturesome men began to push out in all directions from the centers of civilization on the eastern shores of the Mediterranean Sea. Even before the fourteenth century B.C., the Egyptians had worked far to the southward into Africa and far to the eastward into Asia Minor. By the eighth century B.C., the Phoenicians had explored all the coasts of the Mediterranean in boats, and may even have reached England. After the fifth century B.C., the great city-states of Greece became the strongest nations in the ancient world, their citizens the most eager explorers of unknown seas and lands.

The purpose of all ancient exploration was trade and conquest, but much knowledge of the earth and its peoples was gathered along the way. The Greek Herodotus, of the fifth century B.C., seems to have been the first person to make a full written record of his travels. He wrote interesting accounts of the places and peoples he visited in Italy, North Africa, Persia, and along the shores of the Black Sea. His writings were very much like the letters you might send to a friend from a distant place which he has never seen. Herodotus was both tourist and geographer, perhaps more of the first than the second.

In spite of all his wanderings and observations, Herodotus held certain beliefs about the earth which you and I know are erroneous and extremely limited. For example, with most other people of his time, he believed that the earth was a flat disk or plate. He believed that the Mediterranean and Black seas, with their surrounding

Herodotus, leading geographer of the fifth century B.C., believed that the world looked like this.

lands, occupied the center of this great world plate, and that a mysterious ocean river made an unbroken margin round the edge. (See the map above.) Like the geography of John Doe, the geography of Herodotus was limited by his point of view.

As exploration continued to advance, knowledge of the earth and its peoples continued to increase. By the beginning of the Christian Era a vast store of learning had been loosely gathered together under the general heading of geography. The Roman geographer Strabo had completed a seventeen-volume treatise on the geography of the world as it was then known. It included information (and misinformation) on practically everything from the stars overhead to the soils underfoot. Though the known pattern of land and water had become more complex since the time of Herodotus, the world was still generally conceived as a flat plate with a margin of ocean.

Through nearly fifteen centuries of the Christian Era, most people clung to the dinner plate concept of the earth. The plate was badly cracked when Columbus discovered America well beyond where the outer edge was thought to be. When the sailors of Magellan traveled all the way round the earth in a general east-west direction a few decades later, the dinner plate fell to pieces.

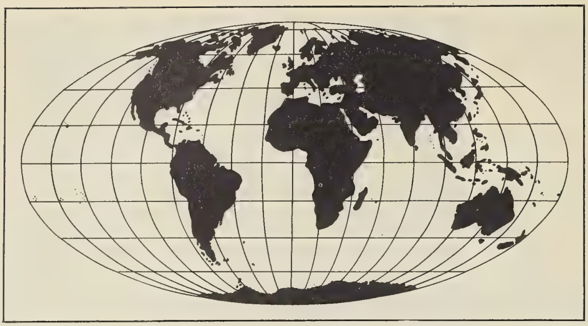
Cylinder geography. The dinner plate concept of the ancient and medieval world was perfectly reasonable and practical for people who had nothing but muscle-drawn caravans, rowboats, and small sailboats to carry them from place to place. Men moving in larger sailing vessels over trade routes which ran with the winds in a general east-west direction round the equatorial bulge of the earth had a different point of view. This new point of view was expressed in the kind of map which is shown on page 5. This type of map was designed by the sixteenth-century Dutchman Mercator as a chart of the world for sailors. Maps of this type are still known as Mercator maps.

The Mercator map pictures the earth as a cylinder instead of a dinner plate, with the cylinder cut and spread out to make a flat map. The result of this is that away from the equator both land and water areas tend to spread out and to look much larger than they really are. Notice Greenland on the map below. It seems almost as large as South America, but it is really very much smaller. The sixteenth-century sailors didn't mind such distortion of regions close to the poles because they seldom went into those regions.

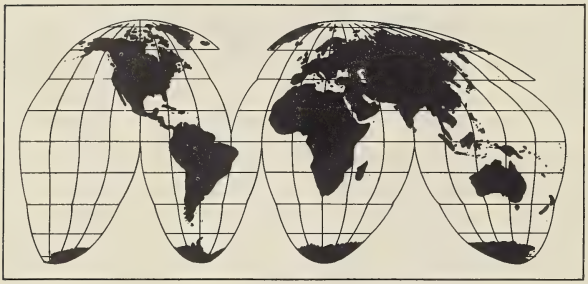
In spite of its faults the Mercator type of map is still useful because any straight line which is drawn on it represents a true and constant compass direction. Because of this fact modern navigators still use the Mer-

Life Magazine

The Mercator map shows the surface of the earth as it looks when transferred to the surface of a cylinder which touches the earth at the equator. Notice that the meridians, which come together at the poles on the globe, appear as straight parallel lines on the cylinder. Below you see how a Mercator cylinder map of the earth looks when spread out flat. Because the meridians do not come together at the poles, regions near the poles are made to appear much larger than they really are.



This is one of several types of maps which show the whole surface of the earth in an oval. Notice that land and water areas near the top and bottom of this map are not so badly distorted as in the Mercator map. This advantage is offset by bad distortion of shapes along the right and left margins.



This is one of several types of "interrupted" world maps which are made by splitting an oval world map into segments. Such maps show approximately the true shapes of the continents by sacrificing the true shapes of the oceans.

cator map in charting their courses. Nobody, on the other hand, should use this type of map as a guide to the size of the land and water areas of the globe, because it is worse than useless for this purpose.

The only really truthful map of the earth is like the earth, a globe. It is impossible to give a really true picture of a curved surface on a flat surface. Take half an orange, suck out the juice, and then flatten the skin with your foot. You will find that it does not spread out in a perfect circle. It rips and spreads at the edge into something that looks like a lop-sided cogwheel of a watch. Much the same thing happens when a flat map is made of a portion of the curved surface of the earth.

Modern map-makers have devised several kinds of world maps in the attempt to reduce the inaccuracies which result from this fact. In every case their success has been definitely limited. Two of the less inaccurate and therefore more useful of these world map types are shown on this page.

Though for centuries men had known that the earth is a sphere, they did not *feel* its spherical nature until the airplane was perfected. Until the very beginning of the Second World War, most of us were still thinking of the earth in terms of continents laid out in western and eastern hemispheres on the surface of a cylinder. This old point of view was so suddenly and completely shattered by the airplane that we haven't yet recovered from the shock. Let us see exactly what the airplane has done to our ideas of world geography.

GEOGRAPHY AND THE AIR AGE

The length of a mile. The airplane has first of all changed our ideas of distance, as a simple illustration will show. If your house were three miles from the house of a friend, it would be hard to see your friend very often if walking were the only possible way of getting from one house to the other. It would take about an hour to cover the distance between the two houses, and another hour to return home. But if either you or your friend had a bicycle, the three miles each way could easily be covered in half an hour. Though the distance would be just as great *in miles* in both cases, it would be only half as great *in time* if you traveled on a bicycle instead of on foot.

If someone asked you, "How long is a mile?" you would be correct if you answered, "5280 feet." You would also be correct if you answered, "A mile is 20 minutes long on foot and 10 minutes long on a bicycle." Nor need you stop there. An automobile traveling 12 miles an hour cuts the length of a mile to 5 minutes. At 60 miles an hour the mile becomes only 1 minute long. An airplane traveling only 180 miles an hour (some planes can travel more than twice as fast as this) cuts the length of a mile to 20 seconds.

What is the difference between walking a mile in 20 minutes and flying a mile in 20 seconds? There is the difference in the amount of excitement we feel, of course, but there is also something more important. If you care to do the arithmetic you will find that 20 minutes is just 60 times as long as 20 seconds. This means that a mile by airplane is only $\frac{1}{60}$ as long as a mile on foot, when measured by the time it takes to get over the ground. By airplane, the home of a friend three miles away becomes as close as your own backyard!

What the airplane has done to time distance. Though a mile is always the same number of feet long, it is obviously not always the same number of minutes long. It is clear that there are really two kinds of distance. We might call one *space distance* and the other *time distance*. In the past, people have thought of distance largely as space distance. More and more, and chiefly because of the airplane, people are coming to think of distance as time distance. By time distance the earth is rapidly shrinking and our ideas about the earth are rapidly changing as a result.

Less than 100 years ago the time distance between New York and San Francisco was months in a covered wagon over the land or in a sailing vessel round the tip of South America. Less than 50 years ago this distance had shrunk to a few weeks by steamship or a few days by rail. During the last few years the distance has shrunk to about half a day by plane. California, which once seemed all but out of reach, now seems nearer to New York than Boston did to George Washington when he made the journey in a stagecoach.

The oceans have shrunk even more than have the continents. Before airplanes began making regular trips across the seas, the fastest steamships averaged no more than 35 miles an hour on long trips. Airplanes can now cross the oceans at an average speed of better than 250 miles an hour. In 1522 the sailors of Magellan took nearly three years to sail round the world. There are many modern airplanes that could fly round the earth at the equator in three or four days!

What the airplane has done to space distance. Airplanes are changing not only our ideas of time distance but of space distance as well. The airplane is the only means of transportation which in all cases can follow the shortest route between two distant places. On land, the train and the automobile must follow the twisting channels of rivers through hilly and mountainous country because they do not have the power to move straight up very steep slopes. They must go round swamps and lakes in flat country. At sea, ships must often go round huge masses of land in courses which take them thousands of miles out of the direct way to their destinations. They must also swing away from the direct course to avoid dangerous reefs and shallows. The airplane encounters no such difficulties. If the weather is right, it can go anywhere by the shortest possible route.

The Mercator map, as we have seen, is helpful in showing routes which ships can follow. In many cases these ship routes are not the shortest possible routes, which air-

Great circles divide the earth into halves. The shortest route between any two places on the globe which are not directly opposite to each other follows the curving course of the one and only great circle which passes through those places.

planes take. Indeed, you could not even find the shortest possible route between two far-distant places on a Mercator map, as a few simple exercises will show.

With a piece of string find the shortest route between New York and Moscow on the map on page 5. Then use the string to find the shortest route between these two cities on a globe. How do the routes differ? Compare in the same way the shortest routes between New York and Calcutta as shown on map and globe. How do these routes differ?

Such simple observations prove that what seems to be the shortest route between two far-distant places on a flat Mercator map is not the shortest route on a curved globe. *The shortest route between two places on a globe is never a straight line.* It is always a curved line, and this line is always a portion of an imaginary circle which passes round the earth in such a way as to divide the earth into halves. Such a circle is called a *great circle* and can only be laid out on a globe, as shown at the left. Most flat maps tend to make us forget this important fact. They tend to give us wrong ideas of space distance, just as the means of transportation for which they were designed tend to give us wrong ideas of time distance.

Only one great circle passes through any two spots on the surface of a globe, except spots which are directly opposite to one another. You can prove this fact in a simple experiment. Mark two spots anywhere on the surface of an orange, except directly opposite to each other. Cut the orange in halves, making the cut pass through the two spots and also through the center of the orange. Do you see that there is only one way of doing this, only one great circle that passes through the two spots which you marked on the surface of the orange?

The same thing is true of the earth. To go by the shortest route between any two places on the surface of the earth, except places which are directly opposite to one another, one must follow the one and only great circle which passes through these two places. In many cases the airplane is the only type of transportation which can do this. Through its speed and its ability to follow great circle routes between the great centers of population on the surface of the earth, the airplane has brought these centers much closer together than they have ever been before. It has given us a new point of view for looking at the face of the earth.

New maps for the Air Age. When you look at an ordinary map of the world you find north at the top, south at the bottom, west at the left, and east at the right. Have you ever wondered why maps are made in this way? It is because we have been used to thinking of the earth with the equator at the middle and the north pole at the top. When we imagine the globe in that position, directions are as we find them on ordinary maps.

Have you ever thought that this way of thinking about the earth is only a habit? The earth is a globe and can be looked at with the axis in any position. With every

Comparison of these great circle air and ocean routes will show why the arctic regions have taken on a new importance in the modern world.

different position, directions will be different. "But why," you might ask, "is there any reason for changing the position in which we have imagined the earth? Why shouldn't we keep on thinking of the earth with the equator at the middle and the north pole at the top?" There is one very good reason why we should not, as we shall soon see.

Look at the map on page 10, which tries to show what you see when you look squarely at the north-pole half of a globe model of the earth. Notice that much of the map shows land. Which way is south on this map? Which way west? east? What has happened to north? Notice that the similar map of the south-pole half of the globe, on page 11, shows chiefly water.

These observations show that when we picture the earth with the north or south pole in the center instead of at the top or bottom of a map, strange things happen to directions. We should say rather that strange things *seem* to happen to directions because north, south, east, and west are in the same position with reference to the earth and to one another as they are in more familiar maps. It is only *our* position and *our* way of thinking about directions that have changed.

Land is conspicuous on a polar map of the Northern Hemisphere.

Any change in our way of thinking—in our point of view—seems strange at first.

These observations also show that most of the water of the earth is in the Southern Hemisphere and most of the land in the Northern Hemisphere. They show that the most important land masses on earth are grouped round the north pole. They show that all the oceans are really but one great ocean. The best way of getting an idea of this world ocean, and of the size, shape, and relations of these land masses, is to look squarely at the north-pole or south-pole half of a globe model of the earth. The next best way is to look at a flat map which tries to show what you see when you look at a globe in that manner.

Compare the size, shape, and position of Greenland as shown on the map on page 5 with the size, shape, and position of Green-

Water is conspicuous on a polar map of the Southern Hemisphere.

land as shown on the map on page 9. Notice also that the map on page 9 shows some of the possible great circle routes which airplanes can take between important cities of the world. Notice that in several cases these routes either cross or lie close to the arctic circle. Because of this the arctic regions are coming to have more importance in geography and in world affairs than anyone before the age of the airplane could have imagined. Maps with the north pole in the center are coming to have a similar importance in the geography and affairs of the Air Age.

Air routes and ship routes. Some of the main trade routes have been marked on the map on page 9. Compare these ship routes with the air routes between the same places, and you will see what a tremendous saving in both hours and miles the airplane

This cargo airplane is unloading freight at a remote field in Alaska.
Such "flying boxcars" will play a leading role in the world trade of the future.

has made possible. Notice, for example, that the ship distance between New York and Calcutta is almost twice as great as the airplane distance between these two cities.

Cargoes for distant lands, to be sure, must still be carried very largely by ships. Ships are still the cheapest means of carrying heavy freight, in spite of the long routes which they must generally take between far-distant places. But when time is more valuable than money, as it often is in periods of war, the more expensive haul by airplane may really be cheaper than the less expensive haul by ship. If light tanks are needed in a hurry on some Pacific island, they had better be carried by airplane. If sent by ship they might arrive after the battle was over.

It is for reasons such as this that the air transportation of freight is growing by leaps and bounds. It is safe to say that this kind of transportation will not stop growing in the future. The day is certainly coming when the freight plane will be of extreme importance in world trade. But we do not have to wait for that day to see that the airplane has profoundly changed the relationship of men to the earth and to one another. We shall see evidence of this throughout this book.

THE RELATIONSHIP OF EARTH AND MAN

The content of geography. As men learned more and more about the earth as a whole, they also learned more and more about special aspects of it. Almost as fast as geography grew, its body broke up into other natural and social sciences. The kind of subject-matter which you find today in such separate high-school courses as biology, history, and civics was once included in geography. Such college subjects as astronomy, geology, and anthropology were all once parts of geography. Geography has well been called the mother of the sciences. But now that her children have grown up, what has become of geography?

The search for geographic relationships. Robbed though she has been by her own offspring, the ancient subject of geography still exists. Its nature, however, has profoundly changed. Odds and ends of unrelated information about places and peoples can no longer qualify as geography. No collection of facts can add up to geography, in the modern scientific sense of the term, unless they create a picture with a definite design. Since about the middle of the nineteenth century, students of the earth have rather generally agreed that *a true science of geography must be based on a study of relationships.*

To illustrate what this means let us say that your class sets out to study a dairy farm on the outskirts of your town. One group studies the climate, soil, and grasses, and learns facts which are part of the subjects called climatology, physiography, and botany. Another group studies what the cows do with the grasses, and learns facts which are part of the subject called zoology. Yet another group studies how the farmer makes a living by selling the milk and butter which the cows produce, and learns facts which are part of the social sciences.

A final group tries to discover the relationships of the facts which the other groups have learned. It tries to discover how the climate influences the soil, how the soil influences the grasses, how the grasses influence the cows, how the cows influence the farmer, and how the farmer influences the milk and butter market. Since most influences work two ways, this group of students also tries to discover how the milk and butter market influences the farmer, how the farmer influences the cows, how the cows influence the grasses, and how the grasses influence the soil. This group, in short, tries to understand the dairy farm as a *working whole*, and as part of the world at large. By doing so it devotes itself to geography in the modern, scientific sense of the term. Do you see, then, that though geography draws many of its facts from other subjects, it can still be a subject in its own right?

The kinds of geography. Even when geography is limited to a study of relationships, it is still a vast and unwieldy subject. Very early in its history geography began to break up into different varieties. A large part of geography came to deal with the relationships of the earth as a heavenly body to the lives of the creatures on its surface. Out of this kind of geography, which is sometimes called *mathematical geography*, have come knowledge of the dimensions and movements of the earth and such practical arts as map-making and navigation. Another large part of geography came to deal with the varied relationships between the air, land, and water of the globe. Out of this kind of geography, known as *physical geography*, has come the special knowledge on which are based such practical arts as weather-forecasting and aeronautics.

Still another large part of geography came to deal with the relationship between the physical surroundings and the activities of men. This so-called *human geography* is the broadest kind of geography because it really includes all the other kinds. Its emphasis, however, is always less on the theater and more on the actors in the drama of human life on earth. It is the most important kind of geography because it is the foundation for both the understanding and the solution of the most serious problems of the world today. It is the kind of geography which, for the most part, you will find in this book.

The approaches to human geography. Though human geography may be broadly defined as *the science that searches for the relationship between the things men do and the regions in which they do them*, there are different ways of conducting the search. One way is to go forth with an eye on how man's surroundings limit his activities. A second way is to go forth with an eye on how man overcomes these limitations.

Spence Air Photos

Sculptured by weather and running water, the Grand Canyon of the Colorado River is one of the most sublime illustrations of change in the physical environment.

No man, for example, can swim like a fish or fly like a bird. By the very nature of man and the world he inhabits, such things are impossible. On the other hand, man can build ships and airplanes with which he can partly overcome these limitations. Wherever we look we can see man on the one hand being limited by his surroundings, and on the other hand overcoming the limitations through the power of his mind and the cleverness of his hands. Obviously, we must see him in *both* these lights if we are to see him clearly. There is a third approach to human geography, which attempts to do just that. This book will use that approach.

Man's physical environment. Wherever you watch the drama of human life, you see it unfolding on a stage with a definite setting. In New York, for example, you see it crowded onto the narrow finger of land which lies between the East River and the Hudson. In Los Angeles you see it more comfortably extended over a plain which lies between the Coast Range and the Pacific. In Butte you see it played on a stage set with mountains, in Omaha on a stage of flat and far-reaching prairie, in Yuma on a stage of almost rainless desert.

The stage on which the drama of human life unfolds may be called the physical environment. It has been built largely by forces other than man, and existed for ages before the drama of man began. The scenery on the stage has been continuously changed by the restless surface activities of air, rain, rivers, and glaciers, and by the restless writhings of earthquakes and volcanoes. Under the drive of these forces the scenery is still changing—but so slowly in most places that we do not notice the changes.

The physical environment differs widely from place to place, and its differences produce differences in the lives of men. The life of a mountaineer who never saw the sea is different from the life of a sailor who never saw a mountain. People of the Sahara Desert, under a rainfall of less than ten inches a year, act and think differently from people of Malaya, under a rainfall of more than one hundred inches a year. Men who raise corn on the plains of Illinois differ in many ways from men who raise copper from the mines of Arizona. Such differences among human beings make it clear that the physical environment is more than a mere stage on which the drama of human life unfolds. Because it influences and is influenced by the activities of men, it is also part of the drama. As such, it becomes part of human geography as well.

The fundamental activities of men. Like all other living creatures, man must eat and drink. Unlike most other creatures, he must also provide himself with more or less elaborate forms of clothing and shelter. In pursuit of these fundamental needs man indulges in certain fundamental activities. These activities are everywhere related to the localities in which they take place.

Natives of the African jungle, where game is abundant, live chiefly by *hunting*. People on the western shores of Norway, the bordering ocean of which is full of marine life, devote their time chiefly to *fishing*. Men of the vast grasslands of Argentina make a living chiefly by *herding*. On the rich soil of Iowa, *farming* is the main occupation; in the forests of Oregon, *lumbering;* in the mountains of Colorado, *mining*. Where raw materials, fuel, and transportation are cheap and abundant,—as in many cities of eastern North America and Western Europe,—*manufacture* and *commerce* are the major ways of life.

The cultural environment. These fundamental activities of men are related, in a variety of ways, to the physical environment where they are performed. Take, for example, the country landscape pictured on this page. Notice that *the striking thing about this illustration is not the physical environment in itself but what man has done to it through his activities.* A house where he shelters himself, barns

In this country landscape the cultural environment has greatly modified the physical environment.

James Sawders

Fairchild Aerial Surveys, Inc.

In this city landscape the cultural environment has almost entirely blotted out the physical environment.

where he shelters his domesticated animals, fences which enclose and protect his planted fields, roads over which he takes his produce to market—these are the links in the chain which unites man and his physical environment.

Wherever men live such chains exist, though they differ widely from place to place. Look at the city landscape shown above. Here, except for the river, the physical environment is all but blotted out by the works of man. Skyscrapers filled with offices and shops testify to his devotion to commerce, as also do the bridges across the river, the train yards, and the ships. Factories and warehouses fringing the skyscrapers speak of the manufacture on which the commerce is based.

So it is that wherever man lives he links himself to his physical environment through a great variety of structures. These structures are the elements of what may be called the cultural environment.

Changes in the cultural environment. Just as the physical environment is endlessly changing, so too is the cultural environment. The latter is chiefly the product of the activities of man, just as the former is chiefly the product of the activities of physical forces. Because human activities ordinarily take place at a much faster pace than the activities of weather, running water, and earth movements, the cultural environment ordinarily changes at a much more rapid rate than the physical environment.

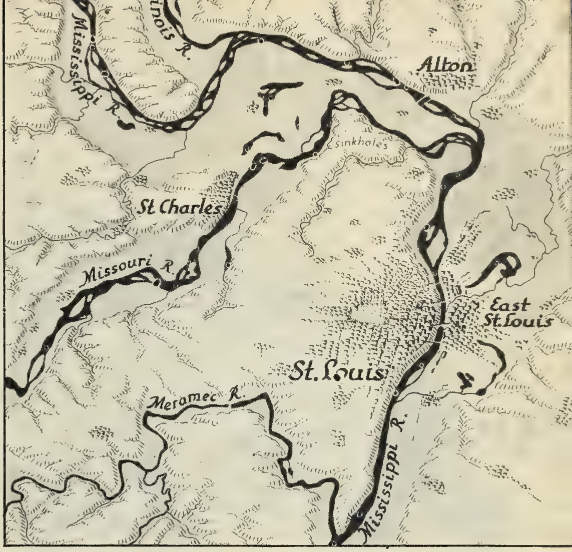
The Mississippi River at St. Louis, for example, flows through a valley which today is about twenty miles wide. Geologists tell us that in the beginning the Mississippi was a much smaller stream, that at the present rate of river wear the widening of its valley at St. Louis must have taken a long, long time. During most of this period there was no St. Louis, no cultural environment, no men. Only during the last hundred years or so did the cultural environment pass through the changes which turned St. Louis from a collection of shacks to a great modern industrial center.

Relationship of the physical and cultural environments. Though the rates of change in the physical and cultural environments are generally vastly different, the two environments are always related. If the Mississippi had not done what it did in the neighborhood of St. Louis, if the Missouri and the Illinois rivers had not joined the main river where they did, there would probably never have been a great city where St. Louis now stands. Man, on the other hand, has done much to alter the appearance of the physical environment by cutting down trees and plowing fields along the upper reaches of these rivers, and by dredging channels and building wing dams and levees along the lower reaches.

Is it not clear from all this that the physical and cultural environments are intimately tied together? Wherever we observe the two environments we can discover some reason or reasons for their relationship. We can see that the two environments have what we might call a blood relationship to each other. This relationship, in other words, is not one of accident but of cause and effect. It is not still and dead but ever-changing and alive. So, too, is human geography, which is the science that tries to understand it.

The earth and its people. Outside your author's window lies a sloping pasture with a woodlot beyond. The pasture gives way at its lower end to a field with a water tower on one side, a dwelling on the other side, and a greenhouse in the middle. In this scene of mingled physical and cultural features the most important element in the eyes of a human geographer occupies little space. That element is the man who is walking from the dwelling to the greenhouse.

Similarly, the most important element for a human geographer in the vast panorama of the earth as a whole is the human beings who dot that panorama. The first and most important fact of human geography is that some two billion people live on the 197 million square miles of the earth's surface. Two billion people are too many for our imagination to grasp when we think of them by themselves. But when we think of them in relation to the earth on which they live their number becomes considerably less impressive.



St. Louis, like all other great cities, is intimately related to its physical environment.

If all the people of the earth were evenly distributed over all the surface of the earth, there would be about 10 people to every square mile of surface If, on the other hand, they were gathered together as closely as an audience in a theater, 50 square miles would hold them, with plenty of room to spare. If they were packed like sardines in a box, all the people on earth would occupy no more space on the surface of the earth than a fairly small mountain peak.

When we look at the actual arrangement of people on the surface of the earth, as shown on the map on pages 18–19, we are impressed by two outstanding facts.

1. Most of the surface of the earth has relatively few people or none at all.

DENSITY O

Each dot represen

POPULATION

50,000 people

Armadillo Projection

2. Most of the people of the earth are concentrated in a few relatively small areas.

Of the 197 million square miles of the earth's surface about 142 million is covered with water, which makes it unsuitable for permanent human habitation. Of the remaining 55 million square miles, about 5 million square miles is covered with year-round ice and snow, and is therefore unsuitable for permanent human habitation. At least another 5 million square miles is too dry for permanent human habitation. About half of the remaining 45 million square miles supports a very limited human population. This leaves only about 22 or 23 million square miles as the homelands of most of the two billion people.

Within the inhabited areas of the globe people are very unevenly distributed, as you can see by the map. The state of Nevada, for example, has on the average less than one person to the square mile, whereas the island of Java has on the average more than 850 persons to the square mile. About three fourths of all the people on earth live on the great continent of Eurasia, but most of them are concentrated in three great centers of population: Europe, China, and India. The continents of North America, South America, Africa, and Australia combined have fewer people than Europe alone.

Why are the people of the earth arranged in this fashion? Human geography can contribute much of the answer to this mighty question because to a large extent *people are distributed over the earth in proportion to the ability of the earth to support them.* To a large extent their lives differ from place to place, as the elements of their physical environment differ from place to place. But with so many people so variously related to the earth and to one another, where can we begin our study of human geography? How can we discover the great truths of geography in a wilderness of details?

There are several good ways of doing so, and each way throws light on a particular kind of geographic truth. Each unit of this book uses one of the ways which modern geographers have followed to fruitful ends; each unit tries to make clear one major aspect of the relationship between men and the earth. The book as a whole, however, tries to do much more than this. It is only too clear that John Doe can never again get along with ideas of geography which are bounded by his own pasture fences. Never before have men and the earth been so intimately bound together in one gigantic world union. Never before has it been so necessary for us to broaden and deepen our knowledge of geography; to know where we stand with reference to geography as a whole. This book as a whole is dedicated to that need.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. Geography is the study of facts about the earth which have very little relationship to one another.

2. The geography of our own immediate surroundings is the most important kind of geography. It is interesting to learn about other lands, but they affect us very little.

3. "Dinner plate geography" is the ability to talk intelligently about the world at the dinner table.

4. The Mercator map of the world is widely used because it shows the true sizes of all the continents in relation to one another.

5. The Mercator map is so inaccurate that it should never be used.

6. The length of a mile is always the same.

7. The distance from New York to San Francisco has become less in the last one hundred years. This is because the space distance in miles has become less.

8. The shortest distance between two places on the earth is always a straight line.

9. North is always at the top of a map with south at the bottom, east on the right side, and west on the left side.

10. Airplanes have largely replaced ships as carriers of freight.

11. People's surroundings limit their activities and there is no way of overcoming any of these limitations.

12. People are unevenly distributed over the earth because they like certain places better than other places.

QUESTIONS FOR DISCUSSION

1. In the past, many people believed that the study of geography was chiefly a matter of learning such odds and ends of unrelated information as the names of rivers, mountains, boundaries, imports, exports, and the like. In view of what you have studied in this chapter, what would you say are the chief reasons why this limited view of geography is out of date in the world today?

2. We cannot escape geography, even if we sometimes do not want to study it. Is this true in your own experience; and if so why?

3. Can you give any examples from your own experience of the fact that the physical environment affects men differently in different places?

4. The outlook of a person who lives in the country is different from the outlook of a person who lives in a city. Give as many illustrations of this fact as you can from what you know of the farmers and townspeople of your neighborhood.

5. Are the people who live within one hundred miles of your home evenly or unevenly distributed? How do you explain their distribution?

THINGS TO DO

1. Make a list of all the materials and commodities (with special reference to food, shelter, and clothing) which you use repeatedly in your daily life. Mark the things that come from within ten miles of your home and those that come from a greater distance. Mark all items that come from foreign countries and, wherever possible, write in the name of the country. How many things come from your immediate neighborhood, from your country outside your immediate neighborhood, and from foreign countries?

2. Select two places at a great distance from each other (such as New York and Moscow) and list the advantages of traveling between them by airplane rather than by boat and train. List the disadvantages.

3. Examine the picture of a country landscape on page 15. Make a list of the physical features in this picture. Make another list of the cultural features, which man has added to the landscape. Examine the picture of the city landscape on page 16 and list the physical and cultural features.

4. Make a report on the physical and cultural environments in which you live. List the fundamental activities that take place round your home. Describe how each activity contributes to the cultural environment and how each is affected by the physical environment. If any activity is of outstanding importance, explain why.

5. Start a geography scrapbook. You will find many items in newspapers and magazines in which some aspect of geography is important. Arrange these materials in your scrapbook in units similar to the units of this book.

6. Examine the map of population distribution on pages 18–19. Make a list of the regions where people are thickly concentrated and another list of the regions which have few or no people.

BOOKS TO READ

Many people believe that high-school students would rather do anything than read a book. If this is true the authors of books must take at least part of the blame. The author of this book believes that high-school students will read books, even "instructive" books, if they are interestingly written.

The most interesting books in the world would look dull in a list of titles that resembles a page from a telephone directory. There will be no such list in this volume for you to neglect. Every recommended book will carry a brief description designed to help you to decide if you care to read it. No book will be recommended which has not been found interesting by many people like yourself.

1. Stories of exploration make exciting as well as instructive reading. *Great Adventures and Explorations*, by Vilhjalmur Stefansson, will give you some of the best and most important of these stories, from the earliest times to the present, in the words of the explorers themselves.

2. There are many interesting books about the importance of the airplane in modern world geography. Try *Human Geography in the Air Age*, by George T. Renner, or *New World Horizons*, by Chester H. Lawrence, for general discussions of this vital matter. Look up *Atlas of Global Geography*, by Erwin Raisz (who made many of the illustrations in *World Geography*), for interesting information on modern maps and map-making. Later in this book, when we deal with special phases of Air Age geography, we shall recommend other books that pay particular attention to these phases.

3. The great French geographer Jean Brunhes was one of the first to present a clear picture of the basic problems of human geography. His book *Human Geography* may seem difficult, but it is worth examining for the many interesting passages it contains. *Influences of Geographic Environment*, by Ellen Semple, is an American classic in the literature of human geography, and is much more interesting than it sounds. Neither of these books, however, falls in the class of "easy reading." *Geography in Human Destiny*, by Roderick Peattie, is an easier and more recent book of this type.

Unit II
Man and Climate

THE STORY OF A FAILURE

How James Smith learned geography. In 1916 James Smith was a young man who had worked on an Iowa farm for several years. He had saved his money and was about to realize the ambition of his life: to buy a little farm on the good black soil of his native state. The only thing that made him hesitate was the news that reached him from Montana. For three years wonderful crops had been harvested on the plains in the eastern part of that state. Farmers were getting rich on land that had not cost them a penny, because the government had given it to them under the Homestead Act of 1909.

Smith began to dream of what he could do on a Montana farm of 320 acres which could be his merely for the asking. He heard that the plowing of the land had by some magic increased the rainfall on the dry Western plains; that "dry farming" (farming without irrigation) there was no longer a gamble. And while he was thinking about these things the government passed the Homestead Act of 1916, which allowed one man an entire section of land, 640 acres.

Smith made his decision. Why spend his hard-earned money to buy a 10-acre farm in Iowa when he could have a 640-acre farm in Montana free? Why not take up a homestead on the plains, raise wheat for the booming World War market, and get rich as others were doing? There seemed no good argument against it. Smith filed on a section of Montana land, bought seeds and tools in Iowa, and headed for the great open spaces.

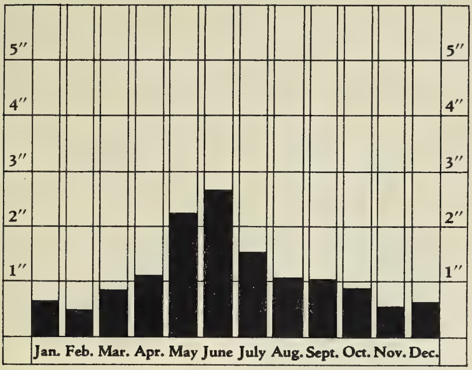
He found his land some twenty miles from a village in the midst of a vast flat landscape. His hopes fell a little when he saw how barren and wild the country was, but they rose when he remembered what other men had done with just the same kind of land. By late fall he had a shack built and his acres partly fenced. Through the long winter, when the blizzards howled, he dreamed of next year's harvest.

When the earth finally softened under the heat of returning spring, Smith plowed and planted a large piece of his new domain. He planned to increase his planting each year until he had all the land under cultivation. He watched the sky for showers which alone could make his glowing dreams come true.

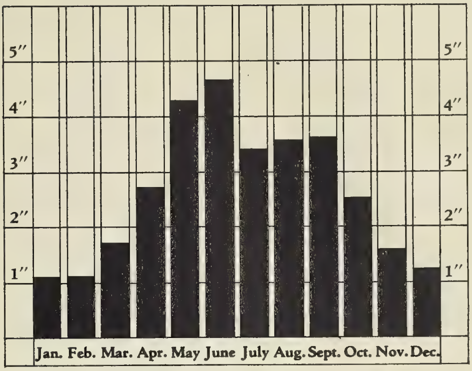
He watched and watched, but the showers did not come. Clouds would bank up on the distant horizon, and sometimes they would even cover the sky, but their moisture never fell on his land. The little wheat seeds sprouted, however, with the moisture that winter snow had given to the soil. Smith was confident that rain would come before July was over.

Rain, however, did not come in July. Instead came winds as hot as the blast from an oven. Day after day the deadly air poured over the little wheat plants. All Smith could do was watch them shrivel and die. Because Smith was courageous he reasoned himself out of despair. A dry farmer, he thought, must expect a bad year once in a while. Next year would probably be a good year. With twice as much land under

The shack that James Smith abandoned has gone to rack and ruin.



Annual rainfall at a station on the Montana plains.



Annual rainfall at a station in central Iowa.

cultivation, this year's loss could be written off the books.

But next year was not a good year. It was another drought year. Montana, in fact, had entered the worst period of crop failure in her farming history. Smith lasted three seasons and then his savings ran out. He returned to his old job on the Iowa farm, a sadder but wiser man. His shack remains as a gravestone over his fallen hopes.

The history of the Western plains has been to a large extent the history of countless James Smiths. Unburdened by any reliable knowledge of geography, they flocked into regions which were too dry for farming without irrigation, except during rare rainy seasons. Hardship and heartbreak were the only crops which in the long run these unfortunates were sure to harvest. The more recent retreat of beaten farmers from the Dust Bowl of the Southwest (see illustration on page 219) is only a fresh example of what has happened over and over again in the history of man's relationship to the earth.

Why James Smith failed. James Smith failed in his venture on the Western plains for several reasons, but chiefly because he did not reckon properly with the climate. He did not realize that a few wet summers in a normally dry climate are a poor guarantee that following summers will be equally favorable to dry farming. Above are two charts, one showing the annual rainfall for a number of years at a station on the Montana plains, the other giving the same information for a station in Iowa. If Smith had seen such charts as these before he made his disastrous decision, he never would have made it. He would have known that the methods of farming which succeed in the long run in moist Iowa were bound to fail in the long run in dry Montana.

The importance of climate. The chain of relationships which runs from climate through vegetation to the life of an individual man is one of the most important elements of geography. In one way or another, all men are related to vegetation and climate. All men must have food, clothing, and shelter, needs which are supplied very largely by vegetation. Vegetation, in turn, is under the direct control of climate.

In places with widely different climates men lead widely different lives because of these differences in climate. Eskimos in lands where frost makes farming all but impossible are chiefly hunters and herders. Arabs in lands where water is scarce and widely scattered are wandering herders and traders. Men whose energy is sapped by the sun and rain of the tropics show neither the health nor the achievements of men in the temperate zones.

A.A.A. Photo by Harmon

This is the dream of James Smith which never came true.

Unlike most of the physical elements which influence the lives of men, climate is practically uninfluenced in return. This does not mean that man is a helpless slave of climate. In a very real sense he makes his own climate through such devices as houses and clothing. In many other ways he limits the limitations and exploits the advantages of the climate under which he lives. So important are these adjustments in the world picture of man in his surroundings that we have reserved this entire unit for their study. Let us begin by seeing more precisely what climate is.

CLIMATE AND THE MOVEMENTS OF THE EARTH

Weather and climate. In the course of a year on the Montana plains, James Smith experienced a variety of examples of what men call weather. He heard the winter blizzards howl round his flimsy cabin, and felt the sting of the driven snow when he ventured out. In summer he watched the thunderstorms break with sound and fury round the rim of the horizon. Cold days, warm days, clear days, cloudy days, still days, stormy days, trooped in endless succession through the year.

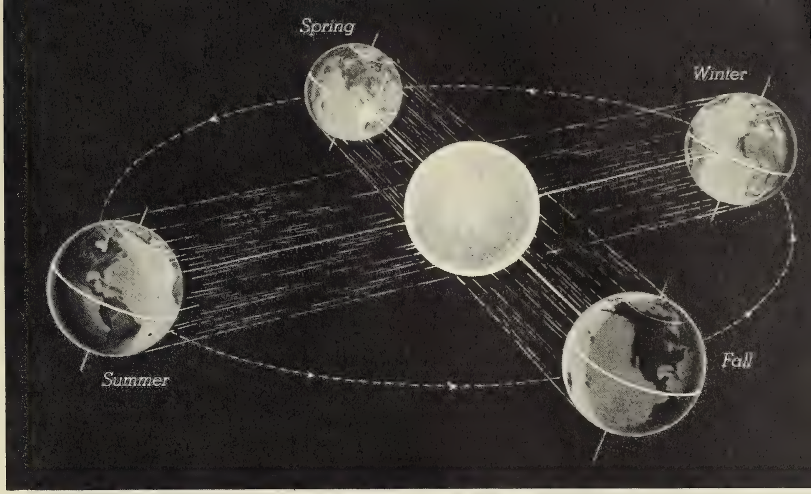
The sea of air, at the bottom of which we live, is restless. What we call weather is the result of this restlessness. We might define weather more exactly as *a local and temporary condition in the atmosphere.* Heat, moisture, and wind in different combinations produce the different atmospheric conditions which are known as weather.

Weather plays a part in every man's life, sometimes an important part. More than one Great Plains farmer has seen the hope of a year beaten to death in an hour by that particularly violent kind of weather which is known as a hailstorm. James Smith escaped this kind of misfortune. It was not any local and temporary condition in the atmosphere which led to his downfall as a dry farmer. His failure resulted from *a general and lasting condition in the atmosphere* which is known as climate.

Climate has often been described as "average weather." Los Angeles, for example, has many dry sunny days in the course of a year; so we say that the climate is "sunny." London, on the other hand, has many damp foggy days; so we say that the climate is "foggy." This does not mean, of course, that it never rains in Los Angeles or that the sun never shines in London. It means that the weather is *generally* clear in Los Angeles and *generally* foggy in London. Rather than to call climate "average weather" we might call it "dominating weather."

Under all the different weather conditions which James Smith experienced on the

This diagram shows what causes the different seasons in the Northern Hemisphere. What alterations would have to be made in this diagram to show the seasonal changes of the Southern Hemisphere?



plains of Montana, there existed in the atmosphere of that region a condition which was more or less constant throughout the year and over periods of many years. That condition was dryness. Less than 20 inches of rain fell on James Smith's ranch in any one normal year, and only part of that normally fell at the right time to help his crops. This general dryness was the chief reason for James Smith's failure. It is also the reason why we say that the region has a dry climate.

The march of the seasons. Climate, like weather, is produced by a combination of heat, moisture, and movement in the atmosphere. The conditions in the atmosphere which determine climate, however, are themselves determined to a considerable extent by conditions outside the atmosphere. Heat is perhaps the most important element of climate, and nearly all the earth's heat comes from the sun. The position of a region with reference to the sun has therefore a vital bearing on its climate.

You probably remember from your study of geography in the elementary school that the earth spins round the sun on the plane of its orbit like a poorly spun top on a floor. The axis of the earth is not straight up and down but inclined at an angle of $23\frac{1}{2}$ degrees to the perpendicular. As the earth revolves round the sun on its slanting axis, the rays of the sun strike it differently at different times. The different climatic conditions which we call the seasons are one of the results of this.

Notice in the diagram above that when the earth is in the position marked "Winter," the northern end of its axis slants *away* from the sun. More sunlight falls on regions south of the equator than on regions north of the equator. When the earth is in this position the Northern Hemisphere has winter, the Southern Hemisphere summer.

Notice that these conditions are exactly reversed when the earth has moved into the position marked "Summer." There the axis slants *toward* the sun. The Northern Hemisphere gets more sunshine and has summer; the Southern Hemisphere gets less sunshine and has winter. Notice finally that halfway between the "Winter" and "Summer" positions the earth passes through positions marked "Spring" and "Fall." In these positions the axis slants neither away from the sun nor toward it; the rays of the sun strike the Northern and Southern hemispheres equally.

Temperature and the length of day and night. The temperature changes which take place from season to season are of great importance in our lives. Among the causes of these seasonal changes in temperature are seasonal changes in the length of day and night. When the days are short during winter in the Northern Hemisphere, the

This is how the earth is lighted on the first day of summer in the Northern Hemisphere.

earth receives less heat from the sun than it does in summer, when the days are long. The differences in the length of day and night result from the different ways in which the rays of the sun strike the earth as the earth moves in its orbit.

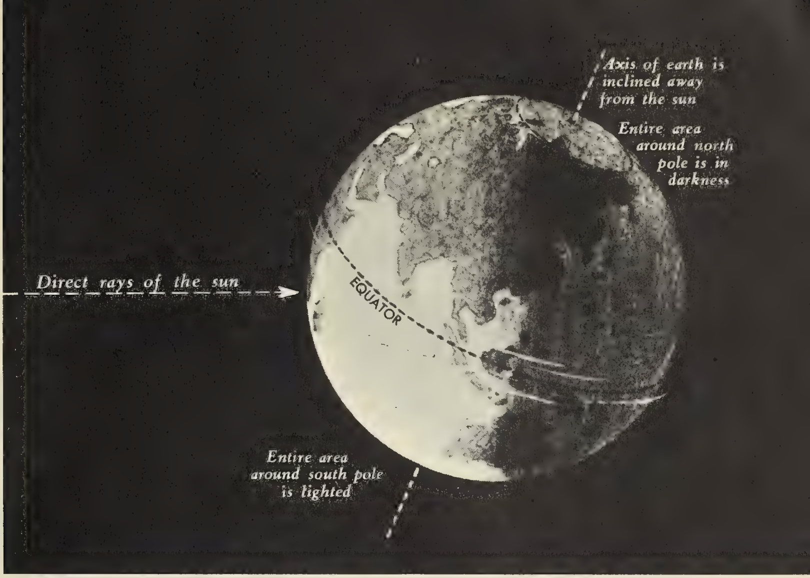
When the earth is just entering the positions marked "Spring" and "Fall" in the diagram on page 27, the rays of the sun strike the equator vertically at noon; both poles get the same amount of light and everywhere on earth between the poles day and night are of equal length. This happens twice each year, on or about March 21 and September 23. These dates are known respectively as the spring and the autumn, or fall, *equinox* (*equinox* means "equal night"). On these dates spring (fall in the Southern Hemisphere) and fall (spring in the Southern Hemisphere) begin in the Northern Hemisphere.

As the earth moves away from the positions marked "Spring" and "Fall," the vertical rays of the noonday sun shift respectively to the north and to the south of the equator. When the earth is just entering the positions marked "Summer" and "Winter," the vertical rays reach the limits of their range to the north and to the south of the equator. This happens twice each year, on or about June 21 and December 22. These dates are known as the summer and the winter *solstice*. *Solstice* means "a standing still of the sun." The term is applied to the two days in the year when the noonday sun reaches its highest position in the sky, where it seems to stand still before beginning to descend.

The lighting of the earth at the summer solstice is shown in the diagram above. Notice that the northern end of the axis is inclined toward the sun; that the vertical rays of the noonday sun strike the earth well north of the equator; that the lighted area of the earth extends well beyond the north pole, while the region round the south pole is in darkness.[1] It is easy to see that with the earth in this position the Northern Hemisphere gets more light than the Southern Hemisphere; that the farther north you went, the longer you would find the day and the shorter the night. Near the north pole, in the land of the midnight sun, you would find the sun above the horizon through all the twenty-four hours.

[1] "Darkness" here and in the following discussion does not mean total darkness. In the polar regions, as everywhere else, there is considerable light in the form of twilight when the sun is below but near the horizon.

This is how the earth is lighted on the first day of winter in the Northern Hemisphere.



If, on the other hand, you should go to the south on this date, you would find conditions reversed. The farther south you went, the shorter you would find the day and the longer the night. Near the south pole, the sun would be below the horizon through all the twenty-four hours.

The lighting of the earth at the winter solstice is just the opposite of the lighting at the summer solstice, as you can see in the diagram above. The southern end of the axis is then inclined toward the sun; the vertical rays of the noonday sun strike the earth well south of the equator; the region round the south pole is lighted, while the region round the north pole is in darkness. As the lighting of the earth shifts from one extreme to another with the gradual swing of the earth in its orbit, the amount of heat which different regions receive from the sun shifts in accordance. The climate of the different regions is affected, and with it the lives of mice and men.

Temperature and the slant of the sun's rays. The temperature changes which take place from season to season depend only partly on the differences in the length of day and night. They depend chiefly on the different angles at which the rays of the sun strike the surface of the earth. Let us say that you live in Chicago, which is about halfway between the equator and the north pole. As

The different temperatures of the different seasons are due to the different angles at which the rays of the sun strike the surface of the earth.

The astronomical zones of the earth are determined by the tilt of the earth on its axis.

the diagram on page 29 shows, the rays of the sun strike your region on less and less of a slant as the earth moves from its winter to its summer positions. Notice in the diagram that because of this fact sunbeams of the same width cover narrower and narrower areas on the surface of the earth.

The energy of the sun is changed into heat when its rays strike the surface of the earth, heat which is concentrated into narrower and narrower areas as the rays strike the earth at higher and higher angles. Do you see, then, why summer is the warmest and winter the coldest season of the year? Do you see how the revolution of the earth round the sun affects the temperature of its surface?

The astronomical zones of the earth. The way in which the earth makes its journey round the sun is the basis for one of the oldest classifications of climate in the history of geography. The map on this page shows the five zones into which the surface of the globe can be divided on this basis.

We have seen that the region round the north pole is in sunlight through all the twenty-four hours of the summer solstice, and in darkness through all the twenty-four hours of the winter solstice. The area so affected extends 23½ degrees south of the pole (which is 66½ degrees north of the equator) because the slant of the earth's axis is 23½ degrees away from the perpendicular. This region is set off by the arctic circle, and is known as the *arctic, or north frigid, zone.* The antarctic circle sets off the *antarctic, or south frigid, zone* in a comparable way.

Zones set off in this way are chiefly zones of light, and as such they have little relationship to climate. Nevertheless, the frigid zones vary greatly in heat, as well as in light, between the seasons of light and darkness. And though they get neither more nor less light than the rest of the earth in the course of a whole year, they get considerably less heat. In these zones the sun is never more than 47 degrees above the horizon. The rays strike the earth at such low angles that little heat is developed. For this reason the frigid zones are on the whole the coldest zones on earth, and may be thought of in a general way as climatic zones.

Another zone is set off on the basis of the way in which the vertical rays of the sun shift back and forth from north to south with the movement of the earth in its orbit. Because of the $23\frac{1}{2}$-degree tilt of the axis, the shift of the vertical rays is held between parallel circles which lie $23\frac{1}{2}$ degrees north and south of the equator. The northern circle, which the vertical rays reach at the summer solstice, is called the tropic of Cancer; the southern circle, which the vertical rays reach at the winter solstice, six months later, is called the tropic of Capricorn. The region between these parallel circles is called the *torrid, or tropical, zone.*

This zone, like the frigid zones, is a heat zone, as well as a light zone. The noonday sun is always well up in the sky over all this region, with the result that seasons differ little from one another. The rays of the sun strike the earth at high angles throughout the year, thus making the torrid zone on the whole the hottest zone on earth.

Between the polar zones and the torrid zone lie the *north temperate and south temperate zones.* Intermediate in their position on the globe, they are also intermediate in their lighting and heating. Unlike the frigid zones, the temperate zones never experience periods of total light and total darkness. Unlike the torrid zone, they never have the sun directly overhead. Their seasons are well marked, with winter that is cold but not so long as the winter of the frigid zones, and with summer that is warm but relatively short. The weather, on the other hand, may at times be so severe in these zones that "violent" would seem a better word than "temperate" to describe them. Such extremes, however, are short-lived.

Thus it is that the movement of the earth in its orbit sets up a general plan for the division of the earth into regions of different climate. So many things work to change and complicate this simple pattern, however, that we cannot accept it as an accurate picture of the earth's climatic regions. We must look more at the earth and less at the sun if we are to know these regions as they vitally affect our lives.

CLIMATE AND VEGETATION

The complexity of climate. The picture of climatic regions presented above would be accurate only if the earth were made entirely of land which stood everywhere at the same elevation; only if the earth were not bathed in a moist and wind-tossed ocean of air; only, in short, if heat were the sole element of climate, and if the heat were distributed solely with reference to the relative positions of sun and earth. Four attributes of the earth greatly complicate the simple classification which can be made on the basis of the earth's relationship to the sun. They are

1. The division of the surface of the earth into areas of land and water.
2. The division of the lands into mountains, hills, plateaus, and plains.
3. The distribution of moisture in the air.
4. The distribution of different air pressures, and of the winds which result from these different pressures.

As we go on with this unit we shall see something of the importance of these four attributes of the earth in shaping its different climates. Their influence on climate is a whole science in itself, but one which we can only touch upon here and there. As human geographers, our chief business is not to explain climate but its effect upon human beings. Is there any way of dividing the earth into clearly different climatic zones on the basis of the importance of climate to man?

The answer is yes, through the medium of vegetation. Just as James Smith was related to the climate of the Western plains through vegetation, so are people all over the world related to the climate of their particular regions. Vegetation is the most important link in the chain which unites climate and man. It is also the magic wand which turns climate from something vague and indefinite into something which we can see and measure.

A long-range look at the earth. The old proverb "You cannot see the woods for the trees" has many applications. Little things, viewed closely, tend to blind us to the big thing of which they are parts. Just as a dime held near the eye looks larger than the sun, a small fact about climate when viewed at close range may seem much more important than it really is. If the man in the moon could speak to earth dwellers, he could tell them many things about the earth of which they never dreamed.

Let us try, for a paragraph or two, to put ourselves in his position. Let us imagine ourselves on the moon, looking at the earth through a telescope. We should probably first be attracted by the over-all pattern of the great land and water areas. Then, narrowing our attention to the more interesting land areas, we should see that they are all crossed, east and west, by bands of various colors, which have the same general arrangement on all continents.

If we observed these color bands from time to time through the course of a year, we should find that some of them slowly change in width, color, and shade from season to season. These bands are produced by vegetation and they are the direct reflection of climate. Their differences give us a good basis for a sound and useful classification of the climates of the earth. Let us see what these differences are.

Training our telescope first on the area round the north pole, we see the brilliant white *icecap*, which marks the nearly complete absence of vegetation in that region. For six months in the year this icecap slowly grows larger; during the other six months it shrinks. While it shrinks, a narrow band round its margins turns light green as spring brings back life to the mosses, grasses, and small bushes of the *arctic pastures, or tundra*, as they are called. South of this narrow band of light green is a wider band of darker green, which does not change in color or width with the seasons. This is the great *northern belt of evergreen forests, or taiga.*

South of this dark-green band lies a band of mottled brown and white, which widens to the south and turns green as the arctic icecap shrinks. This band marks the great *belt of mixed forests and grasslands*, which girdles the earth about midway between the north pole and the equator. Southward, this band gives way to a narrower band, which is brown throughout the year, and which marks the *belt of desert lands.* South of the desert band, round the waistline of the globe, is a broad band of dense and brilliant green. Neither the color nor the width of this band varies much through the year, because it marks the *belt of tropical grasslands and evergreen forests.*

Carrying our observations into the Southern Hemisphere, we find that the color bands there tend to be mirror images of those in the Northern Hemisphere. South of the band of tropical green, we see a narrow band of desert brown, which matches the belt of desert brown to the north. South of the desert band is another wide band of mixed forests and grasslands, whose color changes from brown to green with the seasons. Since the seasons in the Southern Hemisphere are the reverse of those in the Northern Hemisphere, this band is green when the comparable band to the north is brown, and brown when the northern band is green. South of this band there are no other color bands in the Southern Hemi-

Photographs by Sawders and Grant

Vegetation is the direct reflection of climate: (top) desert; (middle) grassland; (bottom) forest.

sphere, because the land masses peter out in the sea. The antarctic icecap, however, more or less matches the icecap at the other end of the earth.

By taking this long-range look at the globe we see the large pattern of the earth's vegetation without being confused by details. We learn two important truths.

1. Noticeably different types of vegetation girdle the land areas of the earth in belts. These belts, though much more irregularly bounded, follow the general pattern of the zones which the movements of the earth determine, and would seem to be related to them.

2. The pattern of vegetation in the Southern Hemisphere repeats in reverse order the pattern of vegetation in the Northern Hemisphere.

These two truths are of fundamental importance to an understanding of the earth's great climatic regions. Let us not forget them when we leave the moon to look at these regions more closely.

World distribution of vegetation. As we view the pattern of the world's vegetation at shorter range, we can still recognize the bands which we saw from the moon. Though they appear much less regular and uniform the closer we approach, they can still be seen to girdle the earth in a general east-west direction and to merge into one another in a general north-south direction. Their appearance in the Southern Hemisphere is still in a general way a mirror image of their appearance in the Northern Hemisphere.

The closer view, however, brings out details which were only hazily visible from the moon. Areas with noticeably different types of vegetation can be recognized *within* bands which looked fairly uniform from the moon. The map on pages 70–71 shows how these different climatic-vegetation regions actually fit together so that they make a jigsaw picture of the earth. The picture shows only the belts of native vegetation because it would be impossible to show on a map of this size the countless areas where men have replaced the native vegetation with cultivated crops. We shall spend the remainder of this unit fitting man into this picture, thus building a new picture of the relationship of climate, vegetation, and man.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. Many people have made money raising wheat on the Western plains. James Smith failed because he did not work hard enough.

2. The weather of any place is a common topic of conversation among the people who live there. This is because they have nothing else to talk about.

3. Recent inventions have largely enabled men to modify the climate of a region to suit their wishes.

4. Differences in temperature during winter and summer are caused by the different lengths of day and night.

5. The winter solstice is on or about December 22. At this time the shortest day of the year occurs, and it is winter everywhere on the earth.

6. Once each year the south polar region is inclined toward the sun. This is called the summer solstice because it is summer in the Southern Hemisphere.

7. The arctic, or north frigid, zone is the region which lies between the equator and the tropic of Cancer, $23\frac{1}{2}$ degrees north of the equator.

8. The temperate zones have a climate which is always mild.

9. Different kinds of vegetation occur on the earth in various irregular bands. This is because man has planted different things in different places, according to his likes and dislikes.

QUESTIONS FOR DISCUSSION

1. What would you say are the advantages of the climate in which you live? the disadvantages? Do you think you could stand the disadvantages if they lasted all through the year? What changes should you have to make if this were so?

2. If you were going into a new region to start farming, what should you want to know about the climate? How would you go about getting the information you needed?

3. Which is warmer on a hot summer day, a hillside facing south or the flat land at the foot of the hill? Why?

4. What differences do you think might exist in the climate of the United States if the axis of the earth were tilted 50 degrees instead of $23\frac{1}{2}$ degrees?

5. Are the days longer or shorter in winter in the regions which lie to the north of your home than they are at your home? Are they longer or shorter in summer in the regions to the south? Why?

THINGS TO DO

1. Make a list of the exact time of thirty consecutive sunrises and sunsets in the region round your home. (Your daily newspaper can probably supply this information; if not, you can find it in an almanac.) Do the days grow longer or shorter? Why?

2. A simple experiment will show you how the lighting of the earth differs at different seasons of the year. Remove the shade from a table lamp and place the lamp in the middle of the table. Light the bulb and let it represent the sun. Place a globe model of the earth at one side of the table to represent the earth. Adjust the height of the globe so that the equator is at the same height above the top of the table as the lamp bulb. Darken the room and turn the globe so that the lighted part cuts through the north and south poles, as in the positions marked "Spring" and "Fall" in the drawing on page 27. The lighting of the globe is now that of one of the equinoxes. You will not be able to tell which equinox this is until you move the globe to another position.

Move the globe round the sun (the lighted bulb) in a circular path, *being very careful to keep the axis always pointing in the same direction.* When you have moved the globe one fourth of the way round the lamp, its lighting will be that of the summer or winter solstice. If all the area within the arctic circle is lighted it is the summer solstice; if all the area within the arctic circle is dark it is the winter solstice. When you have moved the globe halfway round the sun, it is in the position of another equinox. Three quarters of the way round the sun represents the other solstice.

3. List all the ways in which you believe climate affects the lives of the people in your community.

4. Find out from the map on pages 70–71 what climatic-vegetation region you live in. Make a list of what in your experience are the outstanding characteristics of your home climate.

BOOKS TO READ

1. There are many good books on weather and climate and their effects on man. One of the best books on weather for high-school students is *Why the Weather*, by CHARLES F. BROOKS. Another excellent short treatment of weather is contained in the pamphlet *Weather*, published by the Merit Badge Service of the Boy Scouts of America. These books will answer many of your questions about the weather in terms which you can understand.

2. If you are interested in the effects of weather and climate on aviation, you can find dozens of interesting books on the subject. *The Air and Its Mysteries*, by CICELY M. BOTLEY, and *Wonder Book of the Air*, by LAUREN D. LYMAN and CARL B. ALLEN, contain some very interesting and modern information. If you have already made a hobby of this subject and want a more detailed (but not too technical) book, read *Aeronautical Meteorology*, by WILLIS R. GREGG, in as recent an edition as you can find.

3. There are literally hundreds of good books on the effects of various climates on man. We shall recommend several of these books as we deal with the various climates of the earth in the various chapters of this unit. Two of the most interesting general books on this subject are *Civilization and Climate* and *The Human Habitat*, both by ELLSWORTH HUNTINGTON.

III · HIGH LATITUDE SEAS AND LANDS

THE NORTH AND SOUTH POLAR REGIONS COMPARED

Latitude and longitude. In elementary school you learned that places on the earth are located in terms of latitude and longitude. The equator is, as you know, a great circle round the earth, just halfway between the north pole and the south pole. Latitude is distance north and south of the equator, measured in degrees. Points north of the equator are said to be in *north latitude*, points south of the equator in *south latitude*.

Any point on the equator is said to be at zero degrees latitude. A line drawn from the equator to either pole is a quarter circle. There are therefore 90 degrees of latitude between the equator and either pole (because, as you doubtless remember, a complete circle contains 360 degrees). The north pole, accordingly, is located at 90 degrees north latitude, and the south pole is located at 90 degrees south latitude.

If you look at the map on page 37 you will see a line marking the position of the equator. Other lines, called *parallels*, are drawn parallel to the equator both north and south of it. Just as all points on the equator are at zero degrees latitude, so all points on any given parallel are at the same number of degrees of latitude. As you can see on the map on page 37, New Orleans, Louisiana, and Cairo, Egypt, are both close to the 30th parallel north of the equator. They are therefore both at 30 degrees north latitude.

Meridians are used for determining longitude, which is distance measured in an east-west direction. The meridians of longitude cross the parallels of latitude at right angles and are all great circles which pass through the poles. Since there is no fixed line such as the equator to use as zero degrees longitude, one particular meridian had to be selected to serve this purpose. Today all countries use as the zero meridian (known also as the *prime meridian*) the one that runs through Greenwich, England, near London. Longitude is measured both eastward and westward from the prime meridian. The 180th meridian is thus either east or west, half of the way round the world from the prime meridian.

Through parallels and meridians you can locate any point on earth exactly, merely by determining its position north or south of the equator (the latitude) and its position east or west of the prime meridian (the longitude). (See the map on page 37.) New Orleans, which we found to be close to the 30th parallel north of the equator, is also close to the 90th meridian west of Greenwich. Its position on the earth is therefore 30 degrees north latitude and 90 degrees west longitude, or, as generally abbreviated, Lat. 30° N.; Long. 90° W.

Places which do not lie directly on major parallels and meridians can be located exactly in terms of degrees, minutes, and seconds. (You probably remember that each degree of a circle contains 60 minutes, and each minute 60 seconds.) Thus Washington, D.C., is exactly 38 degrees, 53 minutes, and 23 seconds north of the equator. It is also exactly 77 degrees, no minutes, and 33 seconds west of the prime meridian. Its exact location on the surface of the earth can therefore be given briefly as Lat. 38° 53′ 23″ N.; Long. 77° 00′ 33″ W.

Latitude and climate. In this book we shall refer to the regions which lie between 60 degrees of latitude and the poles as the high latitude regions of the globe, or simply as the high latitudes. Similarly, we shall refer to the regions which lie between latitudes 60° and 30° in the Northern and Southern hemispheres as the middle latitudes. We shall refer to the regions which lie between 30° and the equator as the low latitudes.

Lines of latitude and longitude are used for determining the position of places on the globe.
See pages 453–457 of "Maps and How to Use Them" in this book for further discussion.

It should be remembered that these terms are used loosely and merely for convenience in discussion. The boundaries between "the high," "the middle," and "the low" latitudes are not rigidly set, either by nature or by custom. We have already had some evidence that the climatic zones of the earth are controlled by latitude only in a crude, broad way. In the remaining chapters of this unit we shall have much more evidence of this fact.

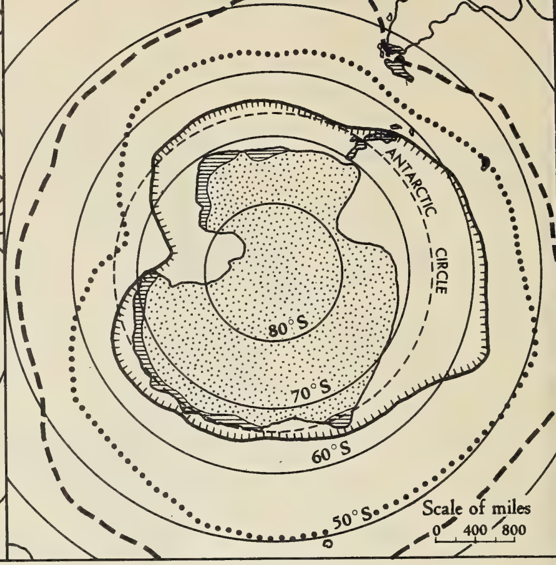
Portraits of the high latitude regions. Though from the moon the two ice-clogged ends of the earth presumably look much alike, they present striking differences on closer view. The maps on page 38 will explain the more important of these differences far better than words could do. Study the maps carefully and observe the following facts:

1. The northern high latitudes are made up of water surrounded by land; the southern high latitudes are the reverse.
2. Three decidedly different types of climate occur in the northern high latitudes; only two of these types occur in the southern high latitudes.
3. Temperatures of the warm months are much more severe in the southern high latitudes than in the northern high latitudes, as the relative amounts of permanent ice reveal.

Let us now see the effects of these facts on the lives of men.

The region that does not exist. Until just a few years ago, the extremely high lati-

North Polar Region



South Polar Region

Glacial climate (no vegetation)
High latitude marine climate (tundra vegetation)
High latitude continental climate (taiga vegetation)

Average temperature of warmest month: 50°F
Average temperature of warmest month: 41°F
Average temperature of warmest month: 32°F

These maps show the distribution of climates and vegetation in the polar regions. You should refer to these maps frequently while studying this chapter.

tude lands and seas at the polar ends of the earth were important only to a few Eskimos, Indians, traders, and explorers. The rest of us were either completely indifferent to them or satisfied to read the tall tales of their frosty terrors in the comfortable glow of our firesides. Today no intelligent person can be indifferent to one of these regions, because the airplane has moved it from the end to the very middle of the civilized world.

The importance of the north polar region has grown far more rapidly than has our knowledge of it. There is no equally important region on earth about which we know less, no other great belt of the globe about which we know so much that is not true. Vilhjalmur Stefansson, who spent many years above the arctic circle, submits the following samples of beliefs about the Arctic:

The farther north you go the colder it gets, regardless of the time of year.
The Arctic is a region of heavy snowfall and terrific storms.
It is dark most of the time.
It is a treeless wilderness where only mosses and lichens grow.
Its natives live in houses built of ice, eat candles, and have no trade or modern equipment of any kind.

All these beliefs—and many others like them—are either partly or wholly false. They are the product of weak observation combined with strong imagination. But they have been expressed so often that they are widely accepted as true. The Arctic, as it is conceived by most citizens of the temperate zones, simply does not exist.

Antarctica. The Antarctic has escaped much of the fiction which has attached itself to the Arctic, probably because it has had only a fraction of the public interest which its companion region to the north has so long enjoyed. Indeed, nobody bothered to discover what lay beyond the storm-churned southern oceans until exploration had several times pried into the secrets of the Far North.

Oddly enough, the most important fact about the Antarctic was revealed by a man who was not an explorer at all in the ordinary sense of the word. W. Lowthian Green, while examining a globe in his study, was struck by the fact that directly opposite every known continent on earth there lies an ocean basin. (Look at a globe and see for yourself.) From this fact Green prophesied the existence of a continent over the south pole to balance the ocean basin which was known to exist over the north pole—before anyone had actually seen the continent of Antarctica.

Later exploration has shown that Antarctica is larger than Europe. It is almost entirely covered with a thick crust of ice and snow, which extends as a shelf beyond the margins of the land and chokes the surrounding seas with drifting icebergs. The land appears only where great mountains break through the frosty crust of the interior, and where here and there a rocky plain shows dark near the outer edge. Though the ocean which surrounds Antarctica teems with living creatures, Antarctica itself is almost as empty of life as the moon. The largest creature ever found to live there the year round is a degenerate wingless mosquito. Penguins come to its coasts to breed; men come to kill whales and to explore. But neither has been seriously tempted to set up housekeeping there on a year-round basis.

Antarctica has been called "the home of the blizzard" and other uncomplimentary things. Unlike much of its companion region round the north pole, it entirely deserves its evil reputation. There is slight doubt that Antarctica and the ocean which surrounds it have the fiercest climate on earth. Though the region yields a little whale oil to a few venturesome men and is rich in untapped coal seams, there is no immediate prospect of its becoming much more than a geographical curiosity. Not even the Air Age is likely to find ways of using this unfriendly and far-off realm.

Glacial climate and life. Any region which is permanently covered with ice and snow, and the average temperature of which

Only the peaks of the highest mountains break through the thick crust of ice and snow that covers the continent of Antarctica.

E. M. Joyce from Ewing Galloway

Courtesy of Hudson's Bay Company

This is what an airman sees as he flies over the icy wastes of the Arctic Ocean.

does not rise above freezing even in the warmest month of the year, is said to have a *glacial climate*. As you can see by the maps on page 38, nearly all the land within 50 degrees of the south pole has such a climate. Within 50 degrees of the north pole, on the other hand, the only land which suffers this type of climate is the central plateau of Greenland. For the human geographer, the most important fact about glacial climate is that no region with this type of climate has ever become the permanent home of man.

Most of the year-round ice in the north polar belt is formed in the ocean rather than on the land. Such ice is known as *floe ice*. It chokes the Arctic Ocean so thickly that Admiral Peary was able to drive dog sleds over 500 miles of it in the spring of 1909 to reach the north pole. The climate of most of this ocean is somewhat warmer than that of interior Greenland and Antarctica. Great winds crack and buckle its ice floes so that stretches of open water appear in many places. Nevertheless, much of the Arctic Ocean is sufficiently cold and icebound to be said to have a glacial climate.

Like the waters surrounding Antarctica, the Arctic Ocean is full of living creatures. Polar oceans are actually much richer in life than the warm oceans of the earth. Countless billions of microscopic plants float in their waters and feed on the salts which the waters hold in solution. Microscopic animals feed on the microscopic plants, and larger animals on the smaller ones. Thus the links in the chain of life grow larger as the chain lengthens—through squids, herring, codfish, seals, and walruses. Oddly enough, the whale is the largest creature in these oceans, but it eats the smallest food: the microscopic plants and animals which it strains from the water through a bony sieve in its head.

Unlike the antarctic waters, which are far from any habitable land, the Arctic Ocean is surrounded by lands on which human beings can live. The Arctic Ocean is thus really a mediterranean sea, round which the great land masses of the earth join. We have already seen something of the new importance which has come with the Air Age to the Arctic Ocean because of this fact. Long before the Air Age, however, the role of this ocean as a mediterranean sea had been important to the people who lived on its shores and islands. Without the rich larder of their central ocean these people could not have existed.

THE TUNDRA LANDS

Polar pastures. The ice-capped lands of the high latitudes and the desert lands of the low latitudes are very much alike. Both are deserts in that they are devoid or nearly devoid of vegetable, animal, and human life. If you turn to the map on pages 70–71, you can observe another similarity. Both are bordered by belts of treeless pasture lands, which separate them from belts of forest lands beyond. The pasture lands of the polar regions are known as tundras.

Tundra is a Russian word which means "a marshy plain." If you look again at the maps on page 38, you will find that most of the tundra lands lie within the arctic circle, though here and there they extend as far south as 55 or 60 degrees north latitude. Tundras also occur in the south polar region, but they are almost of no importance there. Not all these lands are the marshy plains that their name implies. Some are ruggedly mountainous, some flat but rocky. The typical tundra, however, is fairly fiat, low, and marshy in summer, as the photograph below will show.

Types of tundra. When a resident of the tundra speaks of "mushing" from one place to another, he means exactly that. The most characteristic feature of the tundra lands is their summer mushiness. Underground drainage is poor because even in summer only the top few feet of the frozen earth thaw out. Water stands in pools on the surface; spongy vegetation leaps into life under the sunlight of the long summer days. Aside from this general mushiness, however, the tundra lands vary considerably among themselves.

Along the margins of the north polar sea, where the average temperature of the warmest month is below 41° F., the tundra is bleak and forbidding. Only in sheltered spots does vegetation soften and brighten the surface of bare rock. Patches of winter snow which have escaped the sun and the wind linger throughout the summer. This is the *desert tundra*, not wholly the evil land of its reputation but bad enough.

Southward of the desert tundra, where the average temperature of the warmest month is between 41° and 50° F., lies the *grass tundra*. Here are the true arctic pastures, the vegetation of which proves tne falsity of one of the most cherished beliefs about the Arctic: that only mosses and lichens can grow there. Mosses and lichens do grow there, to be sure, and in great number and variety; but there are also over

Most of the tundras that fringe the shores of the Arctic Ocean are marshlands with low vegetation.

Courtesy of Hudson's Bay Company

For a few weeks each summer the flowering plants of the grass tundra rival the rainbow.

seven hundred kinds of flowering plants. Almost immediately after the winter snow is melted or blown away, the rich meadows of the grass tundra turn green with new grass, which is sprinkled with flowers of every color. For a few weeks each summer the grass tundras become gardens, as lovely as can be found anywhere on earth.

Though we have called the tundras treeless, they are not entirely so. Here and there, especially along the southern edge of the arctic tundras, a few trees can be found if one knows where to look and what to look for. The typical tree of the so-called *bush tundra* is a very strange-looking tree. Though several species of trees grow on the north polar plains, all are dwarfed and many are little more than creeping vines. On the ice-free southern edge of Greenland birch trees reach a height of three feet, the best that any tundra can show in the way of trees. Trees, as we of the middle latitudes know them, require deep roots, an impossibility in latitudes where the ground is frozen the year round to within a few feet of the surface.

Tundra animals. Though the antarctic tundra is almost devoid of land life, the arctic tundra is as rich in land animals as in land plants. Its marshes are a heaven on earth for mosquitoes; nowhere are mosquitoes more numerous or more of a pest to man and beast. There are also great armies of flies, which rival the mosquitoes in pestering their neighbors. There are bees and butterflies, which feed on and fertilize the flowers, and many birds, which feed on the insects. Some of the birds, the ptarmigan, for example, are permanent residents which put on white feathers for the winter and brown for the summer. Others are tourists from lower latitudes who go to the tundra to breed.

Higher in the scale of life are great numbers of lemmings (arctic for mice), hares, and foxes. Round the islands and mainland shores of the Arctic Ocean, polar bears hunt the walrus and the seal, while musk oxen chew at the vegetation. Smaller grazers—the reindeer in Eurasia and the caribou in America—wander far into the tundras from the forests to the south. Wolves follow the grazers and men follow both.

Tundra temperatures. The plants and animals of the tundra are the visible reflection of its climate. They are what they are and where they are largely because of the climate. And just as the abundance of tundra life comes as a revelation to a person who has been educated in the myths of the polar regions, so too is the truth about polar climates likely to be a surprise.

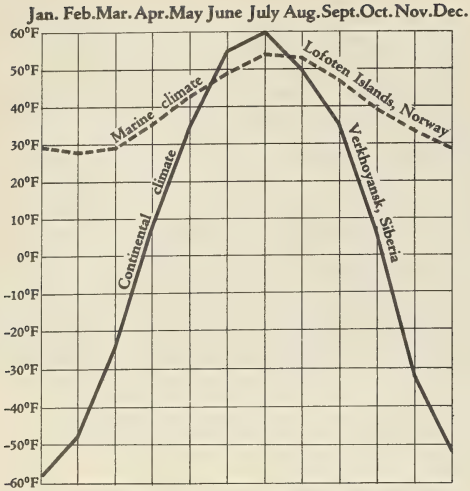
Such a person would be surprised to find that the actual temperatures of these far-off lands do not live up (or rather down) to their reputation. Tundra temperatures, to be sure, frequently sink to $-50°$ F. in winter, and they seldom rise above $50°$ F. in summer. But they are much less severe than the temperatures over the permanently icebound regions which lie closer to the poles.

This is not surprising, because most people expect temperatures to fall steadily as the poles are approached. The surprising fact about tundra temperatures is that they are also considerably less extreme than those of the great forest belts which lie on the equatorward side of the tundras. The lowest temperature ever recorded on the surface of the earth ($-94°$ F.) occurred at Verkhoyansk, Siberia, which lies *south* of the arctic tundra. Even winters in Dakota can rival those of the tundra for severity. Stefansson, who knows them both, believes that the Dakota winters are the worse.

The tundra and the sea. The comparative warmth of the tundra among high latitude regions is caused by the nearness of the sea. Because water is a fluid, the oceans are constantly stirred by waves, tides, and a variety of currents. Much of the heat which develops at the surface of the oceans is transmitted downward by movements of the water. Much of the heat which develops at the surface of the more stable lands, on the other hand, never gets far beneath the surface. Because the oceans are thus heated more deeply than are the lands, they warm up less rapidly and less intensely than do the lands. They also cool off less rapidly than do the more shallowly heated lands.

For this and other reasons, ocean temperatures do not change much from day to night, whereas land temperatures may vary greatly between noon and midnight. Similarly, the temperature changes which take place from season to season are much less

Both the lands and the seas of the north polar region support a variety of wild animals.



This chart shows the different influence of sea and land on places in the same latitude.

pronounced in the oceans than on the lands. *Oceans, in short, have a moderating effect upon climate*, on their own climate and on that of nearby lands.

The climate of the arctic tundras is largely dominated by their central ocean. The chart above will show what a tremendous effect on land temperatures a nearby ocean may have. Verkhoyansk, Siberia, and the Lofoten Islands, Norway, lie in the same latitude, close to the arctic circle. The striking differences in their temperatures are due to the fact that one is inland and the other on the ocean.

Tundra moisture. If you have been schooled in the belief that the lands of the Far North suffer frequent heavy snowstorms, you will be surprised to learn that more than 75 per cent of the tundra is nearly free from snow throughout the year. *Cold air is less able than warm air to hold moisture.* The result of this fact is that nowhere in the Arctic is the snowfall heavy.

The permanent ice and snow of the icecap regions are not the result of heavy annual precipitation of moisture. They are the result of the cold, which preserves from melting and evaporation much of the little moisture that falls. Considerably less snow falls on the tundra than on the eastern United States. Where the wind has not already swept the ground clean, reindeer have no trouble scraping off the snow from the moss and lichens on which they feed.

The myth of the polar night. In the last chapter we saw that poleward the days of summer grow longer and the nights shorter; that in winter the reverse is true. The terrors of the arctic night have been so exaggerated by romantic writers that many otherwise educated people hold strange beliefs about the periods of light and darkness in the high latitudes. Many people believe that the inhabitants of the tundra spend several months each year in total darkness. The fact is that *no tundra dweller spends a single day in total darkness* unless he is blind.

The reason for this is that daylight does not vanish the instant the sun sinks below the horizon. Twilight lasts a long time in the polar regions. It illuminates the sky from the time the rising sun comes to within 18 degrees of the horizon until the setting sun sinks to 18 degrees below the horizon. Because of this fact, there is a little daylight every day in the year as far north as 84° north latitude. This latitude is well beyond the poleward limits of the tundra, and consequently beyond any place where men have year-round homes. The widespread belief in "six months of daylight and six months of darkness" in the polar regions is thus not founded on known facts. Stefansson estimates that even at the north pole one could read a newspaper by natural light on any clear day during at least seven months of the year.

The gloom of the arctic winter, on the other hand, should not be underestimated. At best, the sun is never very high in the sky. At several places where men live it is dark enough for months at a time to interfere with work, and to bring about idleness, with all its bad results. Nor are the continuous sunshine and twilight of the arctic summer an unquestionable blessing. They work seeming miracles on vegetation, but they also interfere with men's sleep and make them nervous. Which brings us at last to the chief question of the human geographer: What effect do all these characteristics of the tundra have on its human inhabitants?

THE TUNDRA PEOPLES

Classification. Though all the tundras of the world together contain fewer human beings than one medium-sized American city, they embrace a variety of interesting peoples and ways of life. Tundra peoples can be roughly classified in three groups:

1. The Eskimos, who are permanent residents of the North American tundra, and who live largely by hunting and fishing.

2. The Lapps, Chukchi, and other tribes, who for the most part are summer residents of the Eurasian tundra, and who live chiefly by herding.

3. The white people, who have filtered into both the American and the Eurasian tundras, and who are chiefly traders, missionaries, and explorers.

Climatic control. There was a time when men were generally considered little more than puppets on the stage of the earth, with the forces of the physical environment pulling the strings. In those days, much was made of climate as a controlling instrument in human life. Some sober scholars went so far as to believe that Eskimos had short necks from hunching with the cold, and that Negroes had been baked black by the tropical sun. Charmed by the conviction that

Tundra peoples make up in variety what they lack in total numbers. These peoples are destined to be profoundly affected by the poleward march of Air Age civilization.

the earth controlled the lives of all her children, such scholars overlooked the fact that some of their views were open to serious doubt and others were downright foolish.

Today the scholarly point of view concerning man and the earth has shifted far toward the other extreme. Geographers have discovered that man is a very resourceful fellow who can make many changes in both himself and his environment. Most modern human geographers are accordingly more interested in man's effect on the earth than in the earth's effect on man. The physical environment is no longer considered the all-important determining factor in human life.

This is as it should be, for man is obviously no mere slave of his surroundings. It is well to remember, however, that neither is man yet wholly the master of a world of his own creation. In a modern city, man is far from most direct contacts with the earth. Natural climate is of little importance where men make their own climate in artificially heated, air-conditioned, electric-lighted buildings. On the tundras things are different. There the earth still guides the steps of men; there climate, not man, is supreme.

You may ask at this point, "Why, if climate is supreme on the tundra, are not all men forced to live the same kind of life? Why can some men be hunters and fishermen, others herders, and still others traders, missionaries, and explorers?" The answer is that no climate on earth is powerful enough to do away entirely with man's ability to choose the kind of life he will lead. Three types of influence shape a man's life wherever he may live: (1) the physical environment; (2) inheritance, both physical and cultural; (3) the human imagination and will. We say that the first type is supreme on the tundra, not because it does away with the other two, but because it is more influential.

Primitive polar hunters Of all the elements of the physical environment, temperature wields the greatest control over the lives of tundra people. By making agriculture practically impossible as a means of existence, temperature severely limits the activities of all men who come to dwell on the arctic pastures. The Eskimos, who seem to have come to the American tundras from Asia at some unknown period of the past, became marvelously well fitted to live within the limits which tundra temperatures placed upon their lives. Through hunting and fishing they have been able to wring a living from one of the unfriendliest environments on earth.

In their primitive condition, uninfluenced by white men's ideas and inventions, the Eskimos are chiefly hunters of seals along the shores of the Arctic Ocean. The seal is the Eskimo's staff of life, yielding food, clothing, tools, weapons, fuels, and even building materials for boats and houses. The whales, walruses, and fishes of the polar seas are also used, and to a lesser extent the caribou and musk oxen of the surrounding lands. The plant life of the tundras, on the other hand, is almost entirely ignored.

The life of the professional hunter is hard, with feasting today and famine tomorrow. Fear of starvation is the whip that drives the primitive Eskimo through his daily chores. He must travel hundreds of miles every year in search of food, for in few places is game sufficiently plentiful to support any permanent settlements. Even such settlements are permanent only in the sense that they are used over and over again at times when game is abundant in the neighborhood. When the game thins out or moves out, the people also move out to search for better hunting. The nature of his physical environment thus makes the primitive Eskimo a wanderer, or, as geographers say, a *nomad*. His culture is largely the result of his nomadic type of life.

Much has been written about the superb way in which the Eskimo has used the materials of his environment to meet the needs of his life. No white explorer has ever invented a better garment for cold climates

The hunter's life is a life of endless wandering. Primitive Eskimo clothing and sledges are ideally adapted to winter hunting round the frost-bound edges of the north polar seas.

than the hooded skin parka of the Eskimo. The Eskimo kayak, made of sealskin stretched over a frame of wood, is one of the most efficient small boats ever built. Eskimo dog harness, sledges, knives, harpoons, and bows and arrows are all beautifully designed and constructed for the work which they must do. The Eskimo snowhouse, on the other hand, is not so common as is often thought. Relatively few of these highly publicized dwellings are used by Eskimo hunters during their winter travels. Most Eskimos live most of the time in stone and driftwood houses chinked with sod, or in tents made of skins.

People who must keep forever on the move have no time to become highly civilized. The industries, arts, sciences, and governments of modern civilization are the creations of people who could settle down, who could live *sedentary* rather than nomadic lives. The arctic nomads must not only use most of their energy in merely keeping alive; they must also get along on less energy than blesses the lives of people who live in less severe climates. The gloom and cold of the long arctic winter take a toll of human vitality which human ingenuity cannot find ways to avoid.

Under these circumstances, it is not surprising that the primitive Eskimo leads a simple social life. Where existence demands a continual struggle with starvation, an elaborate system of inherited wealth and power is impossible. Everybody is poor and only the most able men can hope to become leaders. There are no written laws, no formal government. Tradition and public opinion are the sole guides and regulators of conduct.

Primitive Eskimos live in widely scattered groups, each group made up of a few families with a rather small number of children. The members of the group share their food when they have any, and their suffering when food is scarce. They seldom quarrel. When they dream of heaven they imagine a place that is always warm and bright, where meat is always abundant and nobody ever works. Their dream of heaven, how ever, does not dull their enjoyment of earth. They are a strangely happy people in a land which, from our middle latitude point of view, would seem to make happiness impossible.

Primitive polar herders. Just as animal life of the polar seas supports the hunter of the American tundras, vegetable life of the polar lands supports the herder of the Eurasian tundras. Just as the one leans on the seal, the other leans on the reindeer. The reindeer is the cow of the Far North, yielding meat, milk, cheese, clothing—and building materials, for good measure.

Like hunting on the American tundras, herding is the most characteristic occupation of people on the European tundras. This Lapp with his herd of reindeer in northern Finland is the arctic version of a Texas cowboy with his steers.

The Lapps who live in northern Norway, Sweden, and Finland are the best known arctic herders. At one time all Lapps were nomads who followed their herds over the European tundras in summer, and through the forests and mountains of interior Scandinavia in winter. Today, only the so-called mountain Lapps live fully by the traditions of their ancestors. These traditions are based on the feeding habits of reindeer, which in turn are based on the nature of arctic vegetation, which is under the control of climate. Climate is thus the basic influence in the life of the mountain Lapp, as it is in the life of the Eskimo.

The reindeer grazes on moss, which in winter is more tender and abundant on the forested highlands to the south than on the treeless tundras. In winter, accordingly, the Lapp herder and his family live on these highlands in their hide tent, eating the meat and the dairy products which the herd provides, and a few berries from the woods for variety. They must change their place of residence every few days to keep near the wandering herd, suffering the bitter cold and fighting off the wolves, which also value the reindeer. In summer the herd works northward into the tundra, where the pastures are greener. The herd still eats moss but the herder changes his own diet by giving up meat for fresh vegetables in the form of roots, herbs, and bark.

The herders of the Asiatic, like those of the European, tundras spend the winter in the forested regions to the south. Like the Lapps, they are devoted exclusively to the culture of the reindeer—with one interesting exception. The Yakuts of northeastern Siberia herd cows, presumably because their distant ancestors were herders of cows on the high plains far to the southwest. Cows, unfortunately, do not eat moss. The short summer is therefore a time of fevered haymaking for the arctic cowboys. If this summer's hay crop fails, the cows will have nothing to eat next winter, and both herd and herder will starve.

The Yakut herders provide an outstanding exception to the general rule that climate is supreme in the lives of tundra people. By grazing cows, the Yakuts defy the climate, which favors the grazing of reindeer. Cultural inheritance is a more powerful influence in the lives of these people than physical environment.

Herding is a slightly more reliable occupation than hunting. The arctic herder is a little way—but only a little way—ahead of the Eskimo hunter in his race against star-

The Grenfell mission is an inspiring monument to the good will of men. This hospital is helping to make life easier for the inhabitants of a hard land.

Philip Gendreau, N.Y.

vation. Social life is necessarily simple in both cases. The herder, like the hunter, has strong family ties, which are linked to the difficult, often desperate, and never-ending problem of getting enough to eat. The father rules the family because the food supply depends chiefly on his energy and judgment. The best producer of meat and milk is the acknowledged leader of the community. Generosity is practiced by all because in the long run it has proved to be a better way of life than selfishness. In this respect at least the simple people of the tundra are socially superior to some of their more highly developed brethren of softer climates.

The white man in the Far North. Much has been said about the harm which white men have done to the natives of the tundras. Much of what has been said is true. The following charges against the white man are serious, and they cannot be denied:

1. He has invaded the arctic seas with his modern whaling and sealing boats, and has seriously reduced the natural food supply of the native peoples.

2. He has set up trading posts and has armed the natives with rifles, thus encouraging them to make further serious reductions in their food supply.

3. By reducing the natural food supply, he has caused the natives to settle down round the trading posts. There they lose their native culture and character without getting anything as valuable in return.

4. He has taken a huge toll of health and life by giving the natives his diseases. Living for generations in a cold climate where germs do not thrive, the tundra peoples have built up no resistance to such diseases as tuberculosis, smallpox, and influenza. These white man's ailments are as deadly to tundra human beings as white man's bullets are to tundra animals.

Less has been said about the good which the white man has done in the Arctic, but there is good along with the evil:

1. Some white men have set up missions, which have had some success in righting the wrongs which other white men have done. The Grenfell mission among the Eskimo fishermen of northern Labrador is a model. Dr. Grenfell built churches, schools, and hospitals for these harassed residents of a dreary land. He helped to establish markets and a steamship service for their fish. He introduced the culture of hardy fast-growing vegetables (which, unfortunately, the natives were reluctant to eat) and a herd

By Ewing Galloway, N.Y.

The primitive skills which the Eskimo has acquired through the ages are rapidly disappearing with the northward march of middle latitude culture.

of reindeer (which, again unfortunately, the dogs destroyed). Such missions achieve much good under extremely difficult conditions. But they cannot take the tundra dweller back to the relative state of well-being which he enjoyed before the white man interfered with his life.

2. Perhaps the greatest service the white man has ever rendered the Eskimo has been that of persuading him to add herding to his traditional occupations of hunting and fishing. Though Grenfell failed in his herding experiment in Labrador, other white men succeeded in similar experiments in Alaska and northwestern Canada. Men who know the American tundras well have long thought that herding might not only help solve the serious food problem of the Eskimos but might increase and vary the meat supply of the great populations in the temperate zone.

Toward this end, several varieties of grazing animals have been brought to the American tundras. The buffalo (bison) was brought in from Montana, the yak from Tibet, the reindeer from Siberia. Attempts were also made to domesticate the native caribou (which is a wild reindeer) and the nearly extinct musk ox (*Ovibos*). It is interesting to note that all these experiments either have been successful or have given promise of future success.

Much the greatest success, however, has been that of the introduction of the Siberian reindeer. Ten of these animals were shipped into Alaska from the Asiatic tundra in 1891. Today the American tundra supports more than a million reindeer. Eskimos own most of the herds, and through them they are shifting to a surer and safer basis of living. Through the reindeer, indeed, the white man may someday be able to pay the Eskimo in full for the damage done to him and his native land.

FOREST LANDS OF THE FAR NORTH

The taiga. South of the north polar tundras in America and Eurasia lie the forested lands which go by the name of taiga (pronounced tā′ga), a Siberian word for forest. If you look at the map on pages 70–71, you will see that these northern forests make up the most extensive, as well as the most clearly defined, belt of vegetation on earth. The taiga covers the bulk of northern high latitude lands, with the tundra little more than a fringe round its poleward margin. The great extent of the taiga in the Northern Hemisphere is offset by its complete absence in the Southern Hemisphere, where there is no land in the appropriate latitudes for that type of vegetation.

The belt of the taiga reaches all the way round the globe, from Alaska and northern Canada, across Norway, Sweden, Finland, Russia, and Siberia. It thins off northward into tundra where average summer temperatures of 50° F. or higher last less than a month. Southward it passes into vegetation of different types where average summer temperatures of 50° F. or higher last more than three months. There is a remarkable sameness to the taiga forests throughout their global range. Though they contain a sprinkling of such broad-leaved trees as birch, maple, and aspen, *they are everywhere made up very largely of such cone-bearing evergreen trees as pine, spruce, and fir.* The taiga is truly Longfellow's "forest primeval," a mighty wilderness in which man and his works look small indeed.

Rivers, streams, and lakes are the chief highways through this region. Men once assumed that because the trees grew dense and large along these routes of their boats and sledges, the whole region was a rich storehouse of valuable timber. Now that the airplane has given them a better idea of the country between the waterways, they know that the taiga trees over vast areas are dwarfed by the general dryness and short growing season of the region. They know that many areas have no trees at all.

Taiga animals. The animals of the great northern forests make a much better showing than do the trees among which they live. The taiga is the largest and most valuable fur farm on earth, the home of untold num-

Even this relatively large settlement is but a tiny island in the vast green sea of the taiga.

Royal Canadian Air Force Photo

bers of mink, marten, beaver, sable, and many other kinds of fur-bearing animals. It is also the home of countless deer, caribou, and moose. Its streams and lakes are full of trout and pike; its swamps provide rich feeding and safe nesting for myriads of ducks and geese. Like the tundra, the taiga is a breeding ground for swarms of hungry flies and mosquitoes, which make life miserable for their neighbors during the summer.

Taiga temperatures. Most taiga areas lie too far inland to be affected by the moderating influence which the ocean brings to the climate of most tundra areas. The climate of the tundra may be described as *high latitude marine*, that of the taiga as *high latitude continental*. Temperatures throughout the taiga belt are quite generally colder in winter and warmer in summer than those of the tundra belt.

We have seen that the village of Verkhoyansk in the Siberian taiga holds the record for the lowest temperature ever observed at the surface of the earth. It also holds the record for the greatest range of temperature

Great fur companies have built trading posts such as this one where the trappers from the taiga sell their furs or exchange them for white men's goods.

Courtesy of Hudson's Bay Company

throughout the year. Its *average* January temperature is $-58.2°$ F., its average July temperature $59.9°$ F.—a range of $118°$ F. Winter and summer *maximum* temperatures extend this range much farther; $75°$ below zero in winter and $90°$ above zero in summer are not unusual. Other places in the belt of the taiga have somewhat shorter but still striking ranges of temperature from winter to summer. *This great seasonal contrast in temperature—greater than that of any other climate on earth—is the most characteristic aspect of high latitude continental climate.*

Taiga moisture. Taiga lands, like tundra lands, are relatively dry because the cold air in which they are bathed during most of the year is unable to hold much moisture. Then, too, the moist winds from the oceans have difficulty in reaching the interior of continents, for reasons which we shall discuss in the next chapter. Both rain and snow are more plentiful in those parts of the taiga which lie nearest the oceans; the interior areas are the driest, as well as the coldest. Only a small percentage of this vast domain gets more than ten inches of rainfall in a year; some districts get only half that amount. The short summers and long cold winters, however, hold evaporation in check, and keep these lands from turning into deserts.

Hunting in the northern forests. Much that we said about the peoples of the tundra applies to the peoples of the taiga. The taiga, like the tundra, is unfriendly and uninviting, richer by far in acres than in men. Throughout most of the great northern forest lands, human activity has not risen far above the primitive level of hunting and trapping. Though a considerable number of farmers live near the southern edge of the taiga in Canada, they generally go into the woods in winter to trap.

The North American taiga is largely inhabited by Indians, whose lives are based on fur. When the short summer draws toward a close, the Indian loads his canoes with his family and all his possessions. He moves from the trading post near the edge of the forest to his private hunting ground in the interior. There he sets up a winter camp in a tepee, or tent, with a white man's stove to hold off the bitter cold.

He sets out his trap line and settles down to an endless round of walking from trap to trap, generally on snowshoes and often with a dog sled to help him bring home the kill. In camp his squaw dresses the pelts and cooks the flesh. If game thins out in one district, camp is moved to another. By spring a pile of skins has accumulated and the waterways are open again. Again the Indian loads his canoes and returns to the trading post.

The white men who own the trading posts help the Indians by equipping them with stoves, utensils, steel traps, and rifles, and by furnishing odd jobs during the summer when fur-bearing animals are shedding their hair. The white men, however, did not build the trading posts to help the Indians. They went to the forest to make money, and some of them did so by charging high prices for what they sold while paying low prices for what they bought. White traders can keep the native hunters of the taiga perpetually in debt through unscrupulous business practices. Not all traders, to be sure, are unscrupulous, but their influence on the taiga Indian—as on the tundra Eskimo—has in many cases been bad.

While the Europeans and Canadians were developing the fur trade in Canada, chiefly through the far-flung outposts of the Hudson's Bay Company, the Russians were doing the same in Siberia and Alaska. Russians, indeed, were fur traders centuries before America was discovered, and a large percentage of the world's finest furs still come from the Eurasian taiga. The pattern of development there has closely resembled that of North America, with the native peoples, who produce the furs, getting the least benefit from them.

Lumbering. We have seen that, because of the cold and the dryness, the trees of the taiga grow slowly and not very large. They are rather generally much better suited for pulpwood (used in the manufacture of paper) than for sawed lumber

The most valuable product of the Russian taiga, as of all other taiga regions, is fur. Hunters and trappers kill the animals in the winter when the furs are thickest.

Sovfoto

Canadian Airways Limited, Montreal

This silver and radium mine lies on the shores of Great Bear Lake, deep in the Canadian taiga. Fabulously rich, it is profitably operated in spite of its great distance from civilization.

(used in building). In the past the white lumberman would set up his camp in the wilderness, clean out all the timber within reach, then move to another place. All too often he would butcher rather than harvest the forest. Careless with fire, he has felled even more trees with the match than with the ax.

Until recently only Sweden and Finland among the far northern nations have taken good care of their forests. These nations long ago realized that their trees were their most valuable possession. Blessed with abundant water power, they long ago began to develop great paper, match, and other industries based on water power and wood. They taught other northern nations how to use their forests without abuse. Today Russia, Canada, and the United States all seem to have learned their lesson. They are all making steady progress in the intelligent use and protection of their share of the taiga.

Mining. The Call of the North for many white men who have answered it has been the romantic call of gold. Several of the great rivers which flow through the northern forests are rich in gold-bearing gravels. Long before the famous gold rush of 1898 to the Yukon and Klondike rivers of North America, there were gold rushes to the rivers of Siberia. Taiga rivers are thus both mines and highways to mines. But the cold which holds the rivers in its iron clutch during most of the year also holds back their development and use. Between the rivers the taiga is still largely a trackless wilderness. Nobody knows what mineral wealth it hides.

The most valuable known mineral deposits of this region lie near its more easily accessible southern boundaries. The richest nickel deposits on earth are being mined in the taiga at Sudbury, Ontario, and some of the richest silver deposits at nearby Cobalt. Great iron mines occur along the shores of Lake Superior. Platinum, copper, oil, and various other valuable minerals have been discovered farther north—too far from civilization in most cases to be very useful.

Agriculture. Like lumbering and mining in the belt of the taiga, agriculture is carried on chiefly by white men from regions farther south. Farming is a very unsatisfactory business in a climate where the growing season is short at best, and where a frost may come on almost any midsummer night to make it even shorter. It is not surprising that throughout most of the great northern forest lands agriculture does not exist. (See the map below.)

In a few favored places, however, certain hardy crops can be raised. The Finns and Swedes grow barley and rye close to the arctic circle. They maintain little dairy farms with the help of these grains and the wild meadow grasses as far north as where the taiga gives way to the tundra. In the valleys of the Yukon, Mackenzie, and Peace rivers of Alaska and Canada, successful experiments have been made with hardy fast-growing grains, vegetables, and berries. But agriculture, like mining, in the forest lands of the Far North will probably never be more than a local pursuit at especially favored places. Fur and wood are the chief products of this region as a whole. With these products the inhabitants of the taiga will doubtless continue to be chiefly concerned.

The future of the high latitude regions. For centuries the north polar seas and the lands which surround them have loomed much larger in area than in importance to men. Only recently has their importance suddenly begun to grow, and it is still too early to know exactly what size it will reach. It is still too early, for example, to know how important the tundra will become as a producer of meat. Some authorities believe that tundra vegetation will not stand up under intensive grazing; that herding in this region will never be important to the people of the world at large. The same uncertainty hangs over the future of mining in both the tundra and the taiga. It is reasonably certain, on the other hand, that the taiga will continue to be the chief source of fur and white paper for the civilized world.

The average number of consecutive frost-free nights determines the "growing season" in every locality on earth. You should consult this map frequently as you go ahead with the study of this unit.

The most important future development of the high latitude regions will be associated less with their surface than with the air above it. Cold masses of air which take shape over Greenland, for example, move to the southeast and thus greatly affect the weather of Western Europe. During the Second World War the United States and Canada established weather stations in Greenland and Labrador which produced information of greatest value to the men who waged aerial warfare over Germany. Such weather stations should increase, for the information which they gather is as valuable in peace as in war.

We have already seen how the arctic lands have a central location in the great cluster of continents which rings the Arctic Ocean. We have seen that some of the world's most important air routes already cross these lands and their neighboring waters. Airfields, weather and fueling stations, and settlements have sprung up at many places along the new arctic routes; many more at many more places are a certainty for the future.

Such developments are not wholly the result of the strategic location of the north polar regions. They are partly the result of the climate. North polar air routes are among the safest, as well as the shortest, routes between the continents. The zone of calm air which is called the stratosphere is much closer to the earth over the high latitudes than over the low. In high latitudes the modern airplane thus finds it relatively easy to reach the stratosphere, where flight is comparatively easy and safe.

The modern airplane also finds that the dangerous temperatures in which ice is likely to form on the plane (between 15° and 30° F.) are relatively rare in the atmosphere of the Arctic. The moisture necessary for ice formation is also relatively low. Furthermore, arctic winter temperatures in the upper air are much higher than those at the level of the ground, and are far from being either extremely uncomfortable or dangerous. All told, there is probably no air on earth which lends itself better to long-distance travel in a modern airplane. The effects of this fact—so strangely at odds with the mythology about the Arctic—can hardly be overestimated, but only the future can tell exactly what they will be.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. The high latitude lands are bleak and uninviting regions which hold little promise of future development.

2. The water of warm oceans is richer in life than the waters of the Arctic and the Antarctic.

3. The continent of Antarctica is entirely covered with ice and is larger than Europe.

4. The continent of Antarctica and the waters which surround it are almost empty of life. This is the reason why men do not live there.

5. The tundra regions are always cool or cold, and they have the coldest winter temperatures ever recorded.

6. People all over the tundra regions have to travel by sled in the winter.

7. The Eskimo is well adjusted to life in a severe climate, and he is an excellent example of how people can rise above such a climate.

8. The only vegetation growing in tundra lands is lichens and mosses. For this reason such lands are useless to man.

9. The Lapps live in northern Norway, Sweden, and Finland. They live by hunting wild reindeer and by fishing.

10. The white man has invaded the land of the Eskimo, done much harm, and given nothing in return.

11. The extensive forests of the taiga lands are valuable chiefly for lumber to be used in buildings.

12. The farther north you go the colder it gets.

13. The taiga is a vast region of unbroken forest lands.

14. The temperature in the taiga is more moderate than that in the tundra because the taiga lies south of the tundra.

15. The climate in taiga regions is too severe to support any agriculture.

QUESTIONS FOR DISCUSSION

1. Recall the coldest period of weather you can remember. How did it make you feel? How was your appetite? Should you like to live in a climate where extreme cold lasted for several months? How would you prepare yourself to stand such a climate?

2. Assume that you are planning a trip to the south pole. What preparations would you make? What should you need to take with you? Plan a similar trip to the north pole. In what respects would the plans for these two trips differ?

3. What do you think will be the future of the polar lands which have glacial, high latitude marine, and high latitude continental climates? Do you think that the airplane will affect differently the development of regions with these three different kinds of climate? Discuss in class the reasons for your conclusions.

4. If you inherited a large area of land in a taiga region, what could you do with it? How would you go about developing its commercial possibilities?

THINGS TO DO

1. Look at a globe and see that directly opposite every continent, on the other side of the earth, there is an ocean. Make a list of the continents and oceans, showing which oceans are opposite which continents.

2. Make a list of the main features of the three different types of high latitude climate. List also the products of each climatic region. Write a short report for your class, comparing the three types of high latitude climate.

3. Make a list of the chief animals which are found in the tundra. Refer to an encyclopedia and write a short description of each animal. Do the same for the taiga animals.

4. Look up in an encyclopedia the different peoples who live in tundra lands, and write a description of them and how they live. List the features of their life which are directly due to the kind of climate in which they live. Do the same for the taiga peoples.

BOOKS TO READ

1. Polar explorers have given us some of our most fascinating books on geography. Robert Falcon Scott and four companions reached the south pole by dog sled in 1912, but died on the return journey. Scott's records and diaries of this tragic adventure were later found and published in a moving book by LEONARD HUXLEY, called *Scott's Last Expedition*. *Little America* and *Discovery*, by RICHARD E. BYRD, are interesting and informative descriptions of more recent explorations in Antarctica.

2. The literature of north polar explorations is rich. *Farthest North*, by FRIDTJOF NANSEN, the first man to cross the Greenland icecap, is one of the best books ever written on life under glacial conditions. *The Saga of Fridtjof Nansen*, by JON SÖRENSON, is a fine modern book on Nansen and his explorations. ROBERT EDWIN PEARY, the first man to reach the north pole, wrote the story of his expedition in *The North Pole: Its Discovery in 1909*. *Skyward*, by BYRD, is an interesting account of the first trips to the north pole by airplane.

3. Of all the books on tundra lands and peoples, those of VILHJALMUR STEFANSSON are perhaps the most interesting. His *Friendly Arctic* and *My Life with the Eskimo* are classic and fascinating works. *Kabloona*, by GONTRAN DE PONCINS, describes a personal adventure among tundra people in a unique and memorable way. *A Labrador Doctor*, by SIR WILFRED GRENFELL, vividly describes the problems of a medical missionary on the tundra.

4. *Arctic Village*, by ROBERT MARSHALL, is an unusually interesting study of a native settlement near the northern edge of the Canadian taiga. *Wilderness Wife*, by KATHRENE PINKERTON, is the story of a white family near the southern edge. *North Again for Gold*, by EDGAR LAYTHA, tells a story of modern prospecting in the forested wilderness of the Far North. *Uncle Sam's Attic*, by MARY LEE DAVIS, and *Canada Moves North*, by RICHARD FINNIE, are readable and instructive books on the lands and peoples of the American taiga.

IV · THE MILD WEST COAST LANDS

STRUCTURE AND BEHAVIOR OF THE ATMOSPHERE

The pattern of middle and low latitude vegetation. If you turn to the map on pages 70–71, you will see that the great east-west belt of the taiga gives way to a variety of forests, grasslands, and deserts which cover the middle and low latitude lands of the globe. Some of these belts of vegetation lie partly in the middle and partly in the low latitudes. In several cases the boundaries between the belts follow the north-south direction of meridians of longitude more closely than the east-west direction of parallels of latitude. It is clear from the pattern of middle and low latitude vegetation that influences other than latitude have had a hand in its creation. But what are those influences?

To answer this question we must first look beyond the vegetation to the air above it. We must remember that vegetation is a direct reflection of climate; that the climate of any particular region is the result of a particular combination of heat, moisture, and movement in the atmosphere. In view of this fact we should take a little time to examine the general structure and behavior of the atmosphere.

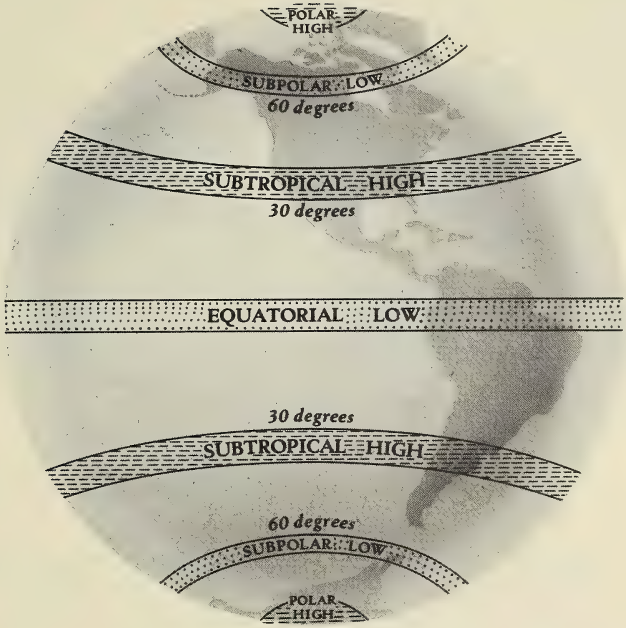
Many books have already been written on this subject and many more will be written as man's exploration of the air goes on. It is not an easy subject to condense into the few pages which we can allot to it here. The remainder of this section will therefore not be particularly easy reading. But it will repay careful study by unlocking the door to an understanding of the climates in which most people live.

Belts of low and high air pressure. You probably know that air is a mixture of gases, chiefly nitrogen (78 per cent) and oxygen (21 per cent). Though these gases are invisible, they have weight, which exerts pressure on the surface of the earth. This air pressure varies from time to time and from place to place.

When the ground is heated by the sun, it passes on some of this heat to the air above. This heated air expands, grows lighter, and rises; cool air moves in to take its place near the surface of the earth. Because rising warm air exerts less than normal pressure on the earth below it, we call a region where warm air is rising an *area* (*if small*) *or a belt* (*if large*) *of low pressure.* Rising warm air cools as it rises, contracts, grows heavier, and then sinks toward the surface of the earth. Where such heavy cold air is flowing toward the ground a greater than normal air pressure develops. We call a region where this is happening an *area or a belt of high pressure.*

Pressure belts of the world. Because the equatorial regions are always warmer than the polar regions, warm light air is always rising from the surface of the equatorial regions and flowing outward toward the poles. The equatorial regions are accordingly belts of low pressure. The polar regions, on the other hand, are belts of high pressure, where cold heavy air is continuously sinking and flowing toward the equator. Owing to the rotation of the earth and other complex factors, downward-moving eddies of air produce other belts of high pressure near latitudes 30 degrees in both hemispheres; upward-moving eddies of air produce other belts of low pressure near latitudes 60 degrees. The diagram on page 59 illustrates these great fundamental elements in the structure and behavior of the air.

Actually, the chief low and high pressure belts of the earth are neither so simple nor so evenly distributed as this diagram implies. Two conditions in particular tend to complicate them. (1) We saw in Chapter II how the vertical rays (and with them the greatest heat) from the sun shift from north

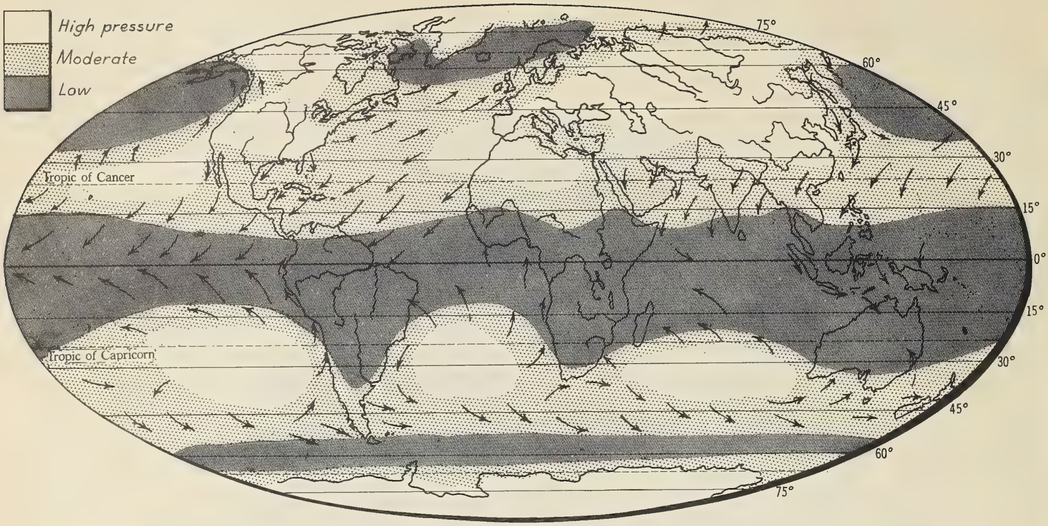


A highly generalized diagram of the major pressure belts of the globe.

to south and back again during the course of the year. Pressure belts, which are under the control of heat, tend to shift with these shifting rays of the sun. (2) We saw in Chapter III that the oceans are less readily heated than the lands. Because of this fact, separated belts of high and low pressure develop in what would be continuous belts of nearly equal air pressure if the surface of the globe were either all water or all land.

Through observations taken with barometers at many stations all over the world, the actual regions of more or less permanent high and low atmospheric pressure seem to be arranged as shown on the maps on pages 60 and 61. Notice that great unbroken belts of high pressure cover both polar regions during both January and July. This is what we might expect from what we learned in connection with the diagram above. The high pressure belts in the vicinity of 30 degrees north and south latitudes, on the other hand, show the differing influence of land and sea. Notice that during both January and July in both hemispheres they are broken down into smaller belts of high pressure.

Notice that the subpolar belt of low pressure near 60 degrees south latitude is continuous round the globe during both January and July. Its uniformity indicates the uniformity of air conditions over oceans which



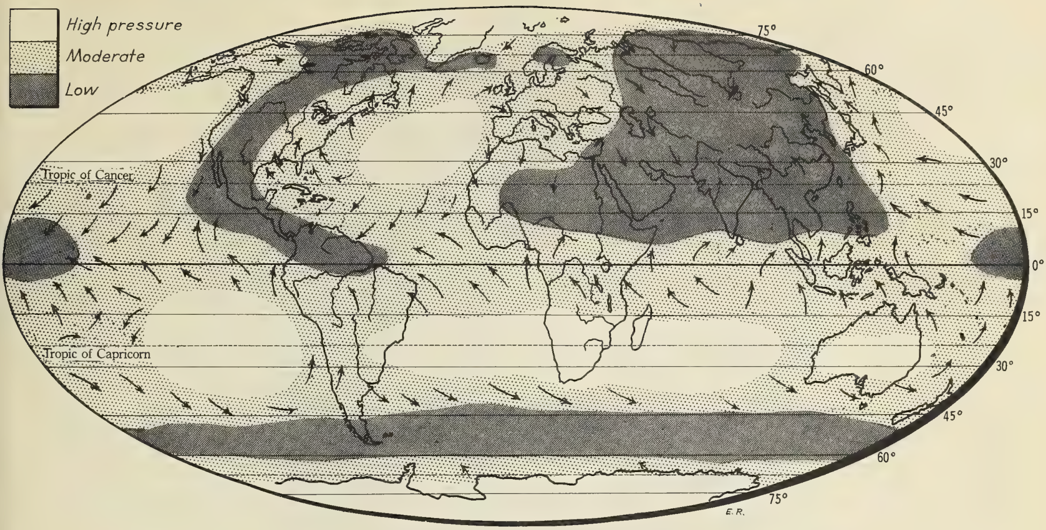
This is the way the great pressure belts of the globe are arrangea in January.

are free from the influence of near-by lands. Notice, on the other hand, that the comparable belt of low pressure in the Northern Hemisphere is broken into smaller belts as a result of the influence of the lands.

The map on this page and the map on page 61 should be studied together. By contrasting the two maps you will see that much change takes place in the pressure belts of the world between January and July. Notice that in July the pressure belts over the oceans shift somewhat to the north of where they are in January, as a result of the shifting of the vertical rays of the sun in that direction. Notice that in January high pressure belts develop over the cold continents of the Northern Hemisphere and low pressure belts over the warmer oceans. Notice that in July, when the continents are warmer than the oceans, these pressure conditions in the Northern Hemisphere are reversed.

The winds of the world. Winds are produced by the horizontal movement of air from places of high pressure to places of low pressure. This movement takes place in the lower few miles of the atmosphere, which is known as the *troposphere* ("sphere of change"). In the neighborhood of 11 miles above the equator, 7 miles above Chicago, and 4 miles above the poles, the temperature differences which keep the air near the surface of the earth forever stirred up do not exist. The upper atmosphere, or *stratosphere*, is free from water vapor, dust, and motion. Temperatures which drop fairly regularly with altitude up through the troposphere cease to drop further when the stratosphere is reached.

The chief, or *prevailing*, *winds* of the world are closely related to the permanent high and low pressure belts of the troposphere. Cold air moving outward from the belts of high pressure creates relatively calm, clear, cool climatic conditions on the earth beneath them. Belts of low pressure, where cold and warm air mingle, are the most restless parts of the troposphere. The climate on the earth beneath them is relatively stormy, cloudy, and warm, as we shall see in more detail later.



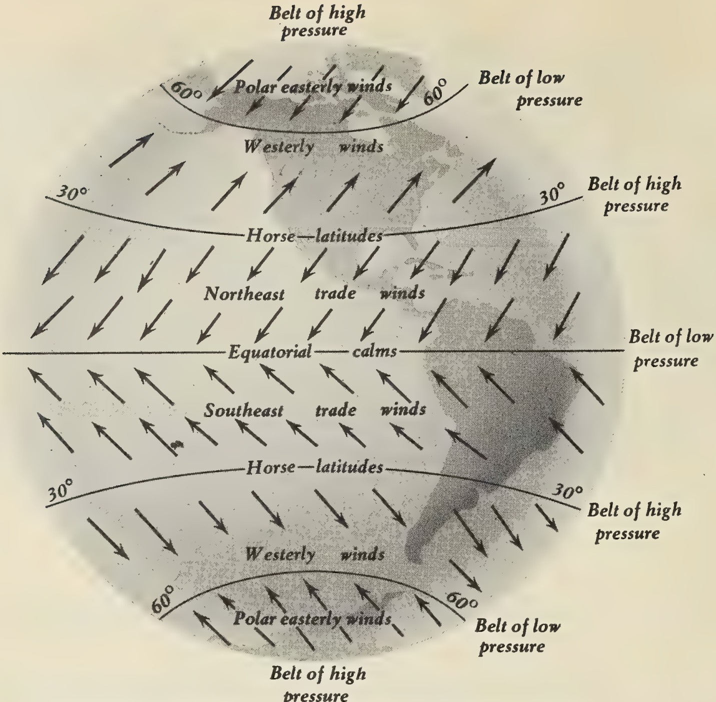
This is the way the great pressure belts of the globe are arranged in July.

If the globe did not turn on its axis, the prevailing winds of the earth would tend to flow directly north and south from the belts of high pressure to the belts of low pressure. The diagram on page 62 shows the most important prevailing winds, and how in general they are turned by the rotation of the earth toward the right of their course in the Northern Hemisphere and toward the left of their course in the Southern Hemisphere. The arrows on the maps on this page and page 60 show in detail how the winds blow between the major high and low pressure belts of the earth.

Winds and ocean currents. The movement of the prevailing winds matches (and in large measure causes) corresponding movements in the surface water of the oceans. These wind-borne ocean currents are called *streams* when they flow deep and strong, *drifts* when they are less pronounced. Compare the movement of the chief ocean currents as shown on the map on pages 64–65 with the movement of the chief prevailing winds as shown on the map above. Notice that the air currents which eddy round the high and low pressure belts of the atmosphere are all matched by eddying currents of water in the oceans beneath them.

Notice that in the Northern Hemisphere both air and ocean currents move round the belts of high air pressure as the hands of a clock move round the dial. Such movement is described as *clockwise*. Notice that in this hemisphere both air and ocean currents move round the belts of low air pressure in just the opposite direction. Such movement is described as *counterclockwise*. Notice, finally, that the movement of the chief air and ocean currents in the Southern Hemisphere is just the reverse of the movement of the currents in the Northern Hemisphere. The currents which circle round the belts of high pressure in the Southern Hemisphere move in a counterclockwise direction, whereas those which circle round the belts of low pressure move in a clockwise direction.

Air moving into the great equatorial belt of low pressure produces the trade



A highly generalized diagram of the prevailing winds.

winds, strongest and steadiest winds on earth. (See the map above and the one on page 60.) If Columbus had not first found this zone of west-blowing winds, he might never have discovered America. As long as sailing vessels were used in traveling from Europe to America, mariners sought the help of the trade winds, though this often meant going far south of the most direct route between the two continents. These same winds are responsible to a large extent for the world pattern of ocean currents, shown on pages 64–65.

The surface water of the tropical oceans is blown steadily from east to west by the trade winds. This results in currents as steady as the winds that produce them. These so-called *equatorial currents* are split and turned from their east-west course wherever they strike a great land mass. The resulting currents swing north and south into the middle latitudes and then sweep eastward and back to the tropics in gigantic circular eddies. In doing this they carry great amounts of warm equatorial water into the oceans of the middle latitudes, which profoundly affect the climates of those latitudes by warming the winds that blow over them. Similarly, other currents moving from high latitudes bring cold water into the middle latitudes, as you can see on the map on pages 64–65. These cold currents influence the climates of nearby lands by cooling the winds that blow over them.

Where the west wind blows. We have said little about the great belts of variable air pressure which occupy most of the land areas of the middle latitudes. The prevailing winds of these latitudes are produced by air moving round the permanent centers of high pressure which lie over the oceans near latitude 30 degrees north and south of the equator. Poleward and eastward of these high pressure belts, the movement of air is from west to east. The winds thus produced are known as the "westerly winds" or simply the "westerlies" because they blow *out of* the west. Though they move evenly and continuously at the higher levels of the troposphere, they are disturbed and complicated in a great many ways at levels nearer the surface of the earth.

One of the chief disturbing elements is the seasonal enlargement of the high pressure belts which lie over the polar regions. In winter the masses of cold air in these regions swell and move out toward the middle latitudes in what are known as *advancing fronts* of cold air. These masses of heavy cold air push under the masses of lighter and warmer air which lie over the oceans in the middle latitudes. Whirling eddies of air (called *cyclones* when composed of light moist air and *anticyclones* when composed of heavy dry air) take form in the zone where the larger masses of heavy and light air meet.

These relatively small and impermanent high and low pressure areas become detached from their parent air masses and move over the continents of the middle latitudes with the westerly winds. In Chapter VII we shall see how they bring a parade of changing wind and weather to the regions below. Eddies of air produced in this fashion may become detached from *any* of the permanent high and low belts of the troposphere, and move over the middle latitude lands under the urge of the westerly winds.

Other conditions further disturb and complicate the orderly movement of the westerlies over the middle latitudes of the earth. In summer, for example, the lands in these latitudes become heated and a belt of low pressure develops above them. Air pressure over the less highly heated oceans is greater than that over the neighboring lands, with the result that *oceanic winds* blow from the oceans toward the lands. In winter these seasonal conditions are reversed, and *continental winds* blow from the cooler lands to the warmer oceans.

All told, the zones of westerly winds are regions of great turmoil in the troposphere. As we go on with this unit we shall see what particular influence this turmoil has on the climate and creatures below.

MIDDLE LATITUDE WEST COAST CLIMATES

West-east thinking. When Bishop Berkeley said that "Westward the course of empire takes its way," he referred to a fact which has greatly affected our thinking. In the history of the world, more than one civilization has spread from east to west. In North America, for example, the east coasts were the first to be discovered and settled, and later development moved chiefly from east to west. Americans have come as a result to think in what might be called an east-west manner. In discussing America it is customary to begin in the east and then to work westward.

In dealing with the climates of middle latitude America, and of other middle latitude lands, it is well to reverse our customary manner of thinking. The course of the westerly winds is just opposite to that of the empires which have moved beneath them. Like the winds, the influence of the winds on the lands and peoples over which they blow moves from west to east. To understand the climates of the middle latitudes and their relationship to one another, we should think in a west-east manner. We shall therefore begin our study of these climates in the west, and then work eastward with the prevailing winds.

West coasts and east coasts. Why can people in Portland, Oregon, play golf in pleasantly cool weather when people in Portland, Maine, are shoveling snow in the bitter cold? Why in general do the west coasts of middle latitude lands have much more gentle climates than the east coasts? The answer lies chiefly in the fact that the prevailing westerly winds bring the mild influence of the sea to the west coasts and the harsh influence of the land to the east

ARCTIC OCEAN
ARCTIC CIRCLE
Labrador Current
Japan Current
West Wind Drift
PACIFIC OCEAN
Gulf Stream
California Current
TROPIC OF CANCER
North Equatorial Current
EQUATOR
South Equatorial Current
Peru Current
TROPIC OF CAPRICORN
Brazil
East Australian Current
Under 10″ yearly rainfall
10″ to 20″ yearly rainfall
20″ to 40″ yearly rainfall
40″ to 60″ yearly rainfall


ARCTIC OCEAN
ARCTIC OCEAN
ARCTIC CIRCLE
Drift
Japan
Current
PACIFIC
TROPIC OF CANCER
OCEAN
EQUATOR
INDIAN
Equatorial Current
Benguela
Current
TROPIC OF CAPRICORN
OCEAN
West Australian Current
East Australian Current
60″ to 80″ yearly rainfall
Over 80″ yearly rainfall
Warm ocean currents
Cold ocean currents

Portland Chamber of Commerce

The sea, which lies to the west of Portland, Oregon, is responsible for the mild winters of that city.

Portland Chamber of Commerce

The land, which lies to the west of Portland, Maine, is responsible for the harsh winters of that city.

coasts. It is because of this fact that Portland, Oregon, is both warmer in winter and cooler in summer than Portland, Maine, which lies in nearly the same latitude. It is because of this fact that all through the middle latitudes mild climates extend much farther toward the poles on the west coasts than on the east coasts of the continents.

If you look at the map on pages 70–71, you will see that this moderating influence of the oceans on west coast climates affects the whole pattern of vegetation in the middle and higher latitudes. The southern border of the taiga, for example, does not follow a parallel of latitude across the continents of the Northern Hemisphere. It follows a diagonal course, which ends some 10 to 15 degrees of latitude farther north on the western than on the eastern coasts. Equatorward of the taiga the same lopsided distribution of vegetation occurs rather generally throughout the middle latitudes. Mild climates pushing poleward along the western positions of the continents, and severe climates pushing equatorward along the eastern portions of the continents, cause the middle latitude belts of vegetation to be pulled from a west-east to a northwest-southeast direction.

The two Portlands are not the only cities that conspicuously illustrate the difference between west coast and east coast climates. Most of the coastal towns of Alaska, for example, are warmer in winter than the coastal cities of New England, though the latter lie hundreds of miles nearer the equator. Bergen, Norway, is as far north as southern Greenland, but its climate—both summer and winter—is less severe than that of Boston, which lies far to the south.

Upper and lower west coast climates. If you look at the map on pages 70–71, you will see that two distinct types of vegetation cover the west coastal regions of the Northern Hemisphere between latitudes 60 and 30 degrees. You will see that these same types of vegetation are pretty generally repeated on the west coasts of the continents of the Southern Hemisphere wherever there is land in appropriate latitudes to support them. The climates which these two kinds of vegetation reflect have certain traits in common. Both are largely under the control of the sea. Both are accordingly warmer in winter and cooler in summer than most other middle latitude climates. In both, the annual range of temperature is much less than that of most other middle latitude climates.

Beyond their general mildness and monotony the two west coast climates have very little in common. Poleward of the vicinity of latitude 40° (between latitudes 40° and 60°), the natural vegetation consists chiefly of heavy evergreen forests, which in the Northern Hemisphere are somewhat like those of the neighboring taiga. The climate of these upper west coast regions is cloudy, foggy, and rainy through most of the year. Equatorward of latitude 40° (between latitudes 40° and 30°), the natural vegetation consists chiefly of dwarf forests, the trees of which are very different from those of the higher middle latitude coastlands. The climate of these lower west coast regions is sunny and dry through most of the year.

WEST COAST MARINE CLIMATE AND ITS EFFECTS

West coast marine climate. The mild moist climate of west coasts which lie between latitudes 40° and 60° is the gift of the westerly winds and the warm ocean drifts, both of which in these latitudes move in a general west to east direction. Warmed as they pass over the warm water, the winds pick up much moisture by evaporation from the oceans below. When this light, moist oceanic air strikes the heavier, cooler air over the land, it is pushed upward, cooled, and forced to give up its moisture. The result is fog and rain at all seasons, but especially in winter, when the contrast between the warm oceanic and the cold continental air is greatest. This type of climate is born of the sea and is appropriately known as *west coast marine climate.*

In North America, the best known example of west coast marine climate occurs on the Pacific coasts of northern California, Oregon, Washington, British Columbia, and Alaska. From San Francisco to the base of the far-off Alaska Peninsula, freezing temperatures and snow are both rare on the lowlands in winter; heat waves in summer are equally rare. But rain is generous, with a total of 60 inches or more for the year.

Rainfall varies greatly within the region with reference to the location of high mountain ranges, which increase the tendency of the wet winds to rise and discharge their moisture. Ketchikan, Alaska, for example, is all but crowded into the sea by high mountains. Its average yearly rainfall of 160 inches rivals that of the equatorial forests. Five inches of rain in that generously watered town have been known to fall in a single downpour, which is more rain than falls in many desert regions in a year.

West coast marine vegetation. The west coast marine climate creates a heaven on earth for trees. If you have ever traveled along the coast from Vancouver to San Francisco, you will never forget the mighty Douglas firs of British Columbia, Washington, and Oregon, or the even mightier redwoods and sequoias of northern California.

These lumbermen are reaping the rich harvest of the west coast marine climate.

James Sawders

By Ewing-Galloway, N.Y.

Redwood forests are both beautiful and valuable.

They are the largest, most impressive, most valuable trees on earth. With them are several other kinds of cone-bearing trees: cedars, hemlocks, and spruces, which also thrive in the mild and dripping air. Here and there where the ground is poorly drained the forests give way to meadows. Where the soil is extremely porous, broad-leaved hardwood trees, more typical of inland regions, have won a hold on the land.

In northwestern Europe the west coast marine climate extends much farther inland than it does anywhere else in the world. Everywhere else high mountains drain the wet westerly winds before they have moved far inland, thus confining the regions of west coast marine climate to relatively narrow strips along the coasts. In northwestern Europe there are no very lofty mountains close to the coast; a west coast marine climate reaches from southern Iceland across the British Isles and deep into southern Norway, Denmark, and France.

The natural vegetation of northwestern Europe south of the taiga has been almost entirely destroyed by civilization. It was probably very much like that which has not yet surrendered to the ax in the coastlands of northwestern North America. In southern Chile and New Zealand, where west coast marine climates also occur, trees grow large and dense. Beech trees of several varieties, however, outnumber the cone-bearing evergreens. The mild moist conditions which are reflected in all these upper middle latitude west coast forests are also reflected in the lives of the human inhabitants.

West coast marine climate and human energy. People who want to play in a pleasant climate might find the fogs and drizzle of Seattle or London depressing. Such people should go to Los Angeles or Nice, where most of the days are bright and dry. But if work rather than play is to be stressed, west coast marine climate comes close to the ideal.

The geographer Ellsworth Huntington has devoted much of his life to discovering the relationship between climate and human energy. He has gathered much evidence to prove that the ideal climate for work and health should have the following characteristics:

1. It should have cool (not cold) winters and warm (not hot) summers.
2. It should be moist except in the warmest weather.
3. It should have frequent changes of weather.

Unfortunately, no place on earth satisfies all these requirements all the time. Huntington's investigations show that people are *physically* most energetic when the air is moist and the temperature averages close to 64° F.; that they are *mentally* most active when the air is moist and the temperature averages about 40° F. According to this, Seattle and London are ideal for physical activity in summer and for mental activity in winter. If these cities had more frequent changes of weather, they could lay claim to an ideal year-round climate. As it is, they can claim as good a climate as the earth

De Cou from Ewing Galloway, N.Y.

The west coast marine climate makes the southern coast of Iceland healthful and invigorating.

affords for the normal activities of men and women.

Seattle and London illustrate the upper middle latitude west coast marine climate at its best. But even at its worst this is still a good climate for work and health. The Norwegians and Swedes, who occupy the upper limits of the European belt of west coast marine climate, are highly energetic and cultivated people. Iceland, whose southern coast falls within these limits, is a forbidding land in the minds of most Americans. Actually, its average annual temperature is close to 40° F.—which is a little too cold for swimming but exactly right for thinking. That the Icelanders do think is amply attested by their history and their culture. Even the less well educated of them can read and write—many of them in three or four languages.

North American west coast marine climate. The region round Seattle, Washington, has practically the same range of temperature as the region round London. The region round Portland, Oregon, has practically the same range of temperature as the region round Paris. Though they differ widely from one another in the amount of rainfall, and though Seattle and London, which are closer to the sea, are somewhat cooler in summer and warmer in winter than Portland and Paris, all these places have a west coast marine climate.

Seattle and Portland are young cities. Their achievements, though great, are not equal to those of London and Paris. But in spite of its youth, the civilization of the American northwest coastlands is highly developed. The future of this region is so bright that President Roosevelt once referred to it as the Promised Land.

Next to the energy of its people, the chief natural resource of this region is wood. From Sitka to San Francisco the ax rings in the forests and the lumber mill hums in the towns. More and more, the rest of Canada and the United States are coming to depend on British Columbia, Washington, and Oregon for their lumber. The result is excellent business for the lumberman and almost certain doom for the finest forests on earth. To be sure, time has brought better protection against forest fires, fuller use of the timber through the reduction of waste, and con-

VEGETATION		CLIMATE
Tundra	1	High latitude marine
Taiga	2	High latitude continental
Rainy west coast forests	3	West coast marine

VEGETATION		CLIMATE
Mediterranean scrub forests	4	Mediterranean
Desert	5	Arid
Steppe	6	Semiarid

CLIMATIC

Regions

VEGETATION		CLIMATE
umid continental rests and grasslands	7	Humid continental
Subtropical forests	8	Humid subtropical
Savannas	9	Savanna

VEGETATION		CLIMATE
Jungles and rain forests	10	Rain forest
Mountains	11	All types
Ice caps	12	Glacial

GETATION

World

Vagn Hansen from Black Star

In Norway, fishing is more important than any other industry.

servation through the replanting of cut-over areas. Such measures are helping to delay the fate which befell the forests of northwestern Europe. But the fact remains that in spite of such measures the Pacific Northwest is consuming its timber about twice as fast as the timber grows.

It is consuming its next most valuable resource almost as fast. The salmon that swarm in its seas can easily be caught when they come into the rivers to breed. The greatest fisheries in the world have been built on this fact. But by a combination of too many canneries and too many dams on the streams where the salmon spawn, the fisheries of the Pacific Northwest have rapidly been declining. One by one the salmon rivers have declined in production from south to north, as human settlement has advanced in that direction. Much the same thing has happened to the halibut, flounder, and herring fisheries of the region. Fortunately, the sea is immensely fertile. If given half a chance before it is too late, it can repair its losses.

As human beings become firmly established in any region, wild resources decline in importance and cultivated resources rise. The cool moist air of most of the Pacific Northwest is not good for corn or wheat, but it is excellent for berries, many vegetables, barley, and oats. Grass grows all the year round in this region and makes the finest natural pasture lands in North America. Countless rivers provide an unrivaled source of electrical energy, yet very largely untapped. Because of all this, agriculture, dairying, and manufacturing in this region have a promising future indeed. The Pacific Northwest has a sound basis for a population many times the size of its present one, and for a civilization as rich as that of England and France, whose climate it duplicates.

European west coast marine climate. Most of the things which the climate promises for the Pacific Northwest have already come to northwestern Europe. The residents of that region have already pretty generally destroyed their virgin forests, but they have kept their fisheries alive. The coastal waters of Norway and the North Sea swarm with cod, haddock, and herring.

Fishing is one of the major pursuits of all the nations that border on these seas.

In spite of the dampness, which prevents certain crops from maturing, and the poor soil, which in many places prevents them from growing at all, the countries of northwestern Europe raise a considerable percentage of the food they consume. The Second World War, by reducing the amount of imported food, has greatly stimulated farming among these nations. France can even raise large quantities of wheat in the relatively dry area round Paris; under normal conditions it can raise nearly all the food it needs. The Netherlands and western Germany also contain rich agricultural lands, which are intensively and scientifically cultivated. The lush pastures of Scotland, Denmark, and the Netherlands are excellent dairy regions, which have given the world its finest breeds of milking cattle. Even England, which before the Second World War was largely dependent on other countries for grains and vegetables, has become an important producer of these foodstuffs by turning large areas of pasture land into crop land.

In northwestern Europe, as in the Pacific Northwest, the energy of the people is the outstanding gift of the marine climate. In Europe, much of this energy has been turned into manufacturing and commerce, pursuits which are encouraged by rich deposits of iron and coal and by an especially favorable location in the civilized world. Not a little energy has been turned into war-making, which is favored by the crowding together of many proud and ambitious nations. But these are matters which are only remotely related to climate. They will be treated more fully later in their proper place.

Southern Hemisphere west coast marine climate. The Southern Hemisphere, which

On the plains of Denmark are some of the finest dairy farms on earth.

is short on land in general, is particularly short on regions with west coast marine climate. Only southern Chile and New Zealand in that hemisphere have climate like that of northwestern North America and northwestern Europe.

Southern Chile is the poorest of all the lands with such a climate. It is populated chiefly by trees—and not very good ones at that. Much of it has not even been explored. It is mountainous, like the Pacific Northwest, but windier, wetter, and colder. Only a few sheep ranchers and sawmills are at work in this region, which is too unfriendly and too remote from the rest of the world to invite any large-scale development.

New Zealand is another matter. Though almost as remote as southern Chile, it is much more hospitable to men. Though still very sparsely populated, it has developed a valuable lumber industry and an admirable system of forest conservation. It grows grain for itself and it exports wool, mutton, and dairy products to Western Europe. Like the Pacific Northwest, it has the water power which may someday make it an important industrial region.

MEDITERRANEAN CLIMATE AND ITS EFFECTS

Mediterranean climate. Equatorward of latitude 40°, the mildness of the west coast climate increases but the moisture decreases. Between latitudes 40° and 30° in both the Northern and the Southern Hemisphere, the climate of the west coasts takes on some of the characteristics of the tropics. Because of this fact it is sometimes called a "subtropical" climate, though it occurs within the limits of the middle latitudes.

If you look at the map on pages 70–71, you will see that the typical vegetation of the lower middle latitude west coasts is best developed in the lands which border the Mediterranean Sea. Here the west coast conditions penetrate eastward in a narrow belt as far as the Caspian Sea, embracing most of the coastlands of southern Europe, northern Africa, and Asia Minor. Because of its extensive development in this region, the typical climate of the lower middle latitude west coasts is called a *mediterranean climate*.

In our own continent, the mediterranean

Some of the finest wool and mutton in the world is produced in New Zealand.

The High Commissioner for New Zealand

type of climate is confined to a narrow stretch of coastland in Central and Southern California. This is the smallest distinct climatic region in North America but, thanks to Los Angeles, which lies in the heart of it, the most loudly acclaimed. Though not all the visitors and not any of the neighbors agree, the residents of Southern California are pretty generally certain that the mediterranean climate, as expressed in North America, is the finest climate on earth.

The chief difference between this climate and that of the higher middle latitude west coasts lies in the nature of the rainfall. We have seen how the permanent high pressure belts of the globe shift southward in winter and northward in summer, with the shift in the position of the vertical rays of the sun. The prevailing winds which swirl round these belts shift with them. In winter, as a consequence, the lower middle latitude west coasts come under the influence of the wet westerly winds, which blow off the oceans. In summer they come under the influence of the dry trade winds, which blow off the lands. Winter rain and summer drought are the result, a condition which is quite different from the general sogginess of the higher middle latitude west coasts.

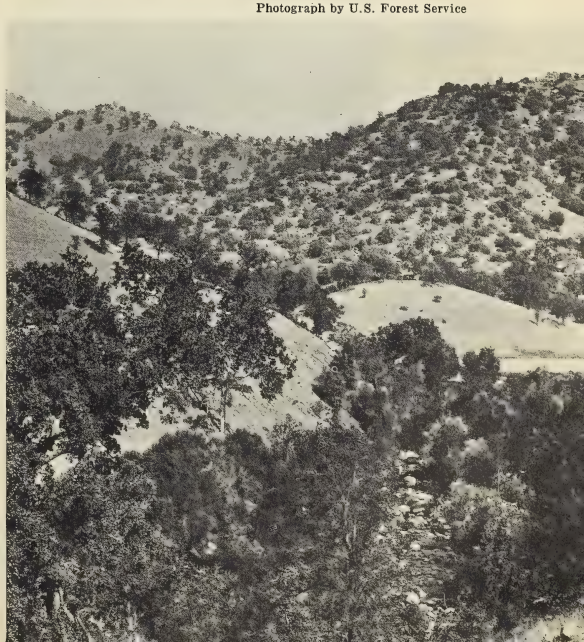
The rainfall on the lower middle latitude west coasts is not only seasonal but relatively slight. Twenty-five or thirty inches of rain a year is about the maximum for regions with a mediterranean climate; many places get only half that much and some get less than half. Summers are hot, as well as almost entirely rainless, except right at the ocean's edge; the humidity, however, is generally low, the nights cool, and the daytime heat not oppressive. The seasonal range of temperature is even less than that of the upper west coasts; much less than that of any other middle latitude climate. Though occasional light frosts are likely to occur on the lowlands every winter, killing frosts are rare. The climate, indeed, is so mild and even throughout the year that it can hardly be said to have any seasons at all.

Vegetation of the mediterranean climate. In lands which have a practically year-round growing period, one might expect vegetation to be luxuriant. But the drought which grips the mediterranean lands during three fourths of the year stunts the trees and thins the forests. The natural vegetation of these lands has an undistinguished appearance, to which the unflattering adjective "scrub" has been applied. It consists of evergreen oaks, myrtles, laurels, and several other types of broad-leaved trees; a variety of evergreen bushes which go by the general name of *chaparral* in the United States and *maqui* in Europe; a variety of coarse grasses which take over the spaces between the trees and the bushes. The photograph on this page will give you an idea of the general appearance of a mediterranean scrub forest.

Where the land is irrigated, practically any plant on earth will thrive under the balmy skies of the lower middle latitude west coasts. The grape and the orange have become as typical of the mediterranean

This is a typical scrub forest in Southern California. The trees are chiefly live oaks, which do not shed their leaves in winter.

Photograph by U.S. Forest Service



Fairchild Aerial Surveys, Inc.

Citrus-fruit orchards beneath snow-capped peaks are typical of Southern California.

climate as the movie studio and the winter resort.

North American mediterranean climate. The few thousand square miles of relatively flat land which lies between the Coast Range and the sea in Central and Southern California is in many ways what its most enthusiastic inhabitants like to say it is: the most remarkable region on earth. It is a climatic island on the continent of North America, utterly different even from the regions which lie just beyond the surrounding mountains. The culture of its people, which stems in no small measure from the climate, is no less unique than the climate.

The tremendous growth in population which this region has had in the last few decades is the best possible tribute to the pleasantness of the climate. The bustle of great industries would seem to refute the charge that the climate favors play but not work. No one, least of all the boosters for the region, would deny that it is an ideal climate for play. But neither can an impartial judge deny the bubbling energy of the population as a whole, which yields ever-increasing harvests of real achievement.

The almost feverish energy of the people in this North American belt of mediterranean climate is not typical of people who live in a similar climate elsewhere. Geographers have called attention to the fact that most residents of the American belt were born under other, more rigorous climates. These people may be operating on stored up energy which in time will run down. The great drive of the present civilization in this region gives the impression of youthful vigor. It is easy to forget that beneath it lies the dust of a Spanish culture which quickly grew old and died. So long as Midwesterners keep flocking into Southern California, however, it need have no particular concern about a shortage of human energy.

When the Spaniards first came to this region in 1769, they found the native Indians a very poor lot. Without summer rains or an adequate system of irrigation for the cultivation of crops, they were living very largely on the primitive level of hunting and fishing. The Spaniards brought great cattle ranches to Southern California and many of their Old World customs. The civilization which they founded is now dead but not forgotten. The memory of it lingers in the names of many a city and street, in the beautiful missions and the white stucco houses with red-tiled roofs. It lingers particularly in the offspring of the orange trees and grapevines which the padres planted round their missions. On these trees and vines the greatest industry of modern California has been built.

Men deserve much credit for the fact that Los Angeles County rose to lead all the counties of the United States in the value of its farm and orchard products. Los Angeles County, like all other regions with a mediterranean climate, is not naturally fitted for agriculture, because of the absence of summer rains and the general year-round dryness. To overcome this handicap the Southern Californians have drilled wells and dug ditches all over the valley lands. They have built dams and reservoirs in the canyons of the mountains to check winter floods and to save the water for summer irrigation. They have even built aqueducts to bring in huge quantities of water from the Sierra Nevada and the Colorado River, between 200 and 300 miles away.

These engineering achievements are proof of what men can do *in spite of climate*. Without them, neither great cities nor great farms could have grown up in the Los Angeles Basin, with its meager 15 inches of rainfall a year. There would not have been enough water for the people, not to mention the crops. The oranges, lemons, grapes, plums, prunes, walnuts, almonds, and a variety of vegetables which are grown in great abundance, all need more water than the climate provides. The only important crops that can be grown without irrigation in Southern California are barley, wheat, and beans.

Like most energetic young civilizations, the present civilization in this region has not been content to devote itself to agriculture alone. Of its many non-agricultural industries, the four greatest are all definitely influenced by the climate.

1. California is one of the richest oil-producing regions in the world. About three fourths of its production of petroleum comes from the relatively small area in the south which has a mediterranean climate. Drilling and pumping oil wells, building and repairing pipe lines, and most other jobs in the oil fields must be done outdoors. The mild climate of Southern California is a great help toward getting such jobs done rapidly and well.

2. The motion picture industry is also benefited by the abundance of clear bright days, for obvious reasons.

3. The great new airplane industry makes much use and profits greatly from the clear air and the low number of storms. Nearly every day in the year brings good flying weather to Southern California.

4. Last, but by no means least, the great tourist industry in this region was born of the pleasant climate and continues to be nourished by it.

Mediterranean climate in the Old World. When we move from Southern California to the lands for which the mediterranean climate was named, we are struck by the differences rather than the similarities between the two regions. Along the shores of

By Burton Holmes from Ewing Galloway

These terraced hillsides of the Mediterranean coast of Spain are intensively cultivated.

the Mediterranean Sea the oldest civilizations on earth of which we have records once had their being. During the thousands of years that separate these civilizations from the civilizations which now occupy this region, yet other civilizations have followed one another in uninterrupted succession. Each of these cultures left its mark upon the land and upon the culture which succeeded it. The result is one of the closest and most complicated unions of landscape and man on the entire globe.

There are many more people per square mile living under the influence of mediterranean climate in the Old World than in the New; their use of the land is the result of centuries of experience. In Southern California, modern mechanical industries and modes of transportation draw one's attention. Along the shores of the Mediterranean Sea, older, quieter, and slower ways of doing things everywhere mark the lives of the people. Beneath these differences, however, are certain striking similarities which grew out of the similarity of climate. The same general kinds of orchards and vineyards claim much of the land in both regions.

Agriculture is the outstanding industry of the people who live on the Mediterranean coasts today. It has all but destroyed the scrub forests which once dominated these lands. So intensively has the soil been tilled that there is little room left for domesticated animals. Only the swamps and the high cool slopes of mountains are used as grazing lands. The sheep and goats that are pastured there cannot begin to furnish what

Americans would consider an essential amount of butter and cream. Fortunately for the health of the people, nature has supplied a good substitute in the oil of the olive.

Olive trees can be grown on dry rocky slopes which cannot well be irrigated and plowed for other crops. They take the place of dairy herds over most of the Mediterranean region. Fig trees too, which also give nourishing food, can be grown on the poorer soil. The vineyards that yield the extremely valuable wines for which the region is famous claim the best locations. Groves of cork trees stand conveniently near to the wine-producing centers.

The orange and lemon orchards, which are so conspicuous in the landscape of Southern California, are abundant everywhere in their native homelands along the shores of the Mediterranean Sea. So are several other kinds of subtropical fruit, and a variety of grains and vegetables. Every bit of ground which can be irrigated has been irrigated. Only by making much of the land produce from one end of the year to the other can the crowded people on the Mediterranean coasts hope to support themselves.

Small regions with a mediterranean type of climate occur in central Chile, South Africa, and in western and southern Australia. They are all culturally too young and too far from the great commercial centers of the modern world to be very important. The ancient lands round the Mediterranean Sea, which were the cradle of modern civilization, are themselves steadily losing importance in the modern world.

To be sure, the Second World War threw the spotlight of world interest upon certain of these lands for a time by making them battle areas of great importance. But they cannot hope to be again what they once were: the hub of the civilized world. The centers of civilization have moved northward to stay, for reasons which will become clearer as we go on with this study of geography in action.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. Low pressure belts are belts of gentle winds and low temperatures.

2. Equatorial regions are belts of high pressure, caused by the high temperatures which exist there.

3. Many modern airplanes fly in the stratosphere because the traffic is less there and it is not so cold as in the troposphere.

4. A wind is named for the direction toward which it blows. For example, an easterly wind is a wind blowing out of the west toward the east.

5. In the belt of the westerlies all the winds are from the west, and the weather is nearly the same all the time.

6. West coast marine climate is characterized by much fog and drizzle and is not a good climate for work.

7. London has a milder climate than New York because it is farther south than New York.

8. The cool wet climate of places such as London and Seattle has a bad effect on human energy.

9. The extensive evergreen forests of the Pacific Northwest are among the finest lumber forests in the world, and are almost inexhaustible.

10. The importance of northwestern Europe in the modern world is due entirely to the presence of large deposits of iron and coal.

11. Many baseball games which are played in Los Angeles must be canceled because of rain. Winter picnics are out of the question there because of the cold wet climate.

12. The people of Southern California are almost exactly like those who live on the shores of the Mediterranean Sea because both regions have the same kind of climate.

13. The mediterranean climate is the finest climate on earth.

14. Practically no important industry has grown up in a region having a mediterranean climate, because the people do not have much energy.

QUESTIONS FOR DISCUSSION

1. Examine the diagram of prevailing wind directions on page 62. What would be the best route from North America to Europe, and return, if you were going in a sailing ship? What difficulty might you have if you were in a sailing-ship race from North America to South Africa?

2. Suppose that there was no circulation of the ocean water to bring warm surface water from the low latitudes into the middle and high latitudes. How do you think this would affect the distribution of the climate and vegetation bands which you saw in your observations from the moon in Chapter II?

3. Compare the advantages and disadvantages of living in a mediterranean climate with those of living in a west coast marine climate. Which of these two kinds of climate do you think you would prefer?

4. Can you think of any ancient cultures which developed under a mediterranean climate? How do you suppose the climate affected the development of these cultures?

THINGS TO DO

1. Draw a circle and sketch in from memory the prevailing wind belts of the world. Label all the prevailing winds and also the positions of the various high and low pressure belts of the earth. Compare your diagram with the diagram on page 62. If your diagram is wrong in any respect, you need to review pages 58–63.

2. Go to the library and read up on farming in the British Isles and Labrador, regions which lie in about the same latitude. Report to your class on the agricultural differences between these two regions and explain the reasons for the differences.

3. Select what you consider to be the six leading products of regions with west coast marine climate. Write a report on the way in which each product is related to the climate. Do the same for the six leading products of regions with mediterranean climate.

BOOKS TO READ

1. A thorough study of the structure and behavior of the atmosphere requires a better training in physics than the average high-school student has had. *The Air We Live In*, by George T. Renner, and *An Introduction to Weather and Climate*, by Glenn T. Trewartha, are up-to-date and fairly simple treatises on this subject. If you have not studied physics, however, you will probably find these books difficult.

2. *Climate and Man*, the 1941 Yearbook of Agriculture published by the United States Department of Agriculture, is a gold mine of information on climate. It can supply helpful outside reading for this chapter and for every other chapter in this unit.

3. One of the most interesting books on the human geography of North America is *North America*, by J. Russell Smith and M. Ogden Phillips. This book contains chapters on the Pacific Coast which are as fascinating as fiction. The American Guide Series, a series of books written under the sponsorship of the United States government, is made up chiefly of volumes on the various states of the Union. The volumes on *Washington*, *Oregon*, and *California* contain informative summaries of the history and geography of the Pacific Coast.

4. A thorough discussion of both the upper and the lower west coast climates of Europe can be found in *Europe*, by Samuel van Valkenburg and Ellsworth Huntington. A scholarly account of the Old World lands with mediterranean climate can be found in *The Geography of the Mediterranean Region: Its Relation to Ancient History*, by Ellen Churchill Semple. These books are not too easy reading, but they are very much worth while for those who are interested.

V · THE DESERT LANDS

THE NATURE OF DESERTS

Mountains, makers of climate. If you live in California you may someday climb Mt. Whitney in the Sierra Nevada. It is a long but for the most part gentle climb. From the top of this highest mountain in the United States you can see one of the most breath-taking views in the whole country. There is more in this view than mere scenery. There is one of the most striking illustrations on earth of how mountain ranges affect climate. Similar illustrations can be seen at many other points along the nearly unbroken wall of ranges which back up the western coastlands of the Americas all the way from northwestern Alaska to the far-off tip of Chile.

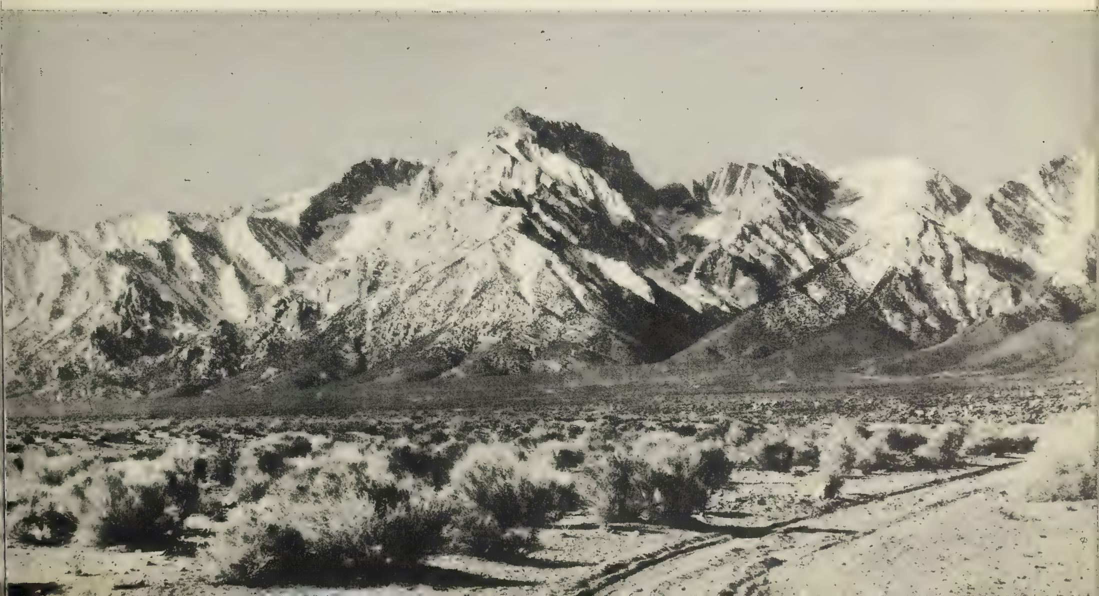
Not only in western America but at several other places on the globe, the boundary between the regions of different climate is a belt of lofty mountains. In flat country, climatic regions grade into one another so gently that it is difficult to say exactly where one region ends and another region begins. Where mountains mark the boundary, however, the change is relatively abrupt. Why?

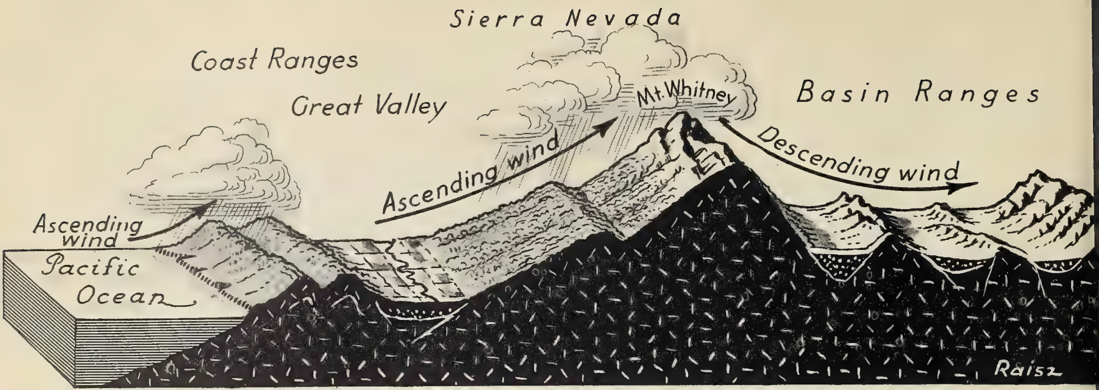
Before we try to answer this question we should take note of an important fact. *Though in many localities mountains mark the boundary between regions of different climate, their own climate is everywhere very different from that of the surrounding country.*

The lower slopes of a mountain share the climate of nearby lowlands, but hundreds of feet up its side may mark as much change in climate as hundreds of miles on level land. Some equatorial mountains have jungles at their feet and glaciers on their heads—with practically any kind of climate you can think of in between. High mountains everywhere are showrooms for a variety of climates which are different from the climates of surrounding regions. That is why mountains are set off by a special symbol on the map on pages 70–71.

Though mountains are thus a sort of no man's land in any simple classification of the

The snow-capped Sierra Nevada of California sharply divide green forest lands on the west from brown desert lands on the east. This picture shows the desert side.





This diagram shows what happens to the wet westerly winds when they pass over the Sierra Nevada. High mountains in many parts of the world profoundly affect climate by affecting rainfall.

world's chief climatic regions, they are very influential in shaping the climates of these regions. Their main influence the world round is in forcing the winds which strike them to rise, cool, and drop their moisture. Nowhere do they do this with greater effect on climate than in the western portions of North and South America. In the last chapter we saw something of how these ranges affect the climate on their westward, or windward, side. Let us now see what they do to the climate on their eastward, or leeward, side Let us go back to Mt. Whitney in California.

From the top of this highest mountain in the United States we can look down on two of the most strikingly different landscapes on earth. Westward lie cool green forests; eastward lie hot brown deserts and grasslands. Could Mt. Whitney and its fellow peaks think, they might take no little credit for what they see on both sides. They help to make the westerly winds off the ocean rise and give their moisture to the lands on the westward side. At the same time they help to turn these winds into thirsty thieves which steal moisture from the lands on the eastward side by evaporation.

The combination of drought and evaporation has made deserts of large regions to the east of the Sierra Nevada and the Cascade Range in western United States. As far north as the central part of the state of Washington there are many square miles of country in which a native of the Sahara Desert might feel at home. Much of Nevada and Utah and portions of Southern California, Arizona, and New Mexico are made up of deserts. Similar deserts stretch over vast areas on every other continent of the globe. Let us see just what these deserts are and why they came to be.

What is a desert? A great many people have never seen a desert; they have strange ideas of just what a desert is. The movies like to picture the desert as a hot, bleak, billowing sea of sand dunes reaching off to a flat horizon. The boys who trained in the American deserts for service in North Africa learned that deserts can get pretty cold on winter nights. They learned that deserts are more likely to be rocky than sandy and that they may be hilly and mountainous, as well as flat. Those who were observant learned that deserts, in spite of their barren appearance, may be the home of a surprising number and variety of plants and animals.

Hot or cold, sandy or rocky, mountainous or flat, populated or unpopulated, desert lands are all alike in one respect. They are all extremely dry. It is this extreme dryness, or *aridity*, which makes them distinct from all other lands on the globe. A desert has been defined as a region which gets on the average less than 10 inches of rain each year. Such a definition is misleading because the rainfall on desert lands is highly irregular. Some places get no rain at all for years on end. Some get their entire year's supply in one or two violent storms. Then, too, desert mountains may get twice as much rain as desert lowlands which lie only a few miles away.

Though low annual rainfall is typical of all deserts, *it is the relationship between rainfall and evaporation which really makes a desert.* Tanks of water have been set out at several places on the great deserts of the world. They were left open to the free play of sun and wind in order to learn exactly how much water the desert air could soak up in the course of a year. It was discovered through these experiments that the possible evaporation for a year in typical desert regions varies from 85 to 150 inches. With the annual rainfall of these regions well under 10 inches, the reason for their extreme dryness becomes clear.

In view of these facts we might define a desert as *a region where evaporation greatly exceeds rainfall.* But what brings about such a condition? Let us go to the nearest deserts—to those which occupy large areas in western North America—and see if we can find out.

THE SUBTROPICAL DESERTS

Location and climate. The deserts of the lower middle latitudes of western North America are described as "subtropical" because they lie near, but not in, the tropics. You will notice on the map on pages 70–71 that subtropical deserts of smaller extent occur in central Chile. Other subtropical deserts occur in the lower middle latitudes of Asia, Africa, and Australia. These deserts are all alike

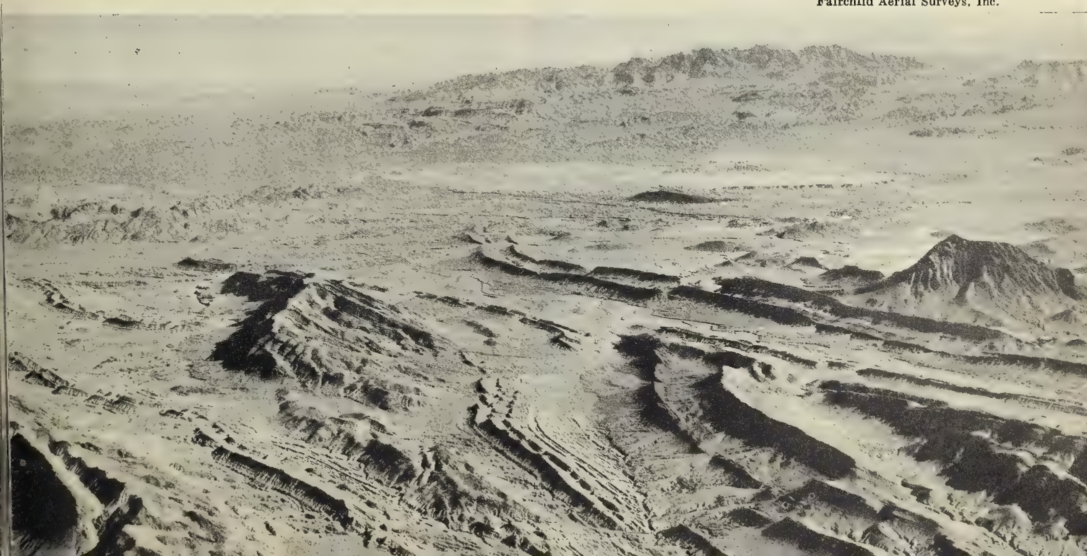
1. In being cut off in one way or another from moisture-bearing winds.
2. In lying to the east of coastal regions with a mediterranean climate.
3. In lying on the poleward sides of the great tropical deserts of the low latitudes.

The map makes it clear that the middle and low latitudes clasp hands through the desert lands of the earth. The subtropical deserts are really only the poleward extensions of the tropical deserts which we shall study in the following section. In America and in certain other regions, the one type of desert runs into the other type without a break and with very little change in climate.

There are, however, certain differences between subtropical and tropical deserts

Though most people think of the desert as a sea of sand, most deserts look more like this.

Fairchild Aerial Surveys, Inc.



which should be noted. Tropical deserts are very largely the result of the dry trade winds which blow over the low latitude lands from east to west, and sap them of their moisture in ways which we shall study later. The subtropical deserts, like the mediterranean coastal lands, come under the influence of the trade winds only in summer, when those winds have shifted poleward. In winter the subtropical deserts come under the influence of the westerly winds, but, as we have seen, only after the winds have been robbed of most of their moisture by mountains.

Some geographers have called the subtropical deserts "cold deserts" to distinguish them from the "hot deserts" of lower latitudes. It is true that the hottest year-round deserts on earth lie closest to the equator. But it is also true that the world record for the highest shade temperature (134° F.) was held until just recently by Death Valley, California, which lies well within the so-called temperate zone.

Though in general the subtropical deserts are hot in summer and cool in winter, they vary greatly among themselves. Elevation above the sea has a decided effect on desert temperatures. Death Valley, which lies below sea level, is intolerable in summer but delightful in winter. The Gobi, a desert which lies high above sea level, is not unpleasant in summer but is bitter cold in winter. All deserts, both subtropical and tropical, are alike in one respect besides dryness. They all have a great range of temperature from night to day. Land which lies under clear dry air both cools and heats very rapidly. The difference in temperature between the desert night and the desert day may be as much as 100° F. — the greatest night to day range in temperature of any climate on earth.

Outlandish member of the lily family, the Joshua tree of southwestern United States illustrates the spiny nature of desert vegetation.

Philip Gendreau, N.Y.

Plant life on the North American deserts. From the top of Mt. Whitney the deserts which roll away to the eastern horizon look almost as bald as the moon. Down on those deserts the view is considerably less barren. The upper slopes of the higher mountains are well sprinkled with bushes and trees. Even the lowest basins are not wholly empty of life. As a matter of fact, hundreds of different kinds of plants and animals thrive in regions which have less than five inches of rain a year. Plants grow even in the driest deserts, but they are not like the plants of well-watered lands. In one way or another they are especially equipped for conserving moisture.

If you should examine the plants in a typical subtropical desert landscape, you would find that many have thorns or spines instead of leaves. Ordinary plants take in moisture through their roots and lose it through their leaves. By having their leaves reduced to thorns or spines, many desert plants present much less surface to the air and therefore lose water much less rapidly. Leafless, they are also much better able to stand against the fierce desert winds.

Raymond W. Thorp

Many desert animals, like many desert plants, have tough and spiny skins for conserving moisture.

Desert plants have other ways of saving moisture against the rainless days. The creosote bush is coated with a substance which shines like varnish and which keeps the juices of the plant from escaping into the air. Several kinds of cacti have fleshy bodies for storing water. Desert trees and shrubs usually do not crowd one another. Each one has long horizontal roots to catch, within a considerable radius, the moisture that falls as rain. Each one also has deep vertical roots, which search for moisture that has escaped evaporation by seeping into the deeper soil.

The little flowering plants of the desert solve the problem of aridity by sleeping through most of the year. When the rains come they suddenly spring into life. During the few weeks when the ground is relatively moist they do what similar plants in wetter lands take months to do. During these few weeks they may cover the somber face of the desert for hundreds of square miles with the smile of their bloom.

Animal life on the North American deserts. The animal which is associated with deserts in the minds of most people is the camel. Camels are natives of Asia and Africa; the only camels on the deserts of North America are those which occasionally work there for the movies. Just before the Civil War, however, things were different. In 1856 Jefferson Davis, who was then Secretary of War, sent a mission to North Africa and Syria to buy camels for the United States. In due time the camels arrived—about eighty of them—and were put to work on some of the more difficult problems of transportation in the arid Southwest.

They were not a success. Though they were stronger than the burros and mules which were widely used as beasts of burden in the remoter parts of the desert, they were much harder to train and to drive. Riding them never became popular because too many people got seasick on their rolling backs. Cattle and horses stampeded and bucked when they approached. In the end the camels that were not shot were turned loose on the desert. They roamed around for a time in little bands and then disappeared.

Native animal life of the North American deserts is less romantic but no less interesting than the camel. A large variety of coyotes, rabbits, rats, mice, ground squirrels, birds, lizards, snakes, spiders, and insects thrive under the harsh conditions of the desert. You could visit the desert without suspecting the existence of most of these creatures unless you knew the one thing which is true of nearly all of them. *Nearly all desert animals adapt themselves to the desert sun by avoiding it.* They huddle in burrows by day and come out to feed at night.

One quaint little desert animal is called the kangaroo rat. If you cross the desert at night you may see him in the glow of your headlights, hopping across the road on his hind feet exactly like a kangaroo. One of the odd things about these animals is their total lack of fear of human beings. They love to sit on their haunches in one's hand, stuffing dry oatmeal into their large cheek pouches and looking up from time to time with their enormous soft brown eyes.

The kangaroo rat is just one of many kinds of rodents which live on the desert. All are adapted for getting what water they need from their food; none either drinks or perspires. A variety of other animals are adapted to the dryness in a variety of other ways. All, however, are more or less alike in having dry skins which prevent moisture from escaping into the air.

The pattern of desert settlement. Men and women, like plants and animals, can live on the desert only by solving the problem of an adequate water supply. Unlike plants and animals, men and women do not always have to make the best of conditions as they find them. They can use their minds to change certain conditions which are unfavorable to their comfort and safety. They can meet conditions which they cannot change by changing their own ways of doing things. In other words, men and women are highly *adaptable*. Their occupation of the stern environment of the desert is one of the clearest proofs of their adaptability.

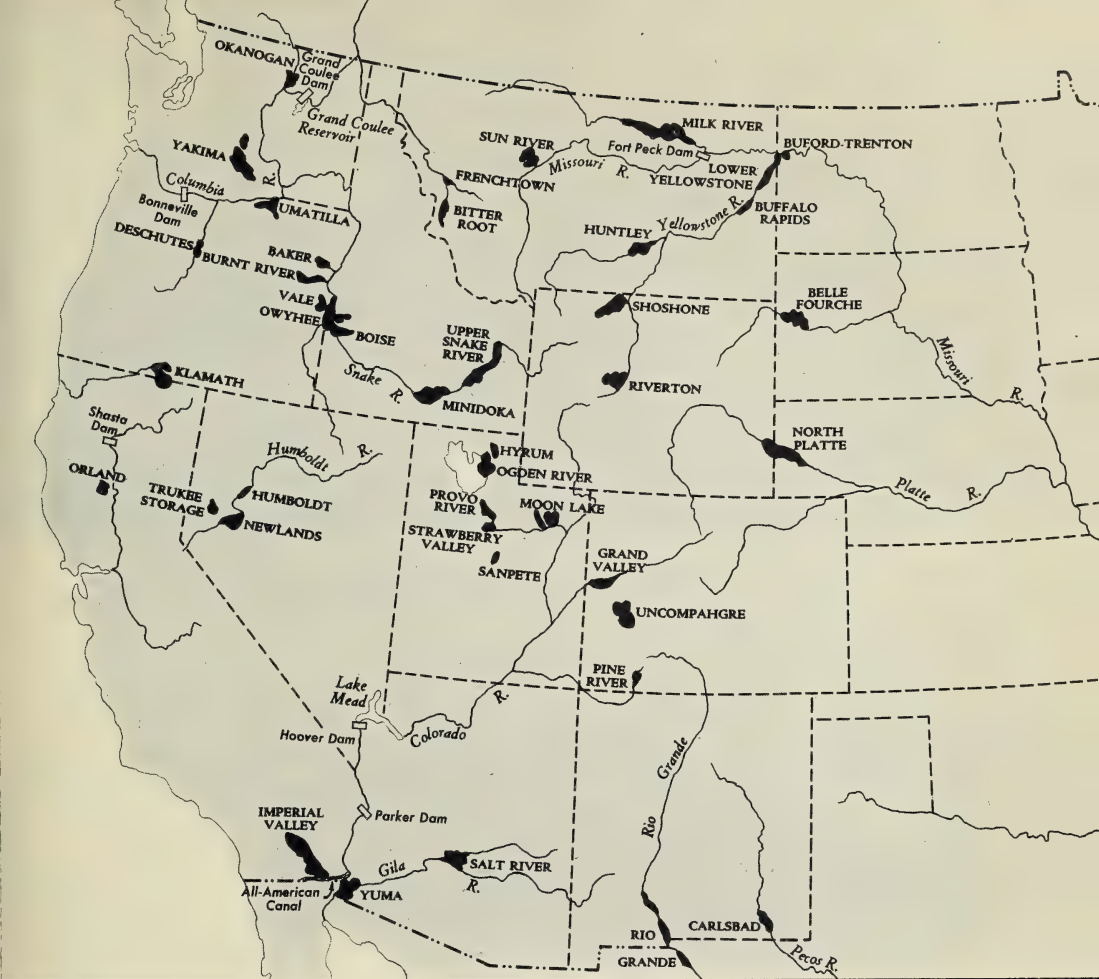
Their adaptability, however, is not without limits, a fact which is also clearly illustrated in their use of the desert lands. These lands make up about 17 per cent of all the land on earth, but they are occupied by only about 4 per cent of all the people on earth. As time has passed, human beings have greatly enlarged their occupation of the desert by conserving and increasing its water resources, but acres are still more numerous there than men. Climate is still a powerful influence in the lives of these men.

In studying the pattern which human settlements make on the broad bare face of the earth's driest lands, we should remember that deserts are regions of extreme contrast. Human adjustments to desert conditions show a comparable contrast. Great areas in all deserts, for example, are so hot and dry that human beings cannot settle there at all Other areas, where large and reliable supplies of water exist locally, are among the most thickly populated regions on earth. One of the outstanding peculiarities of desert lands is the irregular distribution of dependable water supplies. The spotty distribution of human settlements which cling to these water supplies is one of the outstanding peculiarities of man's occupation of the desert.

The changing of dry land cultures. Primitive peoples had long lived on and near the deserts of the world before men with more advanced cultures came into them. Most of these primitive peoples had only the simplest kinds of tools and practically no machinery. They could not drill deep wells or build great irrigation projects. They were pretty much slaves of the climate. As a result, they were pretty much restricted to the following ways of life:

1. They could till little farms on the small wet areas, or *oases*, which occur here and there on the deserts.

2. They could herd small flocks, chiefly near the margins of the desert where there



The important irrigation projects of western United States are related to a few large rivers.

was enough moisture to provide the necessary grass.

3. They could live by robbing the farmers and herders.

In the past, many primitive peoples have combined these three ways of dry land life in accordance with their needs and the opportunities at hand More recently, however, the tide of white men's culture has washed over nearly all the dry lands on earth, reducing or completely blotting out the primitive native cultures. In the United States the lure of gold brought the first wave of white men into the dry lands of the Far West. Then came the sheep and cattle ranchers and later the dry farmers. There are still many miners, ranchers, and dry farmers on the North American dry lands, but they are not so conspicuous as they once were. The men who build and develop the great irrigation projects are in the spotlight today.

Irrigation on the desert. For centuries before the first white men came into the valley of the Rio Grande in southern New

Atchison, Topeka, and Santa Fe Railway

The ancestors of these Pueblo Indians were irrigating their farms along the Rio Grande before Columbus discovered America.

Mexico, the Pueblo Indians had practiced the art of irrigation there. They had turned to the river for what the sky had denied them: enough water at the proper seasons to make farming possible. They had drawn water through ditches from the river to the flatlands which here and there lie along its course, and had built stable communities on the basis of the crops which they were able to raise. The white men found these Indians leading peaceful lives of relative security. What the Pueblo Indians did in a small way, white men did—and are still doing—in a large way.

Irrigation, of course, is possible only in relatively small areas where conditions are favorable. The following two different types of conditions favor irrigation projects on the deserts of the Far West:

1. Certain desert mountain ranges are high enough to condense sufficient moisture from passing clouds to create streams on their sides. These streams flow, as a rule, only during and just after a rain, and most of them disappear into the thirsty gravel beds which carpet the basins at the feet of the mountains. Their water can nevertheless be trapped by dams in the mountain canyons and then fed as it is needed to croplands below.

2. A few large permanent rivers which draw most of their water from wet mountainous country far from the deserts must cross the deserts on their way to the sea. If you study the map on page 87 you will see that the great modern irrigation projects of western United States are related to these through-going rivers. East of the Rocky Mountains the headwater streams of the Rio Grande and the Missouri River supply the water; west of the Rockies it is chiefly the Columbia and Colorado rivers and their tributaries that make the projects possible. Not all the irrigation developments shown on the map are in true desert country, but all are in regions where rain alone cannot be trusted to make farming safe and profitable.

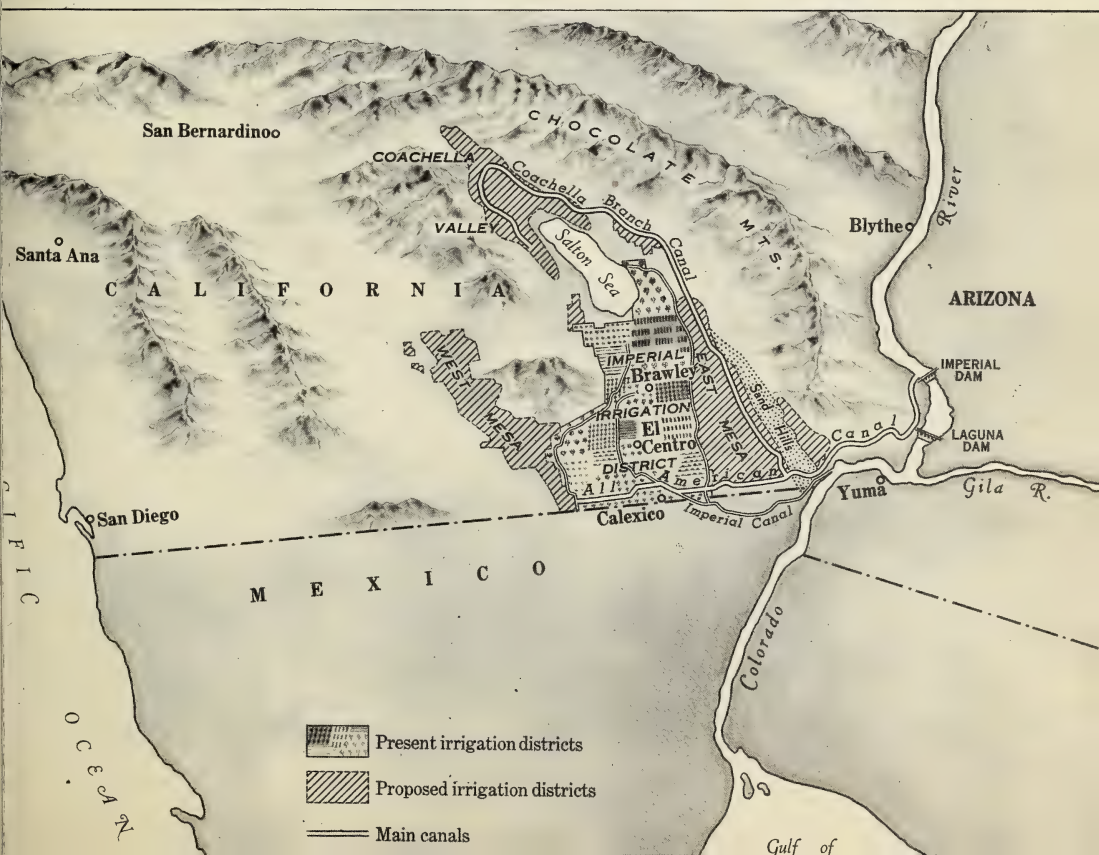
Imperial Valley. Half a day's drive from Los Angeles over excellent roads will bring you to a desert which once was everything anyone has ever imagined a tropical desert to be—except that it was not located in the tropics. Until 1900 Imperial Valley, in southernmost California, was one of the hottest and driest deserts on earth. It is still hot enough to fry eggs on the sidewalks of its cities in July, but it is no longer dry. The map below will show you why.

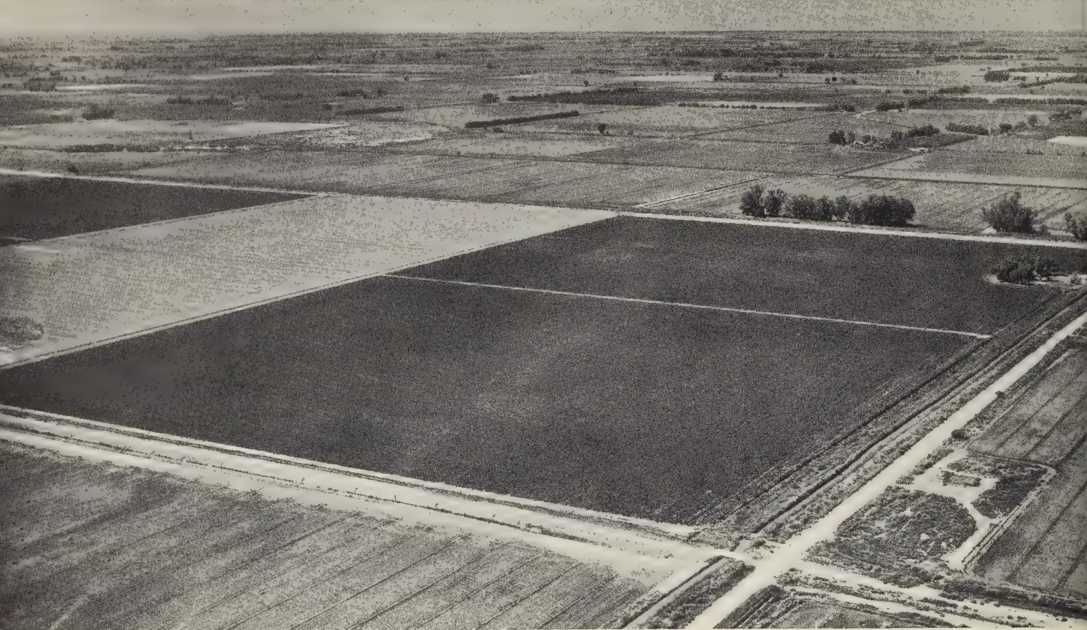
Hundreds of feet below the level of the sea, and cut off from moisture-bearing winds by high mountains which flank it on both sides, Imperial Valley is by nature unusually hot and dry even for a desert. Though open to the Gulf of California at its lower end, it was as dry as a bone when white men discovered it. The Colorado River had built a great delta of gravel and sand across the mouth of the valley, and this natural dam had shut out the sea. What sea water had once been in the valley had been sucked up by the desert sun before the white men came.

Through an elaborate system of dams and canals, water was drawn from the Colorado to the floor of Imperial Valley hundreds of feet below. Overnight, as it were, one of the most worthless deserts on earth was turned into one of the richest farming districts through the magic of irrigation. Beneath sunny and frost-free skies, and in soils which have not been robbed of their valuable minerals by rain, cultivated plants grow fast and well on the irrigated fields throughout the year. Hundreds of thousands of acres are today producing a great variety of crops: alfalfa, barley, dates, melons, cotton, and many others. Because these crops can be put on the market earlier than similar crops from less favored regions, they bring the highest prices.

All told, Imperial Valley is one of man's most brilliant victories over the desert cli-

How modern irrigation has made rich farmlands out of worthless desert lands in Imperial Valley.





Spence Air Photos

The lines on these fields in the Imperial Valley are irrigation ditches.

mate. There have been other notable victories of the same sort at various localities throughout the arid West. They show that under certain conditions man can make one of the least friendly climates on earth bow to his imagination and will.

Subtropical deserts in other lands. Imperial Valley is not a typical subtropical desert, because it has no winter period of cold weather. It differs in this respect from most other desert areas of western North America and from most of the subtropical desert areas of other lands. With the exception of Imperial Valley, however, much of what we have said about the deserts of North America holds true for the deserts which lie just east of the regions with mediterranean climate in South America, Australia, Africa, and Asia.

One of the smallest stretches of subtropical desert lies just behind the Mediterranean seacoast in northwestern Africa. It was on this desert that American soldiers got their first taste of large-scale land fighting in the Second World War. They had been trained for this fighting on the very similar deserts of California and Arizona, and so knew in advance exactly the kind of conditions they would have to face.

Much the largest subtropical deserts lie on the continent of Asia. Deserts, dry grasslands, and mountains begin just behind the Mediterranean coastlands, in Syria and Iraq, and thence run for thousands of miles in a northeasterly direction, past the Caspian Sea and deep into eastern Mongolia. In the subtropical deserts of Asia, as in all deserts, there is a sharp contrast between life on the open desert and life at the oases. On the open desert there are only a few inhabitants and they live very largely by mining and herding; at the oases there are a great many inhabitants and they live very largely by farming and trading. The ancient caravan routes between Europe and China ran from oasis to oasis across the deserts of western and central Asia. For centuries the traffic of world trade and world war was squeezed into these narrow channels by order of the desert climate.

THE TROPICAL DESERTS

Where the trade winds blow. The deserts which we have just discussed lie for the most part poleward of latitude 30° in the Northern and Southern hemispheres. In this location, as we have seen, they come under the influence of the trade winds only in summer, when those winds have shifted poleward. Between latitudes 30° and 20° in both hemispheres lie other deserts, which are under the influence of the trade winds throughout the year. These are the tropical, or trade wind, deserts.

If you look at the diagram on page 62, you will see that the trade winds blow toward the equator on a slant: from the northeast to the southwest in the Northern Hemisphere, and from the southeast to the northwest in the Southern Hemisphere. In doing so they move steadily from cooler to warmer regions. They therefore get warmer the farther they move, and as they get warmer they become increasingly able to hold moisture. Where they cross the great land masses of the earth in a general east to west direction, they make deserts by drawing up moisture from the ground. Because they draw up more and more moisture as they move farther and farther toward the west, the tropical, or trade wind, deserts lie mostly on the western sides of the continents. These deserts are on the whole the largest, driest, and hottest deserts on earth.

"The Great Desert." If you look at the map on pages 70–71, you will see that much the largest unbroken stretch of desert land in the world lies in northern Africa and adjoining regions in Asia. Nearly one third of the entire continent of Africa—some 3,500,000 square miles—falls within this belt. These African wastelands, which we call the Sahara, but which many old atlases labeled "The Great Desert," stood for centuries as a wall between the white men of Europe and the black men of equatorial Africa.

Not until the twentieth century was this wall broken through to any considerable extent. With the rapid improvement in transportation and communication which that century brought, The Great Desert began rapidly to break down—both as an obstacle and as a mystery. Today automobiles and airplanes cross it in safety at several places. More is known about it than about any other desert, except possibly the deserts of North America.

Philip Gendreau, N.Y.

Automobiles have broken through the wall of the Sahara.

Climate of the Sahara. On the whole, the Sahara Desert is drier and hotter than the North American deserts. This is due partly to the fact that it lies nearer the equator, and partly to the fact that its surface is for the most part lower and less mountainous. Though the Sahara has some mountain ranges which are high enough to be capped with snow in winter, more than half its enormous surface is flat or nearly so. These flatlands are divided into rocky plateaus, which the natives have named the *hamada*, and sandy plains, which they call the *erg*. Because of the comparative uniformity of their surface, the climate of these flatlands is more uniform than that of the more mountainous deserts of North America.

This does not mean that the Sahara escapes the extremes of weather and climate which are the fate of desert lands wherever they exist. The Sahara knows well the fury of the sudden cloudburst which may wash away in a few hours a village that has been bleaching in the sun for several years. It knows nights which can put a skin of ice on a puddle of water in the neighborhood of an oasis, and days when a man would literally burn to death if tied like Gulliver to the ground. Then, too, the mountains and high plateaus of the Sahara are noticeably cooler and wetter than the lower plains. In most places, however, change in the elevation of the desert floor is so gradual that a traveler scarcely notices the change in climate which results.

Plant and animal life of the Sahara. The Sahara contains a large share of the most barren land on earth. Only a few relatively small areas in the subtropical deserts are as empty of plant life as are several large areas in the Sahara. There are places where a caravan can move for days without seeing enough vegetation to affect the overwhelming impression of an utterly lifeless world. Yet the Sahara does have its plant life and it is not unlike that of the North American deserts. In many places, widely spaced thorny bushes hug the ground to escape the wind, and probe the soil for moisture with long deep roots. Here and there tufts of coarse wiry grass brave the dry air and the sun. Even areas that look completely lifeless may suddenly turn green and golden during a period of rain, when the little flowering seed plants hurry to live their lives before drought sets in again.

The Sahara also supports a goodly number and variety of animals which are adapted in one way or another to live on short rations of water. The addax, a fine big antelope, has a water sac in its abdomen which serves as a reservoir when drinks are few. Gazelles, hares, jackals, rodents, lizards, beetles, and flies all have ways of dealing with the desert climate.

The most famous of all desert animals, the camel, is also the one which is most completely equipped for the life it leads. Its lips and tongue are hard so that the prickly plants on which it feeds will not draw blood. Its eyes and nostrils can be tightly closed against swirling sand and dust. Its feet have cushions which make walking on loose sand and gravel easy, and which give protection against heat and sharp stones. Its stomach can store water to supply the animal's needs for from three to five days when the pasturage is poor. It can live without water for three or four weeks when the pasturage is good. Its hump stores fat which can be drawn upon when food runs low. All told, the camel is as nearly perfectly fitted for the life it leads as any creature on earth.

Human life between the oases. Romantic writers have often told about the fierce tribes of nomadic herdsmen who roam the tropical deserts in search of grass; who raid the caravans and rob the oasis settlements at will; who even have destroyed whole empires and then have built others to take their place. Though such raids have been made, the raiders were in very few cases true desert men. They belonged to the dry grasslands which lie for the most part beyond the deserts, and which we shall study in the next chapter.

Deserts, as distinguished from dry grasslands, simply do not supply enough grass for any herding worthy of mention. Herdsmen, to be sure, may move into the deserts when rain creates temporary pastures there. Ordinarily, they must stay in regions where rain and grass are more regular and abundant. Human life on the open desert, where it exists at all, consists of little more than a life of travel from one oasis to another. The only true nomads of the Sahara Desert are the men who drive the camel caravans between the oases. These men were never numerous. Now that the tractor, the automobile, and the airplane are competing with the camel, the camel herder is rapidly disappearing.

By Ewing Galloway, N.Y.

This is a typical oasis village in the northern Sahara. As in many another desert settlement, the buildings have thick walls of sun-dried mud bricks for protection against the heat.

The great caravans which once carried rich cargoes of ivory and slaves from Black Africa to the shores of the Mediterranean Sea are now a thing of the past. The robbing of these caravans by dashing nomads is also a thing of the past. Safer and faster means of transportation have come to the Sahara, and to many other deserts, with the coming of modern civilization. There is still a considerable amount of travel on the Sahara by camel and donkey caravan, but it is only of local importance. The herdsmen of the desert borderlands produce meat, milk, leather, and wool, which they bring into the oasis towns to exchange for dates and other agricultural products. Even this relic of past customs is fading away as European goods and European ways of doing things extend their influence over the desert lands and their native peoples.

How oases are made. On the Sahara, as on all other deserts, human activities are centered at the oases. As on all other deserts, the oases are few and far apart. Where intermittent streams come off the desert mountains there is likely to be water in the gravels of the stream beds at the base of the mountains, even when the streams themselves are dry. Shallow wells dug in these dry stream beds, or *wadis*, may yield enough fresh water to support such a settlement as is shown above.

Even the drier portions of a desert are likely to be well watered underneath their surface by rains which have fallen on distant highlands and have slowly seeped into the rocks beneath the desert floor. Where the structure of the rocks is such as to hold some of this water under pressure, the modern drill can tap the underground reservoir and


By Ewing Galloway, N.Y.

These desert merchants are selling cloth at a market in the oasis settlement of Gizah, Egypt, not far from the pyramids.

create free-flowing, or artesian, wells. Entirely new oases have come into existence in this way during the last few decades. But on the Sahara, as on all other deserts, the greatest oases lie along permanent streams which rise in rainy highlands and flow through the desert on their way to the sea.

Egypt, queen of oases. The story of Egypt runs through many centuries of history and to tell it in full would require a whole library of books. We cannot even begin to tell it here. As students of geography, however, we must note in passing that the importance of Egypt in world history rests on the fact that the Nile River flows through it from one end to the other. Without the Nile, Egypt would be a worthless desert; with the Nile it is the most valuable oasis on earth.

With the help of this great dam 13 million acres in the Indus Valley can be irrigated.
Philip Gendreau, N.Y.

Until the twentieth century, irrigation in the Nile Valley depended on the floods which brought water to the desert flatlands along the river. In 1902 Great Britain built the great Aswan Dam to hold back the floods. It also built a vast network of canals and ditches to bring the trapped water onto the cultivated fields in the right amounts and at the right times for the crops. Through these works, many more acres can now be irrigated and many more crops raised than was ever possible in the past. Some 15,000,000 people now live on the oasis of the Nile Valley—about 1700 people to the square mile. It is one of the most crowded agricultural regions on earth.

Like the Imperial Valley in California, which it resembles in many ways, the Nile Valley is also one of the richest regions on earth. Under the influence of the British the traditional desert crops of dates, figs, peaches, and other warm-climate fruits have given way to more valuable "money" crops, such as sugar and cotton. So, in one way or another, modern civilization is changing the character of desert activities, both at the oases and between them. In ways too numerous to be listed here, it is loosening the age-old grip of the desert climate on the lives of men.

Other tropical deserts. We have discussed the tropical deserts with special reference to the Sahara because the Sahara is more or less typical of them all. The great Arabian Desert, which adjoins it, is in many ways a copy of the Sahara, with its vast stretches of nearly empty wastelands and its mighty oasis of the Tigris and Euphrates rivers. Similarly, the barren tropical desert lands of northwestern India embrace the oasis of the lower Indus River. Here, again, the British have recently built a tremendous irrigation project, with thousands of miles of canals and ditches. Though most people are not aware of the fact, more acres can be irrigated in the valley of the Indus than in the valley of the Nile.

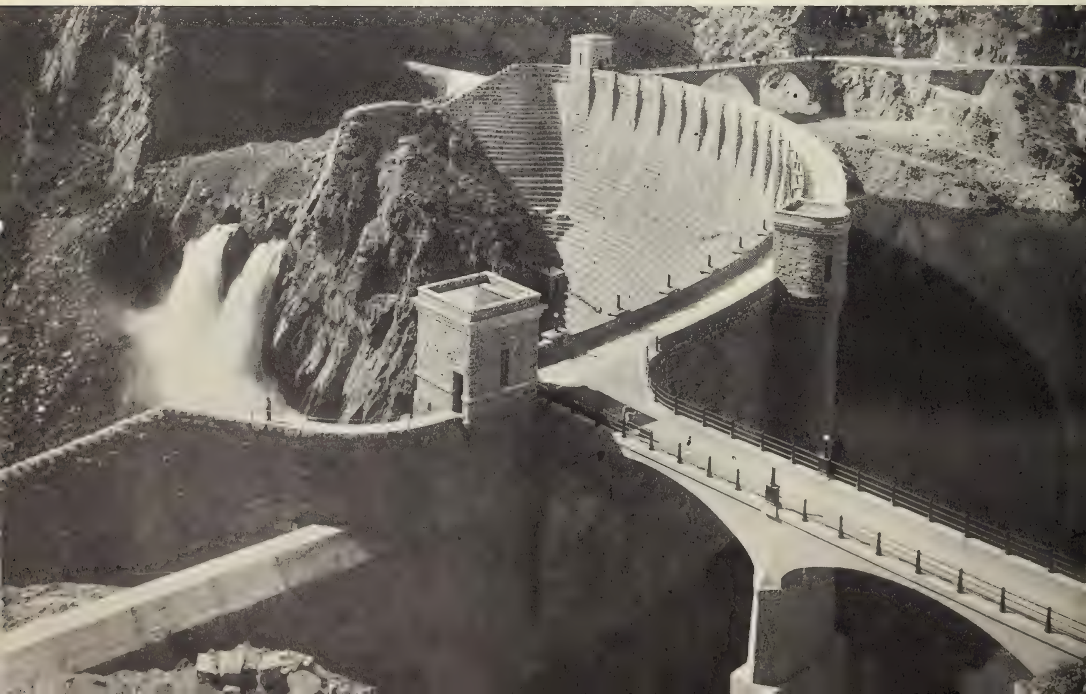
The Great Victoria Desert of southwestern Australia is not blessed with any through-going river and therefore remains relatively undeveloped. The Kalahari Desert of South Africa is also poorly developed, though not a little irrigation is possible in its northern part. The Atacama Desert of northern Chile is so hot and dry that mining is the only human occupation which is possible there, and that only by carrying in all equipment and food from places outside the desert. Oddly enough, the valuable nitrates which are mined there are the gift of the desert climate. These minerals, which are needed in the manufacture of fertilizers and explosives, are soluble in water. Should the Atacama Desert suddenly turn wet, one of the world's richest deposits of nitrates would be washed away.

A glimpse of the Atacama, one of the driest and most desolate of deserts.

By Ewing Galloway, N.Y.

Age-old native methods of lifting water for irrigation are still in widespread use in the dry lands of northern India.

The Roosevelt Dam, in Arizona, is one of the many dams in the United States which are used for irrigating the dry lands of the West.



The future of the deserts. What role will the deserts play in the world of tomorrow? Part of the answer to this question lies in the role which the deserts are playing today. For centuries the deserts, like the oceans, had stood as barriers to the movement and ambitions of men. Today those barriers are crumbling fast under the attack of modern civilization. They will doubtless continue to crumble in the future.

Today the white man has pushed into nearly every desert on earth. He has brought with him his ideas of conduct and his knowledge of machinery. With the one he has already changed the habits of the native peoples; with the other he has changed their land. This double process of change will doubtless go on in the future, but it will be limited—as all human activities on the desert have always been limited—by the amount of water that can be made to serve the needs of men.

Through irrigation of one sort or another, desert populations will doubtless increase as the number and size of the oases increase. There is slight prospect, however, that men will ever swarm into the deserts as they have swarmed into the wet lands of the earth. Much the largest parts of all deserts today are unirrigated and practically uninhabited; much the largest parts probably can never be irrigated or in any other way be made habitable for any large numbers of human beings. Short of the highly improbable discovery of how to make rain, men will have to continue to write off the deserts as essentially worthless regions.

Man's greatest victory over the desert may well come not from his ability to develop the small wet spots, but rather from his ability to move safely and rapidly over the vast dry areas. Now that the Second World War is over, the people of northern Europe and Asia will more than ever before need to exchange their manufactured products for food. Throughout most of the past, the deserts have kept these people from realizing in full the vast agricultural possibilities of the wet tropical lands which lie beyond the deserts. Tomorrow, with desert distances and terrors reduced to insignificance by the airplane and other improved means of transportation, the doorway to the tropics will at last be open wide.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. Deserts, the world over, are caused by mountains that rob the prevailing winds of their moisture.

2. The only important cause of desert climate is low yearly rainfall.

3. All the deserts of the earth are close to the equator.

4. A desert is a dry and continuously hot region which is mostly flat and covered with sand dunes.

5. The only way desert plants can conserve water is to grow long vertical roots which gather moisture from the deeper layers of soil.

6. Only such animals as can stand long exposure to intense sunshine can live on the desert.

7. All the people who live in deserts live on the oases.

8. The reason why more people do not live in the deserts is that the climate is too hot for comfort.

9. The North American deserts have very few animals.

10. The great wonder of Imperial Valley is that it lies several hundred feet above the level of the Colorado River.

11. Most of the people who live in the Sahara Desert make their living by robbing other people.

12. The Nile Valley contains the most extensive irrigation project on earth.

13. The Australians have not yet developed the Great Victoria Desert, because they have little need for the land.

14. Deserts are chiefly important as large areas which are rich in possibilities for future development.

QUESTIONS FOR DISCUSSION

1. If you were going to live in a desert for a year, what preparations would you make? What would you take with you? What new experiences should you expect to have?

2. Try to imagine the changes that would occur if the climate in which you live were changed to a desert climate. How would the change affect the appearance of your neighborhood? How would it affect the activities of the people?

3. How would the climate of the western United States and Canada differ if there were no mountains to cut off the moisture-bearing winds from the Pacific Ocean? How would this have affected the development of the country?

4. During the Second World War the British Eighth Army made a famous advance across the North African desert from Cairo to Tunis, a distance of well over a thousand miles. That army had many problems which were directly caused by the climate. What do you think these problems were?

5. Can you think of any ancient civilizations which developed in a desert climate? If so, why do you suppose they developed there?

THINGS TO DO

1. Make a list of the states of the United States which contain areas with desert climate. Look up the population and the area of each state in a world almanac or atlas, and calculate how many people per square mile each state contains. Then calculate the number of people per square mile in Iowa, New York, and Massachusetts, which contain no desert areas. Which states have the least people per square mile? Why?

2. Mark and label the chief desert regions on an outline map of the world.

3. Write a short article on the differences between people who live settled lives on desert oases and those who live nomadic lives between the oases. Base your article on a comparison of a Nile Valley farmer and an Arabian nomad. You can read up on the lives of these different types of desert people in an encyclopedia.

4. Study the map on page 87. The black areas on the map show the chief irrigation developments of the western United States. Make a list of them and list the following for each: the state in which it is located, the river on which it occurs, the climate in which it is found, and the average yearly rainfall in each area. For the last two items consult the maps on pages 70–71 and 64–65.

5. Look up information about the deserts of South America, South Africa, and Australia. Find out and list the reasons why irrigation developments on these Southern Hemisphere deserts have not kept pace with irrigation developments on the Northern Hemisphere deserts.

BOOKS TO READ

1. There are several good books about the deserts of the North American Southwest. *The Colorado Conquest*, by David O. Woodbury, tells the fascinating story of a great desert river and the struggle of men to conquer it. *The California Deserts*, by E. C. Jaeger, tells things which a visitor to the North American deserts should know. *Desert Country*, by Edwin Corle, tells some interesting stories about people on these deserts. *California Desert Trails*, by J. Smeaton Chase, is the charming account of an Englishman's wanderings in the deserts of Southern California.

2. The classic general work on the North American deserts is *The Desert*, by John C. Van Dyke. It is also very good reading.

3. The classic general work on the Sahara is *Sahara: The Great Desert*, by Emile F. Gautier. This book provides a superb example of fine entertainment combined with sound information.

4. An exciting true adventure on the desolate Danakil Desert of Ethiopia is described in *Hell Hole of Creation*, by Lewis M. Nesbitt. An exciting true adventure on the Arabian Desert is described in *Revolt in the Desert*, by T. E. Lawrence.

VI · THE DRY GRASSLANDS

THE GRASSLANDS OF THE WORLD

Between desert and forest. Between the lightly clothed desert lands and the heavily clothed forest lands of the earth lie the lands which are clothed in grass. A bird's-eye view of the globe would show that grass is the native vegetation on somewhere between one fifth and one third of its land surface. In many places the native grasslands have been turned into croplands by the plow. In other places forest lands have been turned into grasslands by the ax. In all places where grass is the native ground cover, the grassland areas vary in size from year to year as rainfall varies in amount. For one reason or another, then, the grasslands and the climates which they reflect are not definitely set off from the regions of different vegetation and climate which adjoin them.

The desert climate, where it reigns supreme, is marked by extreme violence. But where it is forced to give way to other types of climate, it does so with an odd and baffling gentleness. Except where mountains mark the desert's edge, the change from dry to wet climates is rarely abrupt. This change is registered in most places by grass.

We have already seen that it is not generally possible to determine exactly where the grasslands begin and the deserts end. Even in the midst of the driest deserts, grassy areas may occur along beds of wadis, in hollows among the hills and dunes, and almost anywhere during periods of rain. Desert mountains and plateaus may get enough rain to spatter them rather generously with tufts of grass. Where the desert margins are in flat or rolling country, the grass comes in, as a rule, so gradually that it is scarcely noticeable. And no less gradually does the grass grow thicker and taller as the climate grows steadily wetter away from the desert border zone and up to the zone where the forests begin to come in.

The kinds of grasslands. In view of these facts it is clear that no hard and fast classification can be made of the grasslands and the climates which they reflect. We can only say in a very general way that deserts yield to grasslands wherever the rainfall is greater than 10 inches a year. Where the annual rainfall is less than this amount, bushes are generally the chief type of vegetation; such grass as exists is likely to grow in tufts, which are separated from one another by spaces where no grass grows. Where the annual rainfall is more than this amount, grass which forms a continuous mat over the ground is likely to be the chief type of vegetation. It is there that the true grasslands begin.

In the same very general way we can recognize a zone in which the rainfall averages between 10 and 20 inches a year. The climate of this zone is dry but not so dry as the desert climate; we can call it a *semiarid ("half-dry") climate.* The grasslands that lie in regions of semiarid climate are characterized on the whole by grasses which grow only a few inches to about a foot tall; we can refer to them as *semiarid, or short-grass, grasslands.*

Similarly, where the average rainfall is between 20 and 30 inches a year, the climate may be called a *subhumid ("slightly wet") climate.* The grasslands which lie in regions of subhumid climate are characterized by grasses which grow from a foot to several feet tall; we can refer to them as *subhumid, or tall-grass, grasslands,* or more simply as "prairies." Beyond the wet edge of the subhumid zone, where the average annual rainfall is between 30 and 40 inches, the grasslands yield to forest lands. Where the rate of evaporation is low, however, forests may exist under a rainfall of as little as 25 inches a year.


LAND FORMS
OF
NORTH AMERICA
Scale of miles
0 100 200 300 400 500
Lowlands
Plateaus
Great Plains
Mountains
ARCTIC OCEAN
PACIFIC OCEAN
ATLANTIC
GREENLAND
Baffin Bay
BAFFIN ISLAND
ARCTIC ARCHIPELAGO
Bering Strait
ARCTIC COASTAL PLAIN
BROOKS RANGE
YUKON DELTA
Yukon
YUKON PLATEAU
ALASKA RANGE
ALEUTIAN RA.
Mackenzie R.
Great Bear Lake
Great Slave Lake
Lake Athabaska
Hudson Bay
HUDSON BAY LOWLAND
LABRADOR PENINSULA
LAURENTIAN HIGHLAND
Lake Winnipeg
St. Lawrence R.
Great Lakes
ROCKY MOUNTAINS
INTERIOR PLATEAU OF BRITISH COLUMBIA
COAST RANGES
GREAT PLAINS
Columbia R.
CASCADE RANGE
COLUMBIA PLATEAU
COAST RANGES
SIERRA NEVADA
GREAT BASIN
WYOMING BASIN
Missouri R.
CENTRAL LOWLANDS
Ohio R.
INTERIOR HIGHLANDS
Mississippi
APPALACHIAN PLATEAU
APPALACHIAN HIGHLANDS
NEW ENGLAND HIGHLANDS
COASTAL HILLY BELT
PIEDMONT UPLAND
COASTAL LOWLANDS
Continental Shelf
ATLANTIC COASTAL LOWLANDS
COLORADO PLATEAU
Colorado R.
WESTERN SIERRA MADRE
MEXICAN PLATEAU
SONORAN DESERT
EASTERN SIERRA MADRE
SOUTHERN SIERRA MADRE
Rio Grande
GULF COASTAL LOWLANDS
Gulf of Mexico
BAHAMA IS.
TROPIC OF
WEST INDIES
Caribbean Sea
ARCTIC CIRCLE
ICELAND

Most of the wild grasses of the world are of the short-grass type, which grows in a semiarid climate. Only relatively narrow belts of tall grass normally occur along the wet edges of the great semiarid grasslands. Furthermore, as civilization has advanced into the tall-grass regions, the grass has been replaced by cultivated crops. Civilization brings people, who have need to be fed, and the subhumid climate must be made to produce food which is more nourishing and more suitable than grass. Though fairly large areas of native tall grass can still be found in out-of-the-way places on the globe, they are of little importance in human geography. The short-grass grasslands, on the other hand, are important enough to deserve a whole chapter in this book.

THE INTERMOUNTAIN STEPPES OF NORTH AMERICA

The general nature of steppes. The dry grasslands which border the subtropical deserts of the middle latitudes are known as steppes. The great steppe regions of the globe are the high plains and plateaus of North America, and the high plains and plateaus of Asia, which begin in southeastern Russia and reach far into Mongolia and China. These regions, like the deserts which they adjoin, have a very irregular rainfall. An unusually wet year might shift the position of a region of steppe lands by turning great areas of desert into steppe on the one side and great areas of steppe into tall-grass prairies on the other side. An unusually dry year, on the other hand, might shift the boundaries of a steppe in just the opposite direction.

Though we cannot say exactly where the steppes begin and end, we can easily distinguish them in a general way from all other regions on the globe. All true steppes are marked by the following conditions:

1. A rainfall that averages between 10 and 20 inches a year, and which falls chiefly in spring or summer.

2. Temperatures which are cool to cold in winter and warm to hot in summer.

3. Land surfaces which are without trees except along the streams, and which for the most part are flat or gently rolling.

4. Grasses which in most areas form a fairly continuous mat over the ground, but which do not average more than a few inches to a foot in height.

The North American steppes. Mark Twain summed up the changeable weather of New England in his famous remark, "If you don't like the weather, wait a minute." He might have summed up the variable climate of the mountainous West with equal appropriateness by saying, "If you don't like the climate, walk a mile." The map on page 100 gives only a general idea of the extreme irregularity of the surface of western North America between the Rocky Mountains and the Pacific Ocean. Rainfall in this region is equally irregular because it varies with the elevation of the land. The vegetation, in its turn, varies with the rainfall.

Do you see, then, that by traveling only a relatively small distance in this region, you might easily be able to move from an area with one kind of climate into an area with quite a different kind of climate? It is impossible to draw a map which would be both small enough to put in this book and large enough to show all the differences in climate in this country of jumbled mountains, plateaus, hills, plains, and basins. Deserts, grasslands, and forest lands grade into one another along vague and irregular boundaries throughout the region.

All is not confusion, however, when you shut your eyes to minor details, and look only at the larger elements of the landscape. That is what the map on page 100 does. Notice that when this is done the mountains of western North America fall for the most part into two great belts. One of these belts is made up of ranges which lie near or not far from the Pacific Ocean. The other belt


Philip Gendreau, N.Y.

Some of the earliest Americans lived in these cliff dwellings at Mesa Verde, Colorado.

lies well to the east of the first belt, and is made up of ranges which together are known as the Rocky Mountains.

Notice that the Rocky Mountains are flanked on both sides by lower and flatter lands, which are labeled "Plains," "Plateaus," and "Basins." If you look up these lower and flatter regions on the vegetation map on pages 70–71, you will find that they are made up very largely of steppe country except where the desert pushes its dry fingers into them on the southwest. These are "the wide open spaces" of the Far West, the big lands of little rain, the best-known steppes on earth.

A further study of the maps mentioned above will show you that these North American steppes are like a two-pronged fork. One prong comes up through the Mexican and Colorado plateaus, the Great Basin, and the Columbia Plateau; though interrupted here and there by deserts and mountains, it continues far into the Interior Plateau of British Columbia. We shall refer to the steppes which make up this prong as the *Intermountain Steppes* because they lie "between" the Rockies and the Sierras (and the extension of these ranges north and south). The other prong of the fork passes from the Mexican Plateau up along the eastern side of the Rockies, across the entire United States and far into Canada. These steppe lands are called the *Great Plains*.

Ancient culture on the Intermountain Steppes. The semiarid grasslands which lie between the Sierras and the Rockies contain some of the most beautiful, most interesting, and most poverty-stricken lands on earth. They are the oldest known home of man in North America. The cliff dwellers who once lived on the steppes of Mexico, New Mexico, Arizona, Colorado, and Utah would seem to be the ancestors of the Indians who live there now, but the Indians can tell us practically nothing about them.

The cliff dwellers, however, have told us something about themselves in the things which they left behind them. The remains of their dwellings along streams; the traces of dams, canals, and ditches which they had built to irrigate their fields; the utensils for grinding corn—all tell us that these ancient people were farmers. Their arrowheads tell us that they did some hunting too. But there is nothing in anything which they left behind to tell us that they were also herders.

The cliff dwellers lived on grasslands which nature had fitted far better for herding than for farming. Other primitive people on similar grasslands in the Old World were—and many still are—chiefly herders. The primitive Americans were not herders for an excellent reason: they had no animals to herd. There were no domesticated animals except dogs and fowls on the North American steppes until the Spaniards came in the sixteenth century with their sheep, goats, cows, donkeys, and horses. By that time all the cliff dwellers were dead.

The Hopi farmer. Some of the descendants of the cliff dwellers, however, have carried on in the ancient way. Even today you can find the Hopi Indians living on the northern edge of the Colorado Plateau much as their ancestors must have lived a thousand and more years ago. The homes of the Hopis are on mesas, those flat-topped, steep-sided hills which are a striking feature of the Intermountain Steppes in many places. They chose these natural fortresses for homes at some forgotten time in their history, and they cling to them through habit today, though they no longer have enemies who make this necessary.

Climate affects the life of the Hopi to an extent which people in a modern city would hardly believe possible. The Hopi's land is extremely dry; it could be called a desert were it not for the fact that a little rain does come fairly regularly in July and August. Nearly everything the Hopi thinks and does is related to this rain. His mythology tells of the gods that control the rain; his dances are prayers for rain; his lifework consists in making the rain grow enough food to keep him through the year.

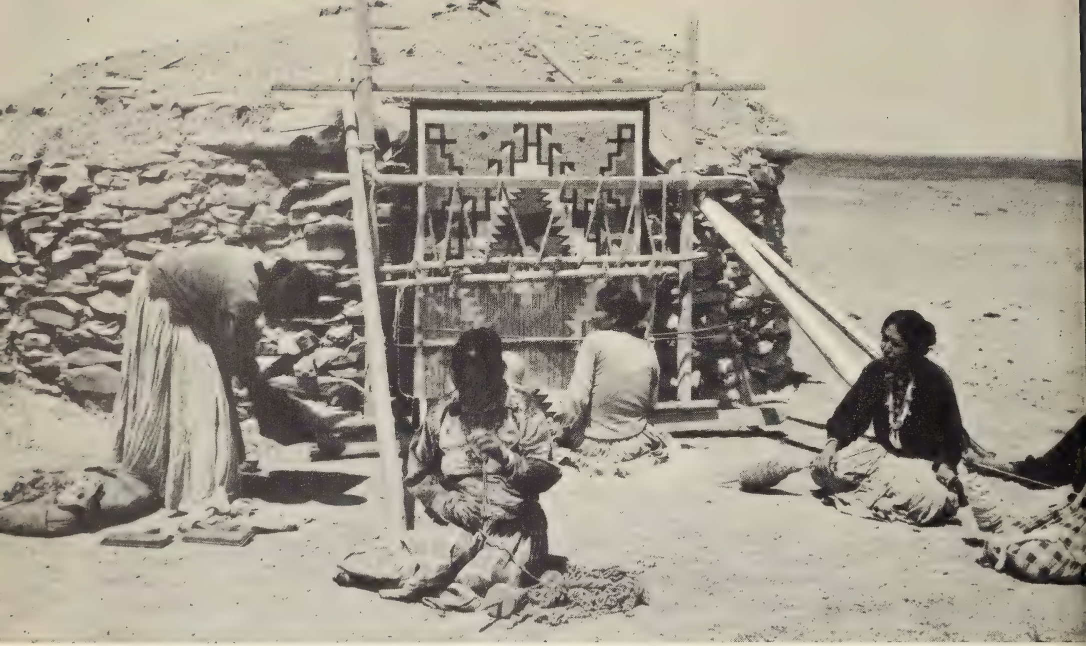
For centuries the Hopi has been developing varieties of corn which will grow and mature under the hard conditions of the semiarid steppes. When June comes round each year he plants his carefully selected seed corn in the dry stream beds which white men call *washes* or *arroyos*. He knows from experience the particular washes which hold enough moisture to sprout the corn before the summer rains arrive. He plants his seeds at least a foot deep to reach this hidden moisture. When the rain finally comes in early July the corn has sprouted long roots, with which it has anchored itself on the washes.

Throughout the Intermountain Steppes, summer rains are the result of intense heating of the ground. The air that blankets the hot ground gets hot and rises; as it rises it cools and its moisture condenses in clouds. Any day in summer you can see such clouds piling up in the sky over the Intermountain Steppes. They look like great cauliflowers with dark edges. They move with the winds until a range of mountains makes them rise higher and cool further. It is then that rain drops to the ground, locally and in most cases violently.

When it drops on the Hopi's land it often fills the planted washes with roaring floods. The corn may be buried beyond recovery, or washed away. Through the centuries, however, the Hopi has learned to harness

The Hopi Indians of northern Arizona still cling to their homes on the flat-topped mesas and to their farms along the arroyos below.

De Cou from Ewing Galloway



From Ewing Galloway

After the Spaniards brought sheep and horses to the Intermountain Steppes the Navaho Indians became herders. Wool from their herds is woven into Navaho rugs.

the floods with crude dams and ditches; to take from them just the right amount of water for his crops. He raises beans, melons, and squash on his strange fields, in addition to the corn, which is his "staff of life." If the gods do not answer his prayers for rain on his own washes, he still can generally find water on more distant washes and carry it home in pots. His life is hardly to be envied, but it certainly must be admired. It is one of man's greatest victories over a hostile climate.

The Navaho herder. The Navaho Indians are neighbors of the Hopis. They live on the great stretches of desert and steppe which make up much of northeastern Arizona and northwestern New Mexico. They have departed from the ways of their ancestors, to live chiefly by herding. The passing summer showers which bring life to the Hopi on his dry washes also bring life to the Navaho on his dry plateaus. All summer the Navaho wanders with his little flock of sheep, goats, or cattle, in search of the grass that comes to places which have been touched by the rain.

In winter the storms that move from the Gulf of Mexico drop some of their moisture as snow on the mountains and plateaus of the Navaho's country. When the snow melts, water runs in the washes to quench the thirst of the herder, and upland pastures grow green for the herd. Summer or winter, the Navaho herdsman must keep on the move—from water hole to water hole and from pasture to pasture, as the weather decrees.

Though chiefly herders, the Navaho Indians also do some farming along the washes. Some of them are excellent and industrious weavers and silversmiths, as any curio shop along the main line of the Santa Fe Railway will prove. All Navahos are shrewd traders, as anyone who has dealt with them knows. Like the Hopis, the Navahos are well adapted to life in a harsh land. They have also learned how to deal profitably with the white man, which is probably the chief reason why the Navahos are more numerous and are increasing more rapidly than any other Indians in the United States.

The white man on the Intermountain Steppes. The first white men to settle on the North American steppes were the Spaniards, who came up from the south. Their culture once filled these semiarid lands. Though dying, it lingers on in the remoter corners of the steppes, particularly round the wetter edges of the Mexican Plateau. Like the older Indian cultures, it was shaped by the climate.

The great number of storms in Mexican political history have been closely related to the small number of storms in Mexican climate. Much of Mexico is semiarid steppe land, where water is scarce. Very soon after the Spaniards conquered Mexico, a few men got control of the well-watered places. Large cattle ranches (haciendas) grew up on those places, some of them hundreds of thousands—and a few of them millions—of acres in extent. On these ranches the white owners lived very well on the proceeds of their great herds. The Indians and half-breed peons who worked for them lived little better than the cattle.

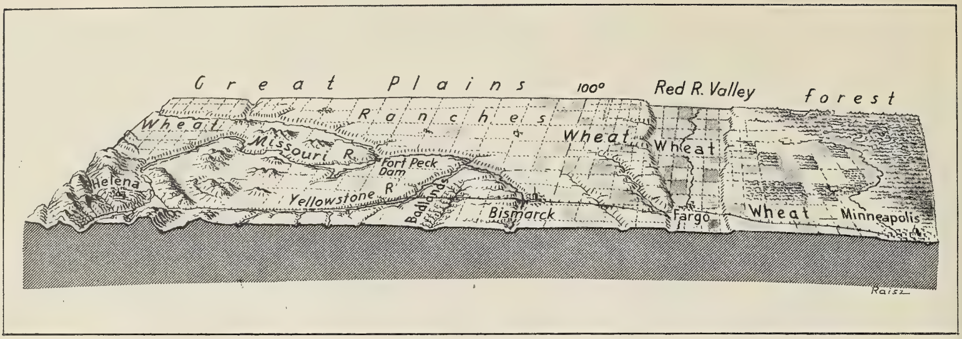
The modern history of Mexico has been largely an attempt to distribute more justly the meager blessings of a semiarid climate. The monstrous private haciendas have been broken up by the government and distributed among the poor. Irrigated farm lands have been created in many places where once only grazing was possible. Though most of the Mexican steppe lands can never be more than grazing lands, cotton, wheat, corn, beans, alfalfa, and other crops are grown in ever-increasing quantities on the irrigated areas.

The Intermountain Steppes in the United States are still populated—where they are populated at all—very largely by Indians and people of mixed Indian and white blood. Unlike the Mexican steppes, they do not have to be highly developed to support large populations. Like the deserts, they have been highly developed only in the few places which are especially favorable to irrigation projects. (See map, p. 87.)

On the whole, the Intermountain Steppes in the United States are poor lands for both farming and grazing. Most of the permanent streams are sunk in deep canyons over most of the region, and are unsuitable as a source of water to irrigate the flatlands above. Most of the grass is short and coarse. Until the population becomes very much greater than it now is, the Intermountain Steppes will probably remain very largely in Indian reservations and national forests. The steppes which are truly important in the geography of North America are those which lie east of the Rockies.

Irrigation has made possible the raising of crops on parts of the Mexican steppe lands.

C. I. A. A. Photo



On an automobile trip from Minneapolis to Helena the traveler crosses a mighty kingdom of grain and grass.

THE GREAT PLAINS

The tall-grass prairies. "Kingdom" is not too large a word for the grasslands which lie between the forested peaks of the Rockies on the west and the humid lowlands of the Middle West on the east. Imagine yourself on an automobile trip across this kingdom, let us say from Minneapolis on the Mississippi River to Helena at the foot of the Rockies. As you speed to the west past the farmlands and woodlands of Minnesota you notice a gradual change in the character of the landscape. Farms become larger and woods smaller until the only trees in the landscape are those which were obviously planted there by men.

You are now near the western boundary of Minnesota and not far from the eastern boundary of the tall-grass prairie lands. You are in a region where grass naturally takes possession of the ground. The roots of the grass form a thick network in the upper layers of soil, which acts as a wall against invasion by other types of vegetation. Trees cannot get a start here; even if their seeds develop so far as to send roots into the matted soil, they later die of thirst because they cannot compete with the grass for the moisture they need. All the second day of your trip you move through lands where the wild grass once stood from three to ten feet high. You see little or none of this prairie grass, however, because the farmers have long since plowed most of it under and planted hay and wheat in its place.

The short-grass plains. You continue your trip into North Dakota, along the fine highway that parallels the main line of the Northern Pacific Railway. At Bismarck you cross the Missouri River. Shortly before you do this you cross another line, which you probably do not notice, because, though it is on the map, it is not on the land which the map depicts. This is the line of the 100th meridian of west longitude, which divides North America into two almost equal parts. The country is flat and uninspiring on both sides of this line; you can neither see nor feel any sudden differences in the landscape, climate, or people after you have crossed it. Nevertheless, the general neighborhood of the 100th meridian is one of the most important geographic boundaries on earth.

Three important changes take place at this boundary:

1. The subhumid climate with an average rainfall of more than 20 inches gives way on the west to a semiarid climate with an average yearly rainfall of less than 20 inches.

2. The native tall-grass prairies give way to the short-grass plains.

3. The conditions under which a man can make a living on a small farm give way to conditions where he may fail on a ranch ten times as large.

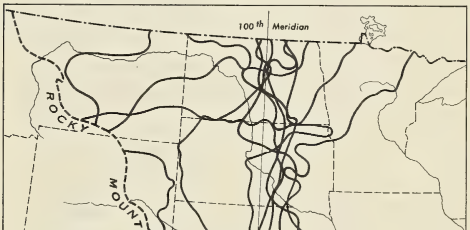
The boundary between the prairies and the Great Plains is, of course, not everywhere or always exactly at the 100th meridian. We have already seen how the boundaries of grassland belts may vary widely from place to place and from year to year. But the average of many years at many places in the United States places this particular boundary close to this particular meridian. As you drive westward of this line you get a better and better sense of the physical nature of the Great Plains. The flatlands rise higher and higher above the level of the sea, the climate gets drier and drier, and the native grasses get shorter and shorter as you speed on your way. Finally you arrive at Helena, after three or four days and a thousand miles of driving.

If you should cross the Great Plains from north to south, you would be even more impressed by their tremendous size. Between the mouth of the Rio Grande on the south and the mouth of the Mackenzie on the north—some 4500 miles as a goose flies—most of the land that borders the Rocky Mountains on the east is flat. Tundra and taiga, as we have already seen, cover the northern portion of these flatlands. Where the relationship between rainfall and evaporation becomes such that trees and grasses must compete for moisture, the grasses as usual win. This happens in central Alberta and Saskatchewan, and the grasslands extend all the way from there to the southwestern border of Texas.

What white men did to the Great Plains. Whether you cross the Great Plains from east to west or from north to south, you cannot miss observing that most of this mighty region is made up of semiarid steppe lands which are fitted by nature for grazing. The herds of bison that once roamed these steppe lands from one end to the other knew by instinct how to use them without abusing them, but men have not been so wise.

The first white men who pushed westward from the prairies to settle on the plains were livestock ranchers. In a few decades their cattle and sheep had destroyed much of the short grass of the plains, just as earlier the plow had destroyed much of the tall grass of the prairies. Grass fires helped, to be sure. but the chief cause of destruction of some of the world's finest grasslands was the grazing of more animals than the grass could support. The photographs on page 108 will tell better than words what overgrazing will do.

To make a bad situation worse, the "sodbusters," with their plows, followed the livestock ranchers onto the plains, pressing ever farther and farther into drier and drier country. James Smith, whose story we told



After H. M. Kendall

The wavy lines show how the boundary between the semiarid and subhumid climates shifts from year to year in the vicinity of the 100th meridian.

Soil Conservation Service

Cattle grow fat on grasslands which have not been abused.

in Chapter II, was one of these. He and many like him were lured by the bait of free land and the false promise of the occasional wet year to try farming on land which during most years is too dry for successful farming. We saw what happened to many of these men, but their personal misfortunes were only half of the tragedy of their mistakes. The other half of the tragedy was that they killed the grass and seriously wounded the land beneath it.

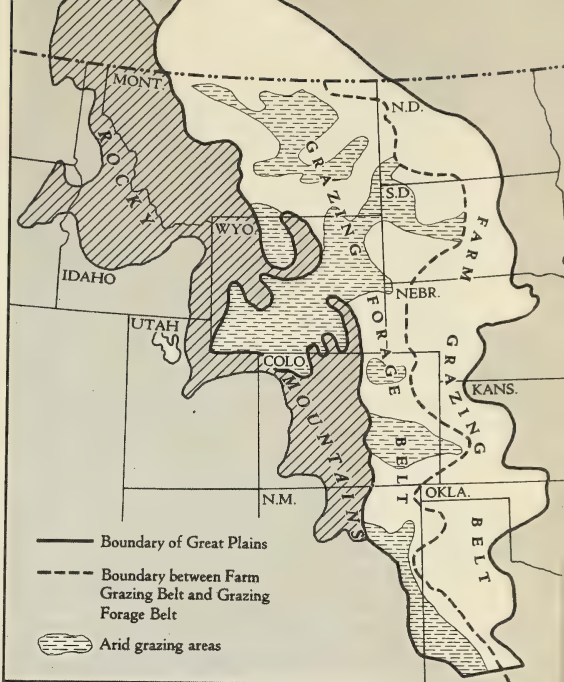
In a later chapter we shall study in detail how rain and wind get in their deadly work. When the native grasses of semiarid steppe lands are worn thin by overgrazing and overplowing, we shall see how floods, dust storms, and misery are the inevitable result. From one end to the other of the North American steppes, catastrophes such as these have quickly followed the white man's occupation. Conditions in large areas of the Great Plains grew steadily worse with time; with the terrible drought years of the 1930's they became a national problem. It was then that the national government took vigorous action to save the region and its people from complete disaster. By coöperating with the climate, instead of defying it, men are now gradually restoring the plains to health.

A program for the plains. In 1936 Dr. O. E. Baker of the United States Department of Agriculture published a pamphlet entitled *The Future of the Great Plains.* In this pamphlet the man who probably knows most about the Great Plains outlines what are probably the best ways of using them. Dr. Baker defines the three broadly different types of land which make up the region, and tells what men can and cannot profitably do with each type.

1. Just west of the subhumid prairie lands, on the wetter edge of the Great Plains, are the lands which Dr. Baker calls the *farm-grazing belt.* The boundaries of this belt shift with the weather, so that the belt

Cactus has taken the place of cattle on this overgrazed grassland.

Soil Conservation Service



After O. E. Baker

A plan for the best use of the Great Plains region.

may be as much as 150 miles and as little as 50 miles wide at any given time and place. No matter how the boundaries shift, however, the belt is always present. The problem of how to make proper use of it is also always present. The same is true of the other belts which Dr. Baker defines.

The right size for an unirrigated farm in the farm-grazing belt is from 640 to 1280 acres. Though croplands are more valuable than pasture lands throughout this belt, most of the land should be devoted to pasture. In the northern part of the belt, where evaporation is comparatively low in relation to rainfall, each cow should be allowed from 5 to 15 acres of pasture. In the southern part of the belt, where evaporation is comparatively high in relation to rainfall, each cow should have from 15 to 25 acres. Livestock of some sort is absolutely necessary in this belt, particularly in its drier southern parts, to offset a possible loss of crops during the unusually dry years. The crops in this belt should be essentially those which are grown in neighboring regions to the east, which we shall discuss in the next chapter.

2. West of the farm-grazing belt is the drier *grazing-forage belt*. Dr. Baker marks the boundary of this belt as the line beyond which pasture lands are more valuable than croplands. This, you will observe, is just the reverse of conditions in the farm-grazing belt.

Unirrigated farms in the grazing-forage belt should contain from 1280 to 2500 acres. Throughout this belt (which is half again as large as the farm-grazing belt) each cow or steer should be allowed from 15 to 25 acres of pasture. Most of the crops of this belt should consist of corn or sorghum, which provide winter food for livestock. All through this belt the raising of wheat is a risky gamble and only a fraction of a farm should ever be devoted to it. The raising of livestock should rank above everything else.

3. The driest portions of the Great Plains are called *arid grazing areas* in Dr. Baker's classification. They occur in great irregular patches along the western margins of the region. Here an unirrigated farm should have an area of 2500 to 10,000 acres. Since sheep can live on less water and shorter grass than cattle, they should make up most of the livestock which is grazed on these areas. How much livestock can safely be grazed varies widely from place to place and from year to year. Large parts of these drier grazing areas are—and should continue to be—owned by the Federal government. They cannot be fairly administered by men acting as individuals for purely personal gain.

Much of the irrigated land of the Great Plains lies in or near the arid grazing areas because of the streams which flow out of the Rocky Mountains. Farmers who are fortunate enough to be located on these streams can grow enough forage in summer to keep their livestock through the winter. They can obviously support many more animals on the same amount of land than can farmers whose land is not irrigated.

The future of the Great Plains. The future of the Great Plains depends on (1) how successful men are in restoring good grass to the areas which have been depleted; (2) how well they learn how to use all areas without abusing them; (3) how willing they are to apply what they learn. The most serious problems of the Great Plains can be solved only by many men acting together for the common good. Unfortunately, not all individuals are willing to make the personal sacrifices which such action may require, even though in the long run it will pay them to do so. Real progress, however, is being made; there are good reasons for hoping that the lot of the average plainsman will improve.

Nothing that men can do, on the other hand, will free the residents of the Great Plains from all the hardships of life in an unfriendly climate. The winds will continue to blow on the plains with a fury which only the winds of the deserts and the icecaps can match. Temperatures will continue to shift as much as 160 degrees between the summer high and the winter low. Hail, flood, drought, dust, blizzards, and plagues of grasshoppers will continue to beat upon men, beasts, and crops. The Great Plains will never be safe for weaklings—nor for any great number of people of any kind.

THE OLD WORLD STEPPES

The origin of pastoral nomadism. What we have said about the physical nature of the North American steppes applies rather generally to the steppes of other lands. Much of what we have said about the life of man on the North American steppes does not apply at all. The oldest, most persistent, and most widespread way of life on the Old World steppes did not come into existence on the New World steppes until relatively recently. That way of life is known as pastoral nomadism.

A pastoral nomad is literally a "wandering shepherd." A pastoral nomad, as geographers define him, is a man who tends sheep and other grazing animals on pastures which are too lean to allow the herder and his herd to stay long in one locality. The true pastoral nomad shifts continually with the shifting condition of the grass. Though he may return more or less regularly to certain favorite areas at certain seasons, he never settles down. His home is where he happens to be today; his hope for tomorrow is greener pastures. His only wealth is his flock and the few personal articles which he can carry with him.

Pastoral nomadism is one of the best illustrations of the power of climate over man. Few men would wander forever unless they were forced to do so. This is proved by the fact that pastoral nomadism has never developed in regions where the climate favored more sedentary ways of life. Climate, however, is not the only thing that makes a roving herder. The herder must have a herd. Unless domesticated grazing animals are available, pastoral nomadism obviously cannot exist.

It is an interesting fact that nearly all the animals that men have ever domesticated were domesticated before the dawn of written history on the steppes of Asia, or in the neighboring steppe lands of Africa and Europe. Pastoral nomadism did not develop on the steppes of North America, South America, South Africa, and Australia until white men brought in the animals which could make that way of life possible. This did not happen in any of these regions until comparatively recent times. The pastoral cultures which have since developed there are those of the immigrant rather than the native. Only on the steppes of Asia do we find a pastoral nomadism which seems to belong to the land. The herders and herds of the Asiatic steppes are as much a part of the land as the grass itself.

Nomads of the Kirghiz Steppe. The classic example of the nomadic life is the tribes that roam the Kirghiz Steppe, which reaches far to the east and north of the Caspian Sea in west central Asia. This region contains some of the broadest semiarid flatlands on earth. Some of these lands are of low and some are of high elevation, and the mountains that cut into them rise in some cases from 12,000 to 14,000 feet above the level of the sea.

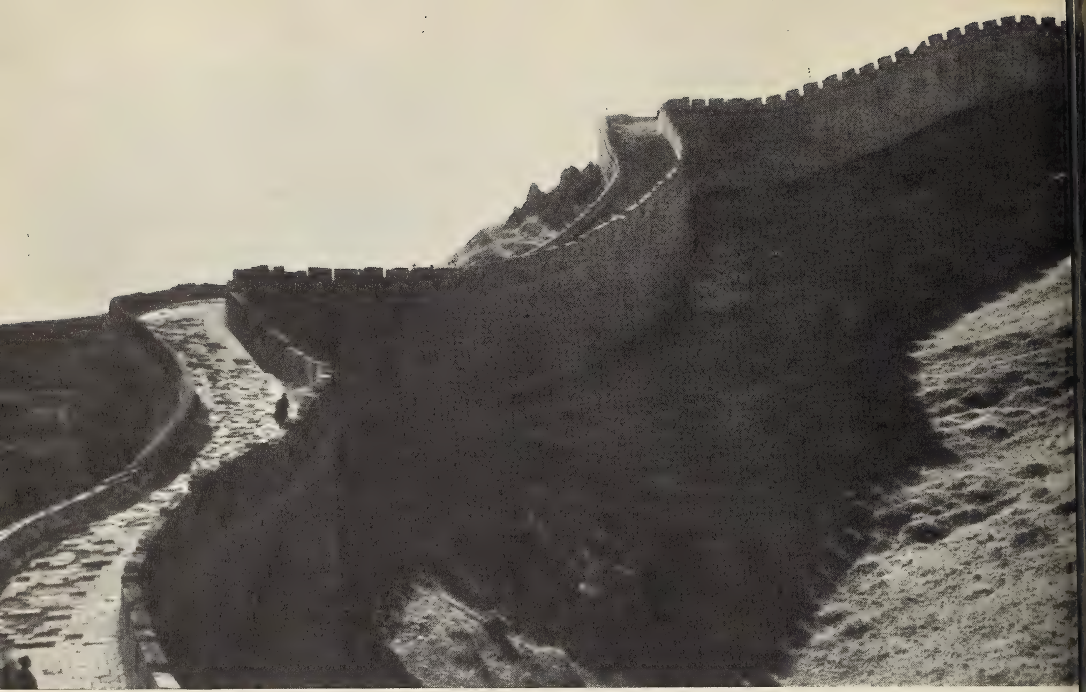
In summer the herders of the Kirghiz Steppe (most of whom are known as Kazaks) are on the plateaus and on the lower flanks of the towering mountains, where the air is cool and the grass is green. In winter the wind and the cold drive them into lower and leaner lands. They may travel several hundred miles between their summer and winter pastures, lingering here and there along the way only so long as it takes the herds to eat the grass.

The photograph on this page shows an encampment of Kazak herdsmen. Such a group may contain dozens of families, hundreds of camels and cattle, and thousands of sheep, goats, and horses. Of all the animals, the horses are most valuable. Without them it would be impossible for the men to drive the herds over the great barren distances which separate the better grazing areas. These people, as you can see, live in large sturdy tents, but they have little furniture or other luxuries of sedentary life. Their only fuel when nights grow cold is the dung from the animals.

The history of pastoral nomadism. Many books have been written and many movies made about the picturesque life of the Asiatic nomad. His character and history are full of drama. His way of life makes him restless and proud, and he is often impatient and cruel. He is typically a "rugged individualist" who resists any government other than that of the tribe to which he belongs. He is the exact opposite of the farmer who clings to the oasis and submits to the social restrictions which the crowded condition of the oasis makes absolutely necessary.

From time immemorial, the pastoral nomads have looked with contempt on

The tent dwellings of Kazak herdsmen can be easily moved from place to place.



By Ewing Galloway, N.Y.

The Great Wall of China was built to keep the nomads of the steppes to the north from invading the agricultural land of China.

their sedentary neighbors of the wet spots. From time immemorial, the herders have raided the villages of the farmers when drought has reduced the herds. From Turkey at one end of Asia to Mongolia at the other end, the nomadic tribes have waged intermittent war on the sedentary residents of the steppes. Many settlements built walls against the raiders; China erected her famous Great Wall along her entire northern frontier to keep them out. Some historians believe that the Roman Empire fell chiefly because of the invasion of Europe by warlike tribes from Asia which had been driven to conquest by a succession of unusually dry years on the steppes.

Commerce on the Asiatic steppes. At many places, the pastoral nomads have won permanent control over the farming settlements of the steppes and neighboring deserts. During most of their history, however, few of them have ever cared to settle down there. Nomads have traditionally been willing to suffer the hardships of their life for the sake of its freedom. When they have conquered an oasis they have generally left its management to the farmers. Their only interest was in visiting the oases from time to time to gather in the loot.

Today these men are far less picturesque than they once were. The despised farmers on the oases have gone a long way toward taming and absorbing their haughty conquerors. Most of the pastoral nomads who are left on the steppes trade peacefully enough with their ancient enemies and slaves. They have taken their place in the ordered pattern of world economic life, as you can probably prove by a careful examination of the shop windows of your town. You will probably find there a lambskin coat or a Bokhara rug which the peaceful patience of one-time restless warriors has made possible.

The future of the Old World steppes. On the steppes of the Old World, old ways of life have almost everywhere been forced to yield to new ways of life. Though what white men call progress has not gone so far on the Old World as on the New World steppes, it has gone a long way and is steadily going farther. Railways, airways, highways, and telegraph lines are each year tying the steppe lands of Asia and Africa a little more tightly into the fabric of world economic and political life.

Through irrigation and the development of drought-resisting crops, agriculture has steadily advanced upon the steppes; herding on unfenced pastures has steadily retreated. Today the once mighty herders of the Kirghiz Steppe are on reservations administered by the Soviet government. Nomads almost everywhere have felt the iron hand of governments which were not of their making. In doing so they have lost much of their reckless freedom, but they have gained under a difficult climate a kind of security which they had never known before.

Here and there, to be sure, in the remoter corners of the steppes, nomadic herdsmen still lead the life of their ancestors. Here and there they still rob caravans and raid oasis villages. But they are strangely old-fashioned in the modern world. The modern raider is not a barbarian who rides a horse and wields a sword; he is a civilized man in a tank with a machine gun.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. No grass grows in a desert.

2. The boundaries between deserts and grassland steppes are everywhere sharp and easy to see.

3. A steppe is a land surface which has a series of terrace-like features which are like the steps of a stairway.

4. The rainfall on a steppe is 10 to 20 inches a year, and you can depend upon this amount falling every year.

5. The short-grass regions of the United States have been scientifically developed and they are now about as productive as it is possible for them to be.

6. The short-grass regions of the United States have been ruined and they hold little or no promise of future development.

7. A steppe has the ideal climate for growing wheat.

8. The earliest inhabitants of North America were nomadic herders who lived on the Intermountain Steppes.

9. The 100th meridian is an important meridian in the United States because boundary lines of many states follow it.

10. The Great Plains of North America are entirely covered with grass.

11. Much of the land of the Great Plains is of no value, because only grass will grow on it.

12. Pastoral nomadism is an important way of life on the steppes of the Old World because men generally prefer to wander from place to place.

13. Pastoral nomads are warlike people who make most of their living by robbing farm communities, travelers, and other nomads.

QUESTIONS FOR DISCUSSION

1. Have you ever traveled from one climatic belt into another climatic belt? If you have, try to recall where you passed into the new climatic belt. Where was the border between the two different kinds of climate? Was this boundary marked by sharp or gradual changes in vegetation?

2. Have you ever noticed that native grasses are among the hardiest of plants? How many of the weeds in your garden are grasses? Have you ever tried to rid a garden of "witch" or "devil" grass? Under what conditions of weather will the grass in your lawn be killed?

3. What practices of the Navaho and Hopi Indians are related to the climate in which they live? How do you think these practices would change if the climate were changed?

4. If you had a ranch near Bismarck, North Dakota, how would you plan to use the resources of the land?

THINGS TO DO

1. Mark the chief regions of dry grasslands on an outline map of the world. Indicate the chief activities of the inhabitants of each grassland region.

2. Make a list of the characteristic features of a steppe, especially those features which distinguish it from a desert and a prairie.

3. Go to the library and prepare a report for your class on how horses and other domesticated grazing animals were introduced on the dry grasslands of North America.

4. Assume that the Great Plains were not settled and that you were looking for land on which to start a cattle ranch. Write a report on where you would prefer to locate and why. Write a similar report based on the assumption that you were looking for land on which to start a wheat farm.

5. Prepare a report on a tribe of Old World steppe people, such as the Kazaks of the Kirghiz Steppe in Russia. Contrast their life before and after it was changed by modern civilization.

BOOKS TO READ

1. The Intermountain Steppes of North America have inspired several good books. Though *The Delight Makers*, by Adolph Bandelier, *Death Comes for the Archbishop*, by Willa Cather, and *Laughing Boy*, by Oliver La Farge, are novels (and very good ones) with this region as a setting, they contain much authentic human geography. *The Land of Little Rain* and *The Land of Journeys' Ending*, both by Mary Austin, are collections of essays which capture both the substance and the spirit of the semiarid Southwest. *Rio Grande*, by Harvey Fergusson, *Our Southwest*, by Erna Fergusson, and *Sky Determines*, by Ross Calvin, are excellent descriptive books on this region and its people.

2. The Great Plains, like the Intermountain Steppes, have inspired not a few good books with a basis in geography. *The Sea of Grass*, by Conrad Richter, is a fine novel of pioneer cattle ranching along the western edge of the region. *Short Grass Country*, by Stanley Vestal, is a readable descriptive book on the southwestern portion of the region; *Powder River*, by Struthers Burt, is the same kind of book on the northwestern portion of the region. *A Son of the Middle Border* (and other Middle Border novels), by Hamlin Garland, is an excellent story of pioneer farming along the eastern edge of the region. *The Great Plains*, by W. P. Webb, is perhaps the best rounded description of the region as a whole. *The Oregon Trail*, by Francis Parkman, is a great literary classic on the lands beyond the Mississippi (and excellent reading if not "required").

3. One of the best books on the pastoral nomads of the Old World is the Bible. *The Pulse of Asia*, by Ellsworth Huntington, and *Seven Pillars of Wisdom*, by T. E. Lawrence, are both interesting and instructive works on the steppes of Asia. The writings of Marco Polo, as edited by Cordier in *Ser Marco Polo*, are among the earliest (and best) works on the geography of this vast region.

VII · THE WET MIDDLE LATITUDE LANDS

HUMID CONTINENTAL CLIMATE AND VEGETATION

Lands of the westerly winds. In Chapter IV we began to follow the prevailing winds across the lands of the middle latitudes. We found that these winds are wet when they first reach the continents from the oceans. We found that except in Europe they are robbed of much of their moisture by high mountains before they travel very far inland. From the top of Mt. Whitney we observed the vast panorama of dry lands which stretch to the east and south. In studying these dry lands in Chapters V and VI we were led into subtropical and tropical latitudes where the westerly winds give way to the trade winds. In this chapter, let us return to the middle latitudes and take up again our journey with the westerly winds.

Eastward and poleward of the deserts and dry grasslands of the world much of the lowlands of the middle latitudes is covered by prairies, forests, and croplands. After losing moisture over the western coastlands and mountain ranges, the westerly winds gather up new moisture in two ways. They (1) pick up moisture by evaporation from the deserts and steppes, and (2) they absorb moist air that has broken away from the great air masses which lie over the oceans to the north and south. The prairies, forests, and croplands that lie eastward and poleward of the dry lands are evidence of this new moisture which the westerly winds acquire in their journey across the continents. From the places where these types of vegetation first appear on the west to the places where the continents give way to the oceans on the east, the westerly winds are wet and the lands beneath have a wet, or *humid*, climate.

Poleward of these middle latitude humid lands lie the high latitude lands, where winters are long and cold; equatorward lie the low latitude lands of year-round heat. In keeping with their position on the globe, the middle latitude humid lands have winters which may be as severe but which are never so long as those of the polar lands. Similarly, they have summers which may rival the equatorial lands in heat but which are of limited duration. The climate of the middle latitude humid lands is thus a mixture of extremes. For centuries these lands have been described as "temperate," which means "free from extremes." Modern geographers are more accurate in the use of adjectives. They divide the climate of the wet middle latitude lands into two related yet recognizable types: the *humid continental climate*, which occurs in upper middle latitudes, and the *humid subtropical climate*, which occurs in lower middle latitudes. Both these types of climate are restricted to inland and east coast regions. (See the map on pages 70–71.)

The humid continental climate. Regions with humid continental climate are few and far between in the Southern Hemisphere because the middle latitudes of that hemisphere are almost entirely covered with water. This lack is generously balanced in the Northern Hemisphere, where the middle latitudes contain the broadest land masses on earth. A large percentage of North America, Europe, and Asia has climate of the humid continental type. As you might expect of so vast a territory, the climate is not everywhere exactly the same. As you go on with this chapter you will see that the humid continental climate contains more variations within itself than any other type of climate on earth.

How, then, you might ask, can this kind of climate be recognized? The fact that the humid continental climate is humid does not make it unique. The upper middle latitude western coastlands, most high mountain ranges, and the forests and jungles of the tropics all have an abundance of rain. Nor

The wet middle latitude lands of the earth lie chiefly in the Northern Hemisphere.

does the fact that the humid continental climate is continental make it unique. The belt of the taiga also has the extreme range of temperature between summer and winter which is the chief mark of a continental climate.

The characteristics which make the humid continental climate unique are not easily apparent in its name. Three things set it off from all other types of climate:

1. The presence of four seasons which in most areas are distinctly different from one another in temperature.

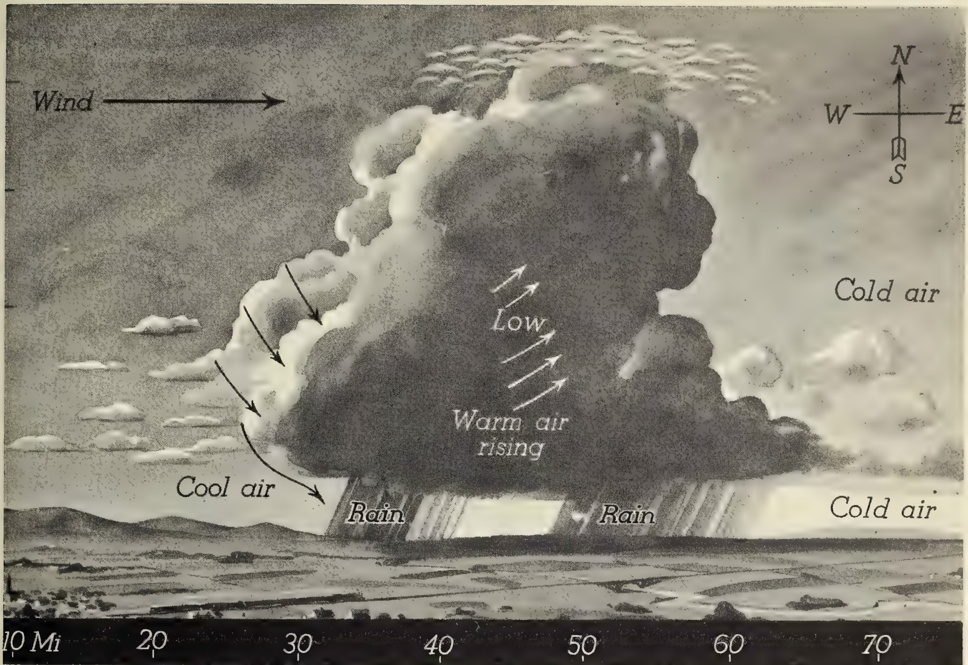
2. Precipitation through all four seasons, but heaviest precipitation in most areas in summer.

3. Changes in weather every few days throughout the year.

Of these three characteristics the third is the most striking and the most important in its influence on men and women. Let us see what lies behind it.

Weather on parade. In our discussion of the westerly winds in Chapter IV, we did not explain in detail the peculiar way in which these winds move over the middle latitude land areas of the globe. They do not march like soldiers in straight and orderly ranks, but whirl in great circular eddies like dervishes in a dance. These whirlpools of air may be as much as 500–1000 miles in diameter, and may move as fast as 500–1000 miles a day in their travels from west to east across the continents. Though they move with the prevailing winds and are parts of them, they develop variable winds within and around themselves which locally may move in any direction.

The whirlpools of the prevailing westerlies are of two varieties, which are known respectively as cyclones and anticyclones. Perhaps you think of a cyclone as a violent storm that tears down buildings and buries people under the wreckage. This is the popular notion of a cyclone. The word, however, means merely something that "whirls round" and does not imply that things have to be knocked down in the process. *Scientists define a cyclone as air whirling round a center of low atmospheric pressure.* Occasional cyclones, to be sure, are violent



Cyclones move over the humid continental lands in an endless parade.

enough to do great damage. Scientists call these unusual storms "tornadoes" when they affect small areas and "hurricanes" when they affect large areas. Ordinary cyclones do little harm and a large amount of good. Dozens of them pass over the heads of more than half the people on earth in the course of a single year.

The storms that keep the weather of humid continental regions continually changing are the result of the cyclones that move over these regions in an endless parade. A cyclone takes form when a mass of warm air which has worked into the middle latitudes from the tropics meets a mass of cold air which has worked into the middle latitudes from the polar regions. The mass of lighter warm air is pushed up by the mass of heavier cold air, which forces the moisture in the warm air to condense and fall to the ground in a storm of rain or snow.

Study the diagram of a cyclone on this page, which explains how this is done. Notice that a cyclone is composed of warm moist air under low pressure surrounded by cold dry air under high pressure. Notice that because of the differences in pressure the cold dry air round the edges of the cyclone moves toward the warm moist air in the center. In doing so, winds are produced which are twisted into spiral eddies by the rotation of the earth. In the Northern Hemisphere these eddies, as you can see, move against the hands of a clock in what weathermen describe as a counterclockwise direction. A cyclone, in other words, is a small traveling edition of the great permanent belts of low atmospheric pressure which we studied in Chapter IV.

As the wind blows into a cyclone, the air rises and then cools; its moisture condenses into clouds and then into rain or snow. In the Northern Hemisphere, the air that moves into a cyclone from the south is warm and moist because it comes from warm moist regions in lower latitudes. This air moves in a counterclockwise direction toward the center and eastern front of the cyclone, making these parts warmer and wetter than the rest of the whirling mass.

Accordingly, when rain or snow drops from such a cyclone it is carried to the land below by the southerly and easterly variable winds which blow near the middle and front of the cyclone. As the cyclone moves on, the northerly and westerly variable winds at the back of the cyclone bring cooler and clearer weather to the land below. The map on page 117 shows the temperature, pressure, wind, and moisture conditions in a typical cyclone of the Northern Hemisphere.

An anticyclone, which means "opposite-cyclone," is just what its name implies: the reverse of a cyclone. It is air swirling downward and, in the Northern Hemisphere, in a clockwise direction round a center of high atmospheric pressure. It is made up of cool dry air surrounded by warm moist air. Anticyclones are responsible for the spells of clear weather which alternate with spells of stormy weather in regions having a humid continental climate. Cyclones and anticyclones (sometimes called simply "lows" and "highs") travel at an average speed of 15 to 30 miles an hour. The parade of cyclones and anticyclones brings a parade of ever-changing weather to the humid continental lands. Later in this chapter we shall see what this changing weather brings to man.

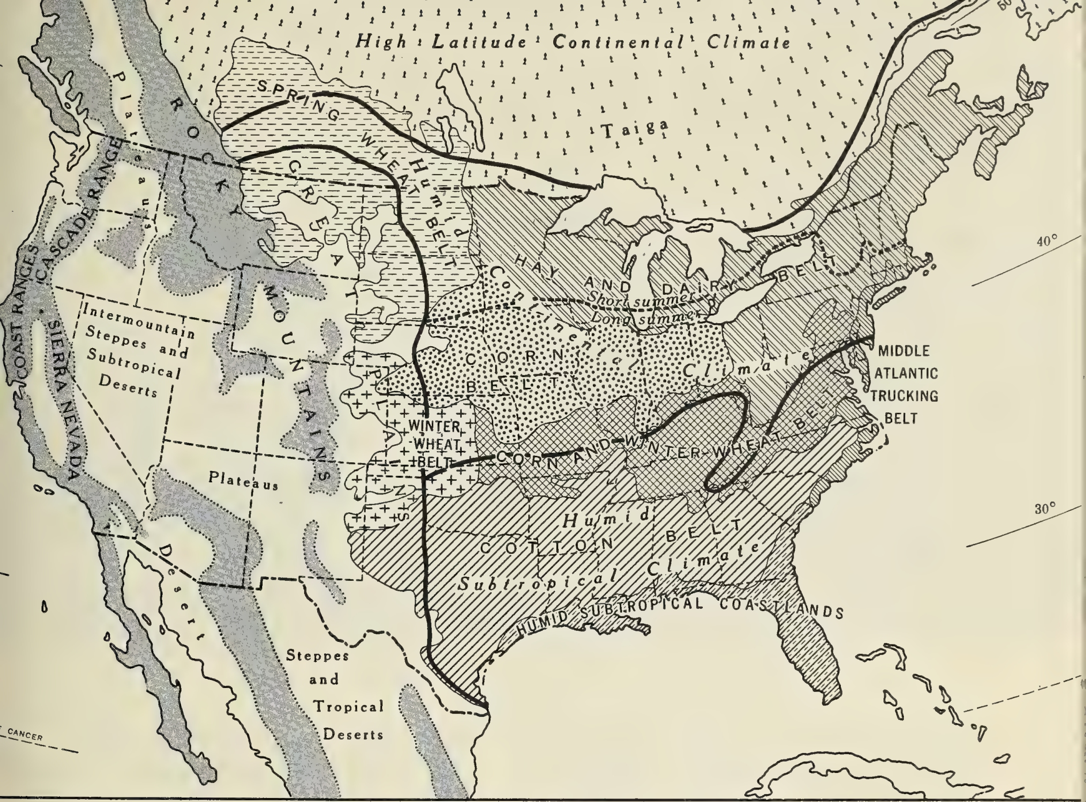
Natural vegetation of humid continental lands. The natural vegetation of cyclonic regions consists of forests of mixed evergreen and broad-leaved trees in the wetter areas, and tall-grass prairies in the drier areas. In even the wetter grasslands of the earth, moisture does not ordinarily soak more than two feet below the surface of the ground. Where the climate provides enough rain to wet the soil beneath the two-foot level, trees are generally able to compete with grass. Under such circumstances, the prairies generally give way to the forests, which are the natural vegetation on most lands with a humid continental climate.

The trees of these forests are familiar to most of us because most of us live in regions where they are native. Though much middle latitude land has been cleared to make way for tilled fields and pastures, there are many places where the native trees still grow. The better soil of the woodland areas is generally taken over by such broad-leaved species as maple, oak, elm, birch, and ash. The poorer soil is covered with stands of such cone-bearing evergreen trees as pine, hemlock, spruce, and fir.

The poleward boundaries of the mixed forests of the humid continental lands are vague. The evergreen trees that make up most of the high latitude taiga are the product of a climate with very long winters and very short summers. The broad-leaved trees that make up the natural cover on most of the humid continental lands are the product of a climate with shorter winters and longer summers. The one type of climate gives way to the other type in a very indefinite zone, in which the two kinds of forests are mingled.

The equatorward boundary of the humid continental forests is equally vague in many regions. In much of Europe and Asia, to be sure, the boundary is fairly clear where it is marked by mountain ranges or grasslands. But in south-central and southeastern North America and in southeastern Asia, humid continental forests mingle with subtropical forests in an indefinite zone where the temperature differences between summer and winter grow increasingly slight as the equator is approached.

Croplands of the humid continental lands. Man has so greatly changed the expression on the face of the earth in most regions with a humid continental climate that its original appearance is little in evidence today and has little geographic meaning. These regions are among the



The agricultural belts of the humid continental and humid subtropical climates of North America.

most heavily populated regions on earth. Much of their natural vegetation has had to be sacrificed so that men would have space for the cultivated vegetation on which their lives so largely depend. The cultivated vegetation of these regions, however, tells a story which is both significant and clear. The distribution of the major croplands proves that *cultivated vegetation is just as much controlled by climate as is native vegetation.*

Because of this fact we can use the croplands of the humid continental lands as keys to unlock the secrets of the climate. The map above shows the chief agricultural regions of central and southeastern North America, where croplands have been widely and intensively developed on what was once prairie and woodland. Let us see what this map can tell us about the relationship of climate and man in these regions.

THE SHORT SUMMER CLIMATE IN NORTH AMERICA

Subdivisions of the humid continental climate. The first thing that becomes clear from a study of the map above is that the humid continental climate of central and east-central North America is not everywhere the same. It can be divided into two subdivisions on the basis of the length of the growing season.

1. *The short-summer subdivision,* with fewer than 150 days which are free from frost each year. This is the poleward variety of the humid continental climate, with summers that are warm to hot and winters that approach in length and severity those of the taiga belt to the north. Though rainfall is not heavy in the western portions of the belt which has this kind of climate, evaporation

J. I. Case Company

The Spring Wheat Belt is the bread basket of North America.

is low enough to make the climate humid. Eastward the rainfall increases and the temperature of both summer and winter becomes more moderate.

2. *The long-summer subdivision*, with more than 150 days which are free from frost each year. This is the equatorward variety of the humid continental climate, with summers that are hot but winters that are milder than those of the short summer variety. Both rainfall and evaporation are greater in the long summer type of climate than in the short summer type. Toward the equator, regions with the long summer climate get wetter and wetter and milder and milder, and their seasons get less and less well marked. In the neighborhood of latitude 35°, the humid continental climate gives way to the humid subtropical climate, which we shall discuss later in this chapter.

The Spring Wheat Belt. The colder and drier areas with the short summer type of climate are known as the Spring Wheat Belt. From Minnesota on the southeast all the way to the foot of the Rockies in Alberta, wheat is successfully grown under a rainfall which averages between 20 and 30 inches a year. No food is more important to the white people of the world than wheat, and about one seventh of the world supply of this grain is grown in this belt.

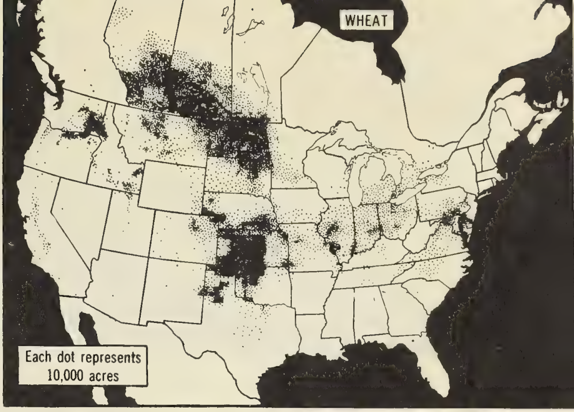
Because the winters of these northerly continental lands are bitter cold, and because they receive their moisture chiefly in summer, the wheat is planted in spring and harvested in fall after the summer rains and sunshine have brought it to maturity. Such wheat is known as *spring wheat* to distinguish it from the *winter wheat* of milder climates, which is planted in fall and harvested in summer after the moisture from winter rains and spring sunshine have matured it.

Wheat is a cultivated grass and grows well on land which once supported the wild grasses of the prairie. Unfortunately, it also grows well *at times* on the short-grass steppes. We have already seen what happens when the occasional wet years of the dry grasslands tempt the wheat farmer beyond the limit of safety. Today the wise wheat farmers know that in most districts this limit is the line of 20-inch average annual rainfall. Though the line is vague, as we saw in the map on page 107, most of them contrive to stay on the wet side of it

Even at best, however, wheat farming is a gamble. The short summer climate is a climate of violent extremes. Agriculture under such a climate is a very uncertain business. As on the steppes to the west, dust storms, drought, flood, hail, or frost may bring ruin without warning to the crops of the Spring Wheat Belt. Even in good years, the life of a spring wheat farmer has its drawbacks. In winter there is little to do but listen to the howling wind and look out at the empty land. In summer there is little to do either, because after the wheat is planted it needs little care until the harvest. Unless he also raises livestock, the spring wheat farmer is in danger of having his life degenerate into a combination of worry and boredom.

The other side of the picture is that wheat is one of the most valuable money crops on earth. It furnishes a large percentage of the people who live outside the tropics with a large percentage of their nourishment. Unlike most of the corn that is raised, it is not fed to animals and turned into meat before it is fed to men. Its hard dry kernels are not easily damaged in shipping or easily rotted by storage in damp warehouses. Its planting and reaping on the treeless plains where it thrives can be done cheaply and efficiently with the help of modern farm machinery.

Development of the Spring Wheat Belt. The farmers of the Spring Wheat Belt in North America have done two things to relieve the worry and boredom of their lives. (1) They have taken many forms of political action to safeguard the wheatlands and to improve the market value of the wheat. (2) They have experimented widely with other crops which might tide them over the years when the wheat crop fails. Part of the story of the political activity of the wheat farmers lies well beyond the field of geography; part of it belongs to the story of grassland conservation, which we shall tell in a later chapter.

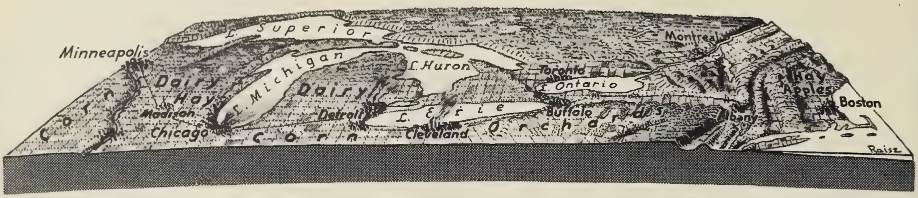


U.S. Department of Agriculture

Most of the wheat in North America is raised in the western part of the humid continental regions

The agricultural development of the Spring Wheat Belt, on the other hand, is in large measure geographic because it has been in large measure dictated by climate. Today most intelligent wheat farmers are convinced that they must "diversify." This means that they must use their land in a variety of ways and not rely wholly on wheat for their living. Diversification has slowly crept over the Spring Wheat Belt from its wet eastward edges well into the less humid central and western parts.

In pioneering days, most of the belt was used for grazing; later the amount of cultivated land increased and was given over largely to wheat and other hardy small grains. Today most of the belt is still uncultivated, but the monotony of the grain fields is relieved in many places by sugar beet fields, potato fields, and berry patches. The most significant trend, however, in the development of the croplands of this region has to do with cattle and with the forage crops which cattle eat. More and more, the wheat farmer is turning to the cattle business—and particularly to the dairy cattle business—as a means of reducing the gamble of the wheat business. More and more, such forage crops as alfalfa, sorghum, and corn are taking their place in the landscape.



Between Minneapolis and Boston lie the varied croplands of the Hay and Dairy Belt.

Though ordinary corn does not mature in much of the Spring Wheat Belt, fast-growing and early-maturing varieties are being developed. But even immature corn and several other kinds of green fodder can be fed to cows if the fodder is stored in a silo. In one way or another the spring wheat farmer is finding means of feeding dairy cattle through the long winter. Though still largely devoted to wheat, he is adopting many of the practices of the Hay and Dairy Belt to the east, wherever the climate is moist enough to permit it.

The Hay and Dairy Belt. In the last chapter we took an imaginary trip across the Great Plains from Minneapolis, Minnesota, to Helena, Montana. In doing so we got a general impression of the native grasslands of North America, and we saw something of what men are doing to them. Let us now take another imaginary trip with Minneapolis as the starting point, but this time let us go east to Boston, Massachusetts. In doing so we shall get a general impression of the native mixed forest lands of the upper middle latitudes of North America, and we shall see something of what men are doing to them.

Minneapolis is a good starting point because west of Minneapolis the menace of drought hangs over the subhumid and semiarid lands. East of Minneapolis, all the way to the Atlantic Ocean, the humid continental climate is reliably humid, with precipitation that averages 30 inches or more each year and storms that distribute rain evenly through the growing season. When we leave Minneapolis for the East we enter a region where the cow is supreme.

To cross the Hay and Dairy Belt from Minneapolis we must first drive in a southeasterly direction in order to round the tip of Lake Michigan, which juts down from the north. This takes us across the state of Wisconsin, where the climate is rather too wet for wheat, too cold for corn, but just right for hay and for dairy cows. We drive all day past prosperous farms which are made up of a mixture of woodland, cropland, and pasture. Life on these farms centers in the sleek fat cows that feed on the lush meadow grasses; in the great barns where the cows are housed and milked, and the silos where their winter fodder is stored. These dairy farms of Wisconsin produce about half of all the cheese which is produced in the United States as a whole. They place Wisconsin at or near the top of all the states in the production of milk and butter.

After passing through Chicago (the people of which consume a large percentage of the products of the farms that we have just seen) our route takes us along the southern shores of the Great Lakes. We are now in one of the most highly industrialized regions on earth. We pass by the great steel and automobile cities of Gary, Detroit, Cleveland, Buffalo, and many others, where influences which we shall discuss later are more important than climate in shaping the activities of men. Agriculture, however, does exist in this region, and as usual it reflects climatic conditions. The Great Lakes have a moderating effect on the climate of nearby lands for the same reasons that the oceans do. They lengthen the growing season and soften the winters of the land along their southern shores. The result is that fruit farming, which profits by this tempering of the climate, has become one of the chief occupations of this region.

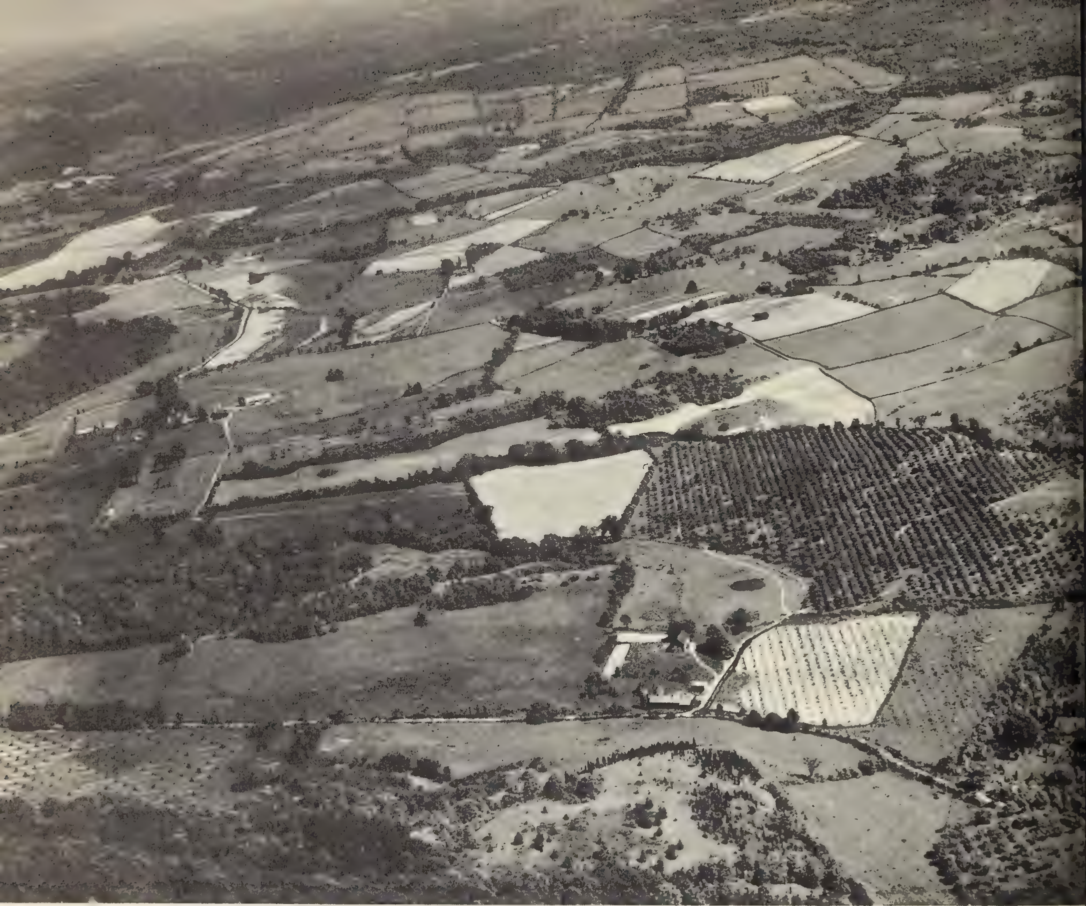
East of Buffalo we enter the dairy farming region of New York and New England. This eastern part of the Hay and Dairy Belt is much like the western part. The dairy farmers of the East, however, sell most of their milk to the cities of the Atlantic Seaboard, and produce less butter and cheese than do the dairy farmers of Wisconsin. Here, as in the belt as a whole, pigs and poultry are raised, as well as cattle. Orchards and vegetable (truck) farms are also common.

Small general farms become increasingly abundant as we near the ocean. At Boston we end our west-to-east trip of some 1400 miles across the Hay and Dairy Belt. We have seen only part of what there is to see because the belt extends almost as far from north to south as it does from west to east. Because of the moderating effect of the Atlantic Ocean at one end and the cooling effect of the Appalachian Mountains at the other end, the eastern edge of the Hay and Dairy Belt extends all the way from the mouth of the St. Lawrence River to southwestern Virginia. (See the map on page 119.)

Future of the Hay and Dairy Belt. When we arrived in Boston we came to the end of the far-flung region with the short summer type of humid continental climate. This region, as we have seen, spans three fourths of the North American continent, from the Canadian Rockies to the Atlantic Ocean. We have seen that wheat farming in the

Some of the finest dairy farms in the world are located in the Hay and Dairy Belt of North America.

By Ewing Galloway, N.Y.



Apple orchards are prominent in this patchwork of fields in the Hay and Dairy Belt of New York State.

western part of the region, and dairy farming in the eastern part, make clear reflections of the climate on the surface of the land. We should not forget, however, that the climate allows a margin for considerable agricultural variation throughout much of the region. Particularly in the Hay and Dairy Belt, men have found many more ways of making use of the agricultural resources of a region with a short summer climate than we have space to describe in this book.

The Hay and Dairy Belt, however, is bound to remain chiefly a hay and dairy belt, as far as its agriculture is concerned. Milk, cream, butter, and cheese stand high among the best foods for human beings; the short summer type of humid continental climate stands high among the climates that favor the production of these foods. The dairy industry has three primary needs: (1) hay to feed the cows, (2) cows to eat the hay, and (3) people to drink the milk and to eat the butter and cheese. Maps 1 and 2 on page 128 show how the first two needs are abundantly met in the Hay and Dairy Belt of North America. Any ordinary map will show how the third need is also abundantly met by the many great cities which lie in or near this belt. There is no reason to believe that this geographic relationship will be greatly changed in the future.

THE LONG SUMMER CLIMATE IN NORTH AMERICA

The Corn Belt. Southeast of the Spring Wheat Belt and south of the western half of the Hay and Dairy Belt lies a region where summer nights are very hot and winter days are very cold. It is a region of flat or gently rolling lands of deep rich soil, with frequent thunderstorms in summer and frequent snowstorms in winter. It extends from central Nebraska on the west across Iowa, Illinois, Indiana to central Ohio on the east. It is the heart of agricultural America and its name is the Corn Belt.

The geography of the Corn Belt is not simple. Climate is just one of many elements in the make-up of this highly developed region. Nevertheless, the key to the understanding of the Corn Belt is corn—and the climate that makes possible a large-scale production of corn. Under most of the activities of the people in this region are the following four fundamental facts:

1. Meat is one of the most nourishing and delicious foods that human beings eat.

2. About two thirds of the livestock in the United States are raised west of the Mississippi River, but about two thirds of the people who consume the livestock live east of that river.

3. Livestock raised on wild grass are lean; their meat is tough and poor in flavor. Corn is an excellent food for fattening and improving the meat of range animals, particularly beef cattle.

4. The cheapest fodder corn and other fodder crops can be produced under a climate which is marked by long, hot, wet summers.

In view of these facts, what was more natural than that the people of the Corn Belt should become specialists in raising and marketing meat? Located in the heart of the continent, they had comparatively easy access both to the animals and to the people who consumed them. This, combined with their unrivaled ability to fatten all kinds of livestock cheaply, goes a long way toward summing up the geography of the Corn Belt.

It accounts for the fact that the Corn Belt produces about 35 per cent of the world supply of corn on less than 1 per cent of the earth's surface. It accounts for the fact that the Corn Belt markets more meat than any other region of similar size anywhere. It accounts for the fact that Corn Belt crop-

These beef cattle have been shipped from the Wesrern range to the Corn Belt for fattening.

Soil Conservation Service

Soil Conservation Service

This typical Iowa landscape lies in the heart of the Corn Belt.

lands are half again as valuable per square mile as those of any other region in the United States.

The Corn Belt farm. The climate must share honors with the rocks and the soil for making this region so productive. In past geological ages, flat layers of mud and lime were deposited on the floors of shallow seas which once covered this region. Later the sea water was drained off and the sediments hardened into rocks, with little change in their original flatness. With time the rocks were broken down into soil which was rich in the minerals that plant life needs, and flat enough over wide areas to be easily tilled. Still later, the winds brought in great quantities of dust, which deepened and further enriched the original soil. Finally, great glaciers moved down from the north and added still more rich soil to the land when they melted.

Even so tremendous a fertility as that of the Corn Belt is not inexhaustible. There, as elsewhere, the continuous cultivation of land takes minerals from the soil, which must be replaced if production is not to fall off. The Corn Belt farmer has learned that he must return through the liberal use of fertilizers the minerals which his crops have drawn from the soil. He is learning that fertilizers alone will not keep up the fertility of his land. To do this he must also *rotate* his crops; that is, he must grow different kinds of crops from year to year on any given field. Different crops make different demands on the soil. By rotating the crops, no one necessary mineral is quickly exhausted, and some crops actually restore the minerals which other crops have reduced.

So, in driving across the Corn Belt in summer, you will see field after field of corn. But you probably will not see a farm that grows corn alone. You will see many fields of oats, wheat, and alfalfa because these are the crops which are generally rotated with corn in this region. The Corn Belt thus also becomes an Oat Belt, and to a lesser extent a Wheat Belt and an Alfalfa Belt as well. (See maps 3, 4, and 5 on page 128.)

In driving across the Corn Belt you will also see a great many domesticated animals. Map number 6 shows that many of the beef cattle that are fattened in the Corn Belt are also born and raised there. An increasing number of dairy cattle are also raised in the Corn Belt. The most popular animal in the barnyard, however, is the hog. He makes more pounds of meat for a given amount of feed than any other animal. The Corn Belt is thus also the Hog Belt, as the map on page 128 clearly shows. Hogs get about 40 per cent of all the Corn Belt corn; the rest is shared by cattle, poultry, other animals, and men.

The Winter Wheat Belt. You will notice on the map on page 119 that off the southwest corner of the Corn Belt lies a small belt, chiefly in Kansas and Oklahoma, which is called the Winter Wheat Belt. The boundaries of this belt are severely set by climate. The land on the west is too dry and that on the north is too cold for winter wheat; the rainfall to the east favors corn and the heat to the south favors cotton. Within the belt the climate of winter rains and spring sunshine favors winter wheat, which is planted in the fall and harvested in spring. But it favors the wheat only when it is in a generous mood—which too often it is not.

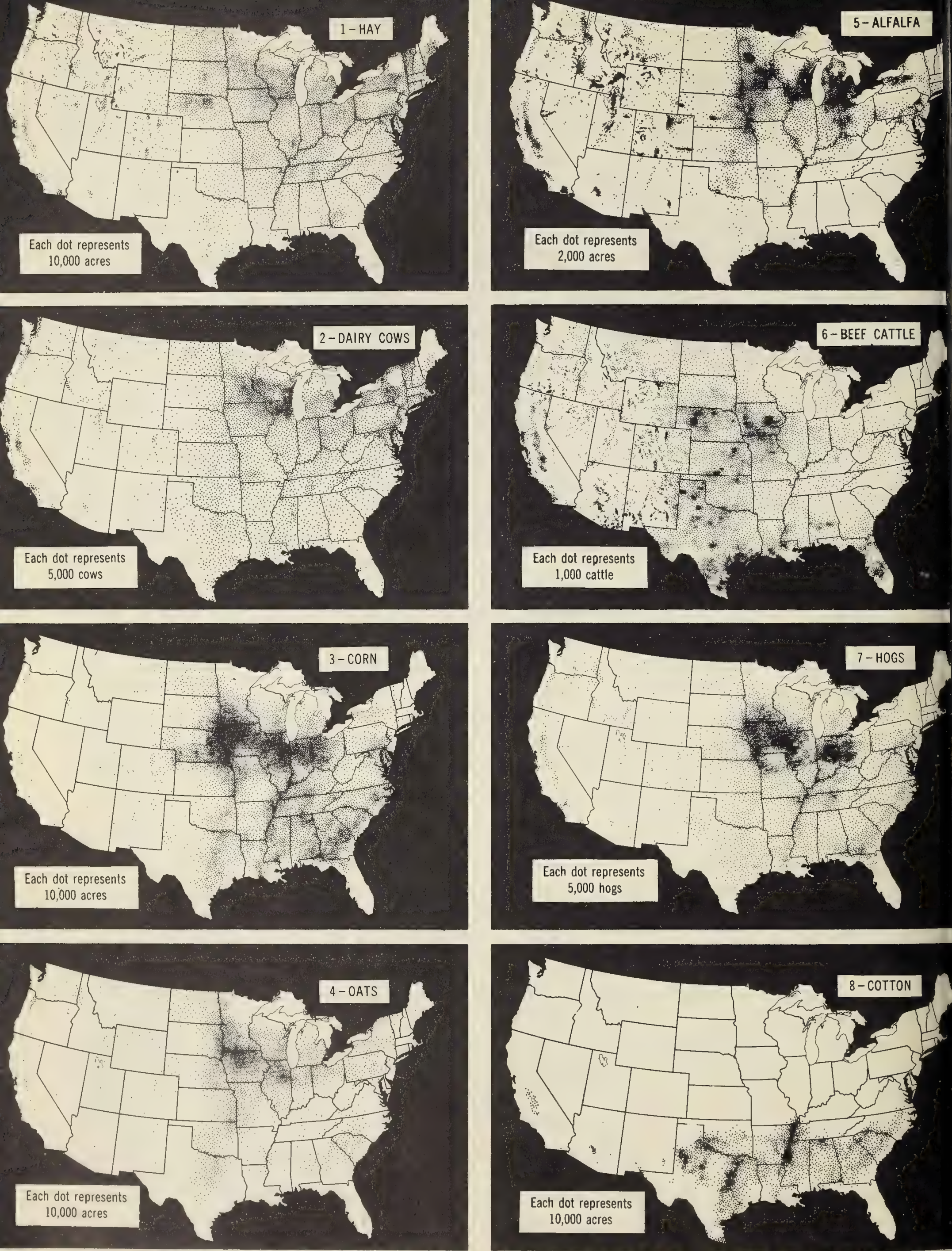
The Winter Wheat Belt, like the Spring Wheat Belt, lies under the everlasting threat of drought. The winter rains of the one are just as uncertain as the summer rains of the other. Dust storms and pests are as likely to fall on the one belt as on the other. Added to the worries of the winter wheat farmer is the fact that winter wheat is softer than spring wheat and its flour less valuable. Not only that, but some three fourths of the croplands of the Winter Wheat Belt have been devoted to wheat—a disastrously high percentage when drought destroys the wheat crop.

The answer to the agricultural problems of this belt would seem to lie in the development of hardier wheat, and of crops which are more drought-resisting than wheat. Though progress has been made along this line, no ideal combination and rotation of crops has yet been discovered for this belt. Its problems are not very different from those of the farm-grazing belt of the dry grasslands to the west. Both are marginal belts with widely shifting boundaries. Much of the land in both belts must be given over to livestock and pasture in order to offset the treachery of the climate and the tragedy which has so often come when the wheat crop has failed.

The Corn and Winter Wheat Belt. The southern part of the region of cyclonic storms in the United States extends from eastern Kansas across Missouri, Kentucky, and Virginia. Under the tempering influence of the Atlantic Ocean, conditions which are peculiar to these southerly lands extend northward across Maryland and well into eastern Pennsylvania. This is a belt of rolling—and in places mountainous—country, with large areas that are unsuitable for agriculture of any kind.

Like the geography of all other belts in the wet middle latitudes of North America, the geography of this belt is complicated because the inhabitants have adjusted them-

The grain elevator where wheat is processed for the market is a symbol of the Winter Wheat Belt.



U.S. Department of Agriculture

Maps showing where three kinds of livestock and five crops are grown in the United States.

Heavy rainfall, mild temperatures, and the nearness of great markets favor vegetable farming in the Middle Atlantic Trucking Belt.

James Sawders

selves to the earth in a great variety of ways. But, as in all other belts, the agricultural adjustment is the one in which climate plays the largest part. This belt is called the Corn and Winter Wheat Belt because its mild wet climate and hilly topography, though not ideal for either corn or wheat, permit the cultivation of both these crops in many districts.

Convenience as much as anything else has determined the popular combination of corn and wheat in this region. The wheat is planted in September after the corn has been harvested. It sprouts in the cool moist weather of autumn, and when winter sets in, it covers the ground like grass. Though the winter is mild, it is too cold for growth; the wheat must wait for the warmth of early summer to complete its development. While the farmer is waiting for this to happen he has time to plant his corn. The typical farm of the Corn and Winter Wheat Belt produces cattle and clover, as well as corn and wheat. The farmer feeds the corn and the clover to the cattle and sells the cattle and the wheat.

The Middle Atlantic Trucking Belt. On the map on page 119 you will notice a narrow belt on the Atlantic coast which is labeled the Middle Atlantic Trucking Belt. Here the nearness of the ocean greatly modifies the humid continental climate. Rainfall is heavy and evenly distributed throughout the year. Temperature differences between the seasons are much less marked than in regions to the west. Many kinds of vegetables grow well under such conditions. This fact, combined with the nearness of fine markets in the cities of the Atlantic Seaboard, makes this strip of coastland ideal for truck farming.

In the past the farmers of this belt have devoted their croplands almost exclusively to vegetables, with the result that they have often produced more vegetables than they could sell. In the future they will probably turn more and more to the production of meat and dairy products as a safeguard against the failure of the vegetable markets.

Almost anything can be grown on the flat sandy soils of these wet coastal lands. Experience has shown that these soils will produce especially fine crops of clover, alfalfa, peas, beans, and corn if they are properly fertilized. In spite of this fact, an amazingly large percentage of this belt has lain for years uncultivated because of the many marshes and mosquitoes. But the marshes can be drained and the mosquitoes driven away from what the geographer J. Russell Smith has called "one of the richest unused resources in America."

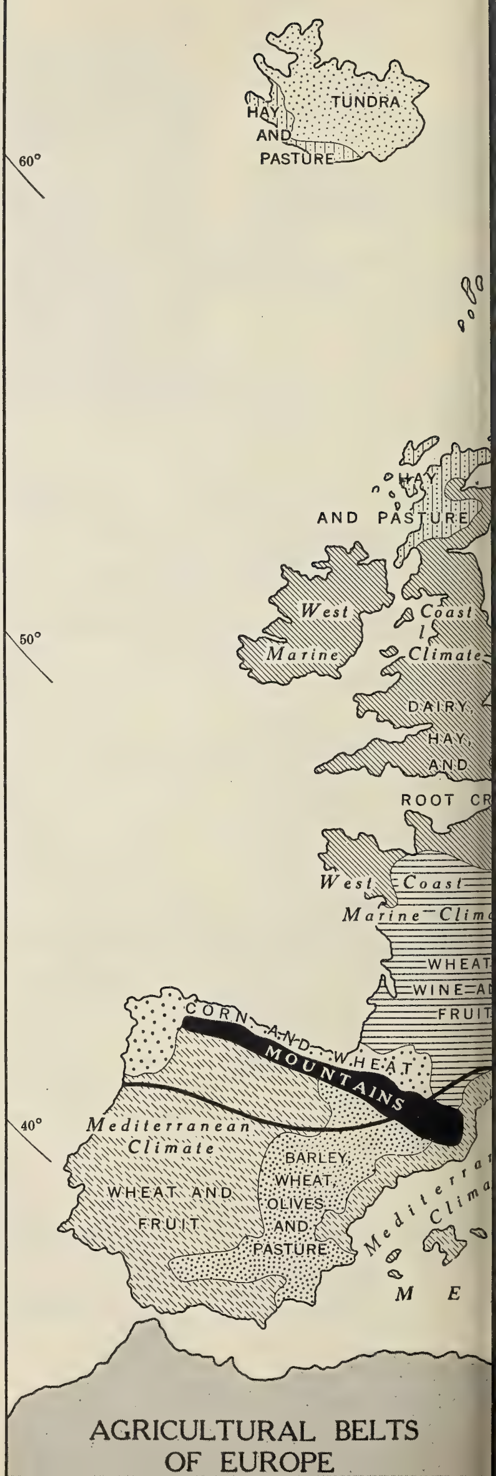
THE HUMID CONTINENTAL CLIMATE IN OTHER LANDS

The climate of Europe. In Chapter IV we saw that the absence of high mountains along the west coast of Europe permits the west coast marine type of climate to extend much farther inland than it does in western North America. By the time the westerly winds pass over Denmark and western Germany they lose much of the moisture which they pick up from the Atlantic Ocean. From there eastward across Europe and Asia to the Pacific Ocean, the influence of the sea on the climate of most middle latitude regions is very slight.

Between the taiga on the north and the mediterranean coastlands and steppes on the south, central and east-central Europe has a climate which in many ways resembles that of central and east-central United States. Cyclonic storms bring moisture during every season of the year, but chiefly in summer. The climate of most of this region is much like the short summer climate of North America. There are relatively few places with the long summer climate in south-central Europe because the general high elevation of this region offsets the effects of its southerly location. (See the map at the right.)

The agricultural belts of Europe. In Europe, as in North America, climate reveals itself and its influence on men most clearly in the croplands. The crops of Europe, however, are not always those that are best suited to the climate under which they are grown. The European farmer has more to worry about than the weather. Europe is made up of many little nations, each living under the fear of war—when not actually fighting a war. Each of these nations, accordingly, grows as many different kinds of crops as it possibly can so that its food supply will not be disastrously cut down when war cuts off its imported foods.

Other economic and cultural influences greatly affect agriculture in Europe. Trans-




TUNDRA WITH NO AGRICULTURE
High Latitude Marine Climate
TAIGA WITH NO AGRICULTURE
POLAR BARLEY
POLAR BARLEY
High Latitude Continental Climate
MOUNTAINS
HAY AND PASTURE
OATS
OATS
West Coast Marine Climate
OATS
Humid Continental Climate
RYE AND BUCKWHEAT
Coast Marine Climate
SUGAR BEETS AND WINTER GRAINS
SPRING WHEAT
Steppe
SUBTROPICAL BARLEY
DAIRY, HAY, AND ROOT CROPS
MOUNTAINS
MOUNTAINS
WHEAT, WINE, AND FRUIT
MTS.
CORN AND WHEAT
Humid Continental Climate
CORN AND WHEAT
BLACK SEA
Mediterranean Climate
FRUIT
WHEAT, WINE AND FRUIT
BARLEY, WHEAT, OLIVES AND PASTURE
BARLEY, WHEAT, OLIVES & PASTURE
WHEAT AND FRUIT
MEDITERRANEAN SEA

portation facilities, market conditions, competition from other nations, land values, customs restrictions, and taxes all share with the climate the role of determining what crops shall be raised. Tradition also plays a leading part. Through long habit, for example, Russians prefer a diet of rye bread and potatoes, and are only just beginning to appreciate dairy products. The Mohammedan population of Turkey will not eat pork, because their religion forbids it. *Such influences as these tend to obscure the effects of climate on agriculture everywhere, but nowhere so much as in Europe.* The result is a much larger number of agricultural belts in Europe than anywhere else on the globe.

Man, however, can nowhere escape the broader demands of climate. These broader demands are reflected in the broader pattern of agricultural belts which lie under the humid continental climate of Europe. These belts are shown in the map on pages 130–131. You will notice at once both similarities and differences between this map and the map on page 119, which shows the agricultural belts of the humid continental climate in North America. The chief similarity is that grain of one sort or another is the major crop in nearly all the belts of both continents. In Europe, as in America, wheat is grown in the cooler and drier sections, corn in the warmer and wetter sections, and a mixture of wheat and corn in the sections where these two varieties of climate grade into one another.

The chief difference is that the humid continental climate extends much farther to the north in Europe than in most of North America. Great belts of barley, oats, and rye are cultivated in Europe in latitudes which are still largely abandoned to virgin forests in North America. If you wonder why this difference should exist, reread the section "West coasts and east coasts" in Chapter IV.

Another striking difference is that the great Hay and Dairy Belt of east-central North America has no counterpart in east-central Europe. This difference, however, does not reflect a difference in climate. In North America most of the largest cities, and consequently most of the best markets for dairy products, are in the East. This fact, as much as climate, determines the location of the Hay and Dairy Belt. In Europe most of the largest cities are in the West, and the chief hay and dairy districts lie close to these teeming markets. They thus lie west of the boundary of the humid continental climate. Dairy products grow progressively rarer in Europe from west to east. There are many people in eastern Europe who never saw butter until it came to them as a Lend Lease gift from America during the Second World War.

Europeans as a whole are mighty eaters of grain. Just as dairy lands decrease from west to east in Europe, grain lands increase. Before the war some 31 per cent of the croplands of Great Britain were devoted to grain; eastward this percentage rose to 71 in Rumania. Between eastern Belgium and Russia there are millions of people who depend chiefly on rye for their nourishment. This is due partly to tradition but also to the fact that both the soil and the climate of east-central Europe are better suited to rye than to any other grain.

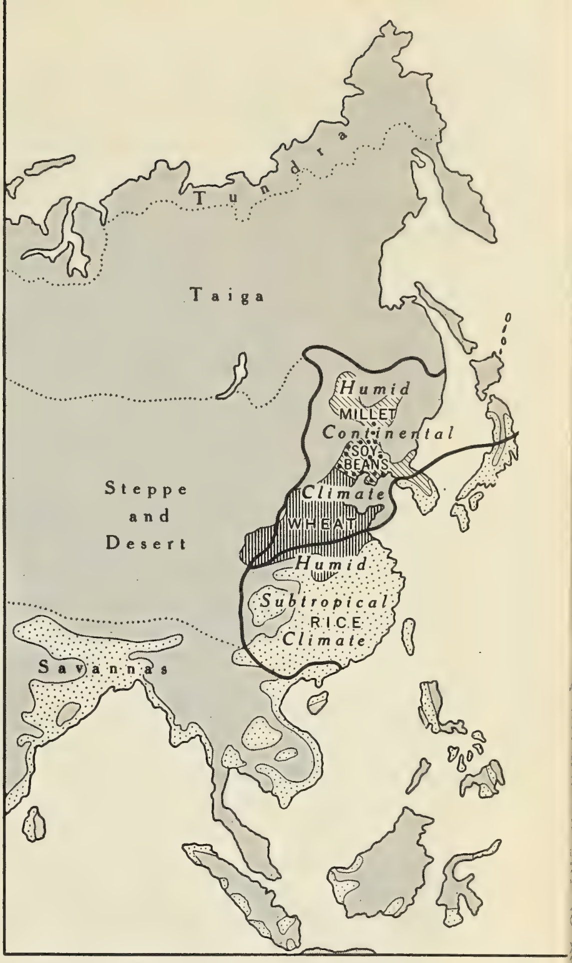
The wheat belts of Europe lie chiefly southeast of the rye belt. They reach their greatest development on the cool subhumid flatlands of southern Russia, where about one fifth of the world supply of wheat is grown. The corn belts of Europe lie southwest of the wheat belts, chiefly in northern Italy, Hungary, Yugoslavia, and Rumania. Here the long, hot, rainy summers are ideal for corn, but the land is so full of mountains that corn has never been developed as it has been in North America. A great many hogs are raised in central and eastern Europe, but they are fattened chiefly on potatoes rather than corn.

On the whole, the humid continental climate is less productive in Europe than in North America, chiefly because Europe has much poor soil and many mountains. Most European nations are unable to raise all the food they need. This creates geographic, social, and political problems of the gravest nature, as we shall see when we study the political geography of Europe in Unit VI.

The climate of east-central Asia. Eastward from Europe, across the wide expanse of southern Siberia, the westerly winds carry little moisture, and the climate at its wettest can only be called subhumid. Here the forests and croplands of the humid continental type are pinched out of existence by the taiga on the north and the steppes on the south. The moderating influence of the Pacific Ocean, however, causes this belt to reappear at the far eastern end of Asia, so that it covers most of Manchuria, middle Japan, and north-central China. (See the map on pages 70–71.)

In these lands of east-central Asia, the climate resembles that of eastern United States and east-central Europe. These are the lands that gave birth to some of the oldest civilizations on earth, and which still nourish some of the densest populations. The agriculture through which the nourishment is achieved has shown little development with time. Most of the people of this vast area are raising much the same crops in much the same way that their ancestors did some thousands of years ago.

The agriculture of east-central Asia. No two adjustments to the same type of climate could conceivably differ more widely from each other than those of the people of Europe and North America and the people of east-central Asia. The key to the difference, as far as agriculture is concerned, is machinery. The occidental farmer does as much work as possible with machinery, and as little as possible with muscle. On occidental farms one sees many mechanical planters, cultivators, harvesters, threshers, milking machines, and cream separators; on oriental farms one sees chiefly men and beasts. This fundamental difference affects agriculture in three ways:



The agricultural belts of east-central Asia.

1. A much smaller percentage of the land is cultivated in the Orient than in the Occident.

2. The farms of the Orient are of much smaller average size than those of the Occident.

3. There is a much larger average yield of crops per acre in the Orient than in the Occident.

The oriental farmer, in other words, can till only a little soil with his muscles and his beasts and his few crude tools. He therefore tills only the best soil with an intensity which is unknown to the occidental farmer

The simplicity of oriental farming is matched by a simplicity in the pattern of agricultural belts in the Orient. The entire southeastern part of China has but one staple crop: rice. The ricelands lie chiefly in a zone of hot wet subtropical climate which we shall discuss later in this chapter. Where this climate gives way on the northwest to the humid continental climate, the ricelands give way to wheatlands. These in turn give way to millet lands and soybean fields in northern China and Manchuria.

Great multitudes of oriental people live for the most part on these few kinds of food. Locally they raise such crops as cotton, sugar, tea, and silk. They keep few cattle and produce no dairy products worth mentioning; they have little meat of any kind except pork. Only in Japan has much progress been made toward a more varied and scientific development of the croplands. But Japan is so small, so mountainous, and so thickly populated that no amount of improvement in her agriculture will ever be able to solve the problem of feeding her people. This problem, which has led to one of the great tragedies of modern times, will be discussed at some length later in this book.

The humid continental climate in the Southern Hemisphere. The Southern Hemisphere is chiefly a kingdom of water where middle latitude lands with a humid continental climate are rare. This climate is practically nonexistent in southeastern Africa and Australia. A considerable region in South America, however, has climate of this type. Unlike the humid continental climate of North America, which is reflected chiefly in trees, the humid continental climate of South America is reflected almost exclusively in grass.

The thin end of South America stretches like the tail of a dog far into the middle latitudes of the Southern Hemisphere. The backbone of the Andes runs down to the very tip of the tail, with Chile on one side and Argentina on the other. Grass grows like hair along the middle of the Argentine side. Though the natural prairie lands of southeastern South America extend well into Paraguay and Uruguay on the north, they are best developed in east-central Argentina. There the wild native grasses once rose high enough in many areas to hide a man on horseback.

Like all other prairie lands, those of Argentina have been invaded by civilization. Along their dry western edges enough wheat is grown to place Argentina high among the wheat-producing nations of the earth. Most of the humid portions of the grasslands, however, are used chiefly for grazing cattle and sheep. Argentina is accordingly one of the largest consumers and exporters of meat on earth. In Chapter XXI we shall study the humid continental grasslands of South America in more detail.

The most valuable crop of humid continental lands. We have devoted a great deal of space to the agricultural adjustments of the people of humid continental lands because through agriculture these people reveal the most direct influence of climate upon their lives. But the indirect effects of climate are even more important and far-reaching. The people of these lands not only raise more food than do the people of all other climatic regions; they produce more of almost everything else that civilized men require.

They mine more minerals, manufacture more machinery, build more railroads, bridges, and cities, sail more ships, run more governments, and think more thoughts than all the rest of mankind combined. They do these things at least partly because the stimulating variety of their moist climate of ever-shifting seasons and weather fills them with health and energy. This health and energy make up much the most valuable crop that is grown in the wet middle latitudes. It will figure again and again in this discussion of geography in action because it influences the thoughts and activities of men in every corner of the world.

"THE SOUTH"

The humid subtropical climate. We have already seen that certain features of the *dry* tropical type of climate and vegetation extend well into the lower middle latitudes along the *western* sides of the continents in both the Northern and the Southern Hemispheres. The coastlands and deserts in these regions have climate and vegetation which strongly suggest the tropics, and which for this reason we have described as subtropical. Similarly, certain features of the *wet* tropical type of climate and vegetation which we shall study in the next chapter extend well into the lower middle latitudes along the *eastern* sides of the continents.

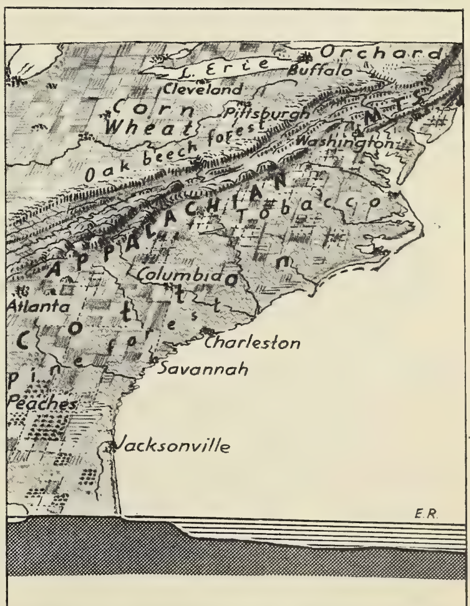
That part of the United States which is known as "the South" is such a wet subtropical region. It occupies about the same latitudes on the southeastern corner of the continent of North America that the mediterranean coastlands and deserts occupy on the southwestern corner. All these regions have subtropical climates, but they are very different from one another.

Compare, for example, Southern California, which lies in the heart of the west coast subtropical belt, with Georgia, which lies in the heart of the east coast subtropical belt. Southern California has little rain, and what it has falls almost entirely in winter; Georgia has much rain, which falls throughout the year but chiefly in summer. Southern California almost never hears the crack of thunder or sees the flash of lightning; Georgia has thunderstorms which the cyclones of the westerly winds bring in at every season. Southern California seldom suffers from extremes of weather; Georgia has intense heat in summer and frequent freezes in winter.

These two regions provide an excellent example of the differences between west coast and east coast climates which we discussed in Chapter IV. Though both regions are in subtropical latitudes, the climate of Southern California is affected by the characteristic middle latitude west coast mildness. That of Georgia, on the other hand, is affected by the characteristic middle latitude east coast severity.

Vegetation of the South. The contrast between the west coast and the east coast types of subtropical climate in North America is clearly reflected in the vegetation. The scrawny scrub forests of Southern California are replaced in Georgia by extensive forests of large trees which bespeak the more generous rainfall. If you travel southward from Buffalo you can notice a change in the character of the native woodlands as you approach the subtropical belt. The oaks, maples, and other typical broad-leaved trees of the humid continental belt gradually give way to stands of pine. The natural vegetation throughout the South is made up to a large extent of pines and other cone-bearing trees.

Between Buffalo and Atlanta one passes from a region of broad-leaved trees, orchards, and croplands of corn and winter wheat into a region of pines, tobacco, cotton, and peaches.



The Cotton Belt. The croplands too will give you a key to the changing climate. When fields of corn and winter wheat give way to fields of cotton, you are definitely in the South. No other climatic region in North America is so uniformly bound together by a single crop as the South is bound together by cotton. From central Texas and southern Oklahoma all the way to the Carolinas, cotton is king. The Cotton Belt covers most of the land with the humid subtropical climate in North America, as

American Potash Institute

Fertilizer made the difference in the size of these two cotton bolls.

the map on page 119 shows. Throughout its agricultural history, about half the croplands of the Cotton Belt have been devoted to cotton. For more than one hundred years the fortunes of men and cotton have ebbed and flowed together.

Cotton will grow in almost any kind of soil that holds moisture well, but it is much more particular about climate. As a general rule, it cannot be successfully raised in regions with fewer than 200 frost-free days each year, or where the average summer temperature is below 77° F. It does not do well where the rainfall is much less than 23 inches or much more than 30 inches a year. It must have a fairly dry autumn for the harvest because heavy rains at that season would beat the cotton into the mud before it could be picked. The North American Cotton Belt, as shown on the map on page 119, is limited on the north by cold, on the east and south by too much rain, and on the west by too little rain. Within the belt, conditions are ideal for cotton.

They are so ideal that the cultivation of cotton has long been an obstacle to the development of the many other agricultural possibilities of this great region. We have seen the dangers of a one-crop system of agriculture in our study of the North American Wheat belts. The same danger has hung over the Cotton Belt through most of its history. When floods, freezes, soil erosion, boll weevils, and bad markets have come, the cotton planters have had little defense against financial ruin. Fortunately, the Cotton Belt climate will smile on other crops besides cotton, if only the people will let it.

Though much of the soil in this region is poor, it can be greatly improved by scientific cultivation. The cotton bolls shown on this page will give you an idea of how a liberal use of fertilizers can affect the yield of cotton. A three-year rotation of cotton, corn, and clover or alfalfa is also extremely beneficial, and is being practiced on many cotton plantations today. The hope for the future of Cotton Belt agriculture, however, is only half in the improvement of cotton production. The other half is in the production of other crops.

The American farmer has taken a suggestion from the farmers of China, who for ages have cultivated the soybean. This remarkable bean is so rich in protein and fat that it takes the place of meat and dairy products in the diet of millions of Asiatics. Soybeans grow well in the sandier soils of the American South and they are being grown there in steadily increasing amounts. Americans in general are slowly becoming aware of the virtues of a food which they have long neglected. Peanuts too are becoming more and more important in the American diet, and the Cotton Belt is producing them. Tobacco, peaches, pecans, sweet potatoes, and a variety of grains and


Caterpillar Tractor Company

Soybeans are one of many crops which do well in the Cotton Belt.

leafy vegetables stand high among the crops which can be and are being raised in increasing abundance in this region.

Animal culture has lagged behind plant culture throughout the South. The mule, to be sure, has long been a familiar resident of Dixie because he can work harder on poorer food than any other domesticated animal. Hogs too have long been plentiful, though undistinguished, over all this region. Through more careful breeding, however, and through more extensive development of such fodder crops as corn, cowpeas, and velvet beans, the Cotton Belt hog is being improved. With proper care he can become as worthy as any of his kind on earth because the climate is one in which he thrives.

Though cattle can be pastured throughout the year in the Cotton Belt, they have only recently begun to lay claim to any considerable percentage of the cleared land. Aside from the general indifference to almost everything but cotton, three things have held back the cattle business in the South: (1) Hay cannot be properly dried and cured in much of this humid region. (2) Cattle ticks are numerous and extremely harmful. (3) Most breeds of cattle have been developed in cool climates and do not thrive in a hot humid climate.

Fortunately, each of these difficulties can be met. Silos can preserve all sorts of cattle feed perfectly; disinfectants can keep a herd practically free from ticks; cattle imported from India, where they have been bred to live in a climate of humid heat, can be raised instead of the more familiar cattle of the North. Through these means both beef and dairy cattle are increasing and improving in several Southern districts.

The problems of the Cotton Belt. In spite of having a climate in which almost anything will grow, the Cotton Belt has long been a region of serious problems. There are many surprises and contradictions in man's adjustments to the earth. Agriculture

U.S.D.A. Photograph by Marion Post

Mechanical cotton pickers are helping the South to harvest its rich agricultural wealth.

is the foundation on which civilization is built; at first thought it seems obvious that civilization should flourish wherever climate favors agriculture, and languish wherever it does not. But we have already seen how man has repeatedly developed a high type of civilization under the hostile desert climate. It is also true that he has repeatedly failed to develop a high civilization under far more friendly climates.

The humid subtropical climate is perhaps more favorable to agriculture than any other climate on earth. All over the earth, however, regions with this type of climate have been handicapped by poverty and misery. The American South is in many ways an exception to this general rule because its agricultural, political, and social developments have gone far beyond those of any other humid subtropical region. Yet when compared with several other climatic regions in North America, the South has developed slowly.

Doubtless one of the chief reasons for this is the weakening effect of the sultry heat on the white man. His energy falls as the mercury rises. Diseases take hold of him, especially malaria and hookworm disease, which thrive in a hot humid climate. When the people of the Cotton Belt first began to realize that cotton and tobacco were among the most valuable money crops on earth, they had neither labor-saving machinery nor an excess of energy to speed the production of these crops. They solved the problem by bringing in African slaves, who could work hard in the steaming fields without getting ill, and who could live cheaply off the excess of the land. Profits were great for a time until the Civil War put an end to the system of slave labor and changed the whole economic structure of the Cotton Belt.

Slave labor was not only degrading to men; it was also disastrous to the land. Forests that guarded the earth from floods and erosion (which are particularly harmful in regions of heavy rainfall) were thoughtlessly destroyed. When gullies began to carve up the fields, or when continuous cultivation and leaching of necessary minerals by rain lowered their productivity, new fields were hacked out of the wilderness.

Before the Civil War most Cotton Belt planters did not farm the land. They mined it for quick profits and left ruin behind. What the Civil War did not destroy of this reckless system the boll weevil did.

Recovery has been slow but it is definitely on the way. Government measures are gradually reducing both the social abuses that lingered on after the war and those that developed because of the war. Conservation is slowly restoring the tortured land. Science is reducing the depredations of the boll weevil and helping to develop new crops which the boll weevil cannot harm. There is real hope today that the Cotton Belt of tomorrow will be able to reap rich harvests of wealth and general well-being from its highly productive climate.

The wet subtropical coastlands. The coastal lowlands from southwestern Texas to southeastern South Carolina, and the entire peninsula of Florida, have a climate which is considerably more tropical than that of the rest of the South. Here frosts are rare in winter and the growing season lasts through all or nearly all the year. Seasonal differences are slight and the palm tree, emblem of the tropics, is conspicuous in the landscape. The breezes off the ocean moderate the heat which plagues the inland areas of the South, so that many residents of the Cotton Belt go south in summer to get cool. Many Northerners go to the same places in winter to get warm. Tourists are the most valuable crop of this particularly gracious climatic region, but there are many other crops as well.

Sugar cane and rice do well on the lowlands of the Mississippi delta in Louisiana and elsewhere in this region. Citrus fruits do well all the way from Texas to Florida. Other fruits and many vegetables can be produced early in the year throughout the belt, and sold for high prices in the markets of the North. Though much of the soil is not very fertile, fertilizers can perform miracles on it. Three crops a year are common in many districts. Many of the extensive areas of marshland can be—and are being—drained. All told, these coastal lowlands are the most pleasant and most prosperous part of the American South.

Wet subtropical coastlands produce a variety of unusual crops.

These papaya trees in southern Florida yield an abundance of juicy and tasty fruit.

James Sawders

THE HUMID SUBTROPICAL CLIMATE IN OTHER LANDS

The humid subtropical climate in the Southern Hemisphere. North and northeast of the humid continental grasslands of South America lie the humid subtropical forest lands of Uruguay, Argentina, Paraguay, and Brazil. (See the map on pages 70–71.) In southeastern Brazil the great subtropical Parana pine forests provide an almost untouched reserve of softwood for building purposes. Subtropical eastern Paraguay has some of the finest hardwood forests on earth, which are likewise practically untouched. Both these regions have the holly tree yerba maté, which has been considerably exploited because its leaves provide maté, the most widely popular drink in South America.

The agricultural possibilities of the humid subtropical climate of South America have been most highly developed in northeastern Argentina. Whereas, in the United States, the chief cultivated crop of this type of climate is cotton, in Argentina it is alfalfa. Earlier in this chapter we saw that the cattle industry is outstanding in Argentina as a whole. By adding alfalfa to the diet of the cattle, more and better meat can be produced more quickly than if the native grasses alone are used for feed. Flaxseed, wheat, and corn are also grown in increasing amounts in northeastern Argentina, which is truly one of the finest agricultural belts on earth.

In Brazil, Uruguay, and Paraguay, the lands with the humid subtropical type of climate are still largely in a frontier stage of development. They are none the less lands of the richest promise. The developed areas of southeastern Brazil have been given over chiefly to livestock, and they already produce much meat for home consumption. A variety of fruits and vegetables, and some rice, corn, wheat, and sugar cane are also grown there.

In Uruguay there are many fine natural pastures within the subtropical forested belt. These form the basis for the cattle and sheep ranching which are the leading industries of the country. As yet there is very little farming in Uruguay, though many different crops could be raised if a demand for them should arise. Eastern Paraguay too is blessed by a mild wet climate, but it is so far from large centers of population that little development of any kind has yet taken place there. All these South American lands with the humid subtropical type of climate are unusually poor in people and rich in re-

In these Brazilian farm buildings maté leaves are dried for the market.
The great pine trees in the background are another rich resource of this region.

Philip Gendreau, N.Y.

By Ewing Galloway, N.Y.

These women are planting rice after the man and water buffalo have plowed the paddy.

sources. As we shall see in some detail in Chapter XXI, they are awaiting the future. With more people at home and better avenues of transportation to the markets abroad, they will someday take their place among the great productive belts of the earth.

As you can see by the map on pages 70–71, the humid subtropical climate occurs over relatively small areas to the south and east of the deserts and steppes in southeastern South Africa and Australia. In Africa such areas are used chiefly for corn and sugar cane; in Australia they are used chiefly for dairying. Along the wet edges of the steppes to the northwest of the dairy belt, Australia raises more sheep than any other country in the world.

The oriental ricelands. The latitudes which are devoted chiefly to cotton in southeastern North America and to alfalfa in southeastern South America are devoted chiefly to rice in southeastern China, southern Korea, and southern Japan. Rice culture, however, is not restricted to these latitudes. It can be carried on successfully over a very wide expanse of the earth's surface where the winters are mild and the summers long, hot, and wet. Rice probably originated in the swamplands of the true tropics and much rice is grown there today. Even more, however, is grown in the humid subtropical belt of the lower middle latitudes. The map on page 133 will show how rice culture blankets both the tropical and the subtropical latitudes of southeastern Asia.

Rice differs from other cultivated grains as ducks differ from robins. Rice fields must not merely be watered; they must be flooded during the early stages in the growth of the rice plants. They must get water either by heavy rainfall during the growing season or by irrigation from nearby streams. They must have soil which is not too porous, because the water must cover the stalks, as well as the roots, of the infant rice.

Because of these restrictions good ricelands are relatively few and far between. Oriental rice belts, like the wheat and millet belts to the north, must make up in yield per acre for the relatively small amount of land that is under cultivation. Fortunately,

© Screen Traveler, from Gendreau

These terraced rice paddies in Java are irrigated by water which flows off the mountains in the background.

rice is the most generous food plant on earth. Sow a handful of rice, and under proper conditions of climate and care you will get fifty handfuls in return. The average yield of the Chinese ricelands is nearly three fourths of a ton per acre. A two-acre farm with such a yield can feed a larger than average Chinese family.

The great productivity of the rice plant is half the reason why the humid subtropical climate of Asia can support one of the densest populations on earth. The other half of the reason is that the riceland peasants work like ants through all the daylight hours. Rice yields its blessings only for a price. In regions where mechanized farming is practically unknown, the price is the sweat of men and beasts. With hoe, spade, and perhaps a crude plow and a team of water buffaloes, the rice planter plows, smooths, plants, cultivates, fertilizes, and harvests his soggy fields, or "paddies." If the paddies lie above the level of the water supply in irrigated territory, water may have to be brought in by water wheels which are turned by human muscles. The photograph on page 141 will give you some idea of what life in the ricelands means.

Where rice is grown in hilly country, a strange kind of landscape develops. The photograph on this page shows some of the terraced rice paddies of Java. Though Java lies in the true tropics, where most farmers are handicapped by climate, the Javanese farmers have overcome the handicap of stifling year-round heat and uneven land to become the finest rice growers in the world. Notice the mountains behind the paddies. Water from the streams that flow off these mountains is led over the planted hillsides between the mud dikes, which lie on them like the tracks of some gigantic worm. Intense cultivation of such fields as these yields two or three crops a year, and may support as many as 2000 people to a square mile.

Other crops of riceland regions. As in all other agricultural belts, the rice belts are not given over entirely to the crop for which they are named. Cotton is also grown in the humid subtropical areas of China. A large percentage of the world supply of silk and tea is grown under this type of climate in China and Japan. Some wheat and millet are grown in the drier, and some sugar in the wetter, districts. Citrus fruits and a variety of vegetables do well in many localities. In keeping with conditions throughout the Orient, animal culture is relatively unimportant.

The future of southeastern Asia. As in all other regions with the humid subtropical type of climate, the "good earth" of southeastern Asia is good in a variety of ways. But it has never been good enough to provide a very high standard of living for the teeming hordes of human beings who cling to it. Humid heat drains the energy of the native people, even though they have learned how to live in such heat without suffering as people do who are unaccustomed to it. Most of the inhabitants of the humid subtropical lands of Asia are underfed, overworked, and miserably poor. Nothing can be done to the climate which has helped to develop this situation, but much might be done to the system of agriculture which has furthered it.

The great need of oriental agriculture in general is more land under cultivation at less cost in human toil and fatigue. Oriental farms should be expanded to include poorer land; crops should be increased in amount and variety; the labor needed to produce the crops should be decreased. Only in this way can the level of average oriental life be brought up somewhere near to the level of average occidental life.

Such a goal is no mere dream. It could be achieved if modern farm machinery were used to the fullest possible extent, and if age-old legal and emotional bonds between the peasant and his fields could be broken. Nothing short of a revolution could be expected to gain these ends, but the Orient is actually in the throes of revolution today.

These people are planting tea on an oriental hillside.

Perhaps the Second World War will prove to have so shattered the traditional pattern of human adjustments there that a new and better pattern can take shape. If the war should do this it would almost be worth its terrible cost.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. In wet middle latitude lands there is no very cold weather in winter and no very hot weather in summer.

2. In the belt of westerly winds the wind always blows out of the west.

3. A cyclone is a violent storm of warm moist air which does great damage, and an anticyclone is an area of calm and dry air.

4. Farming in the Spring Wheat Belt is a profitable and reliable business.

5. Dairy farming is not profitable in the Spring Wheat Belt, because of the difficulty of raising sufficient forage for the cattle.

6. Dairy farming is important in Wisconsin, New York, and New England because the farmers prefer to raise cows rather than wheat or corn.

7. The most important industry in the Corn Belt is raising and marketing corn to be made into cornmeal and breakfast foods.

8. Hogs are an important farm product in the Corn Belt because of the large amount of waste products on the farms which can be fed to the hogs.

9. Winter wheat matures during the winter months and therefore is grown where there are long winters.

10. The food crops of Europe, as of North America, are those which are best suited to the climate in which they are grown.

11. Lands with humid continental climate are important only because of the large amount of food which is grown there.

12. Lands with humid subtropical climate hardly ever have any frost or any snow in winter.

13. The humid subtropical climate is a very disagreeable climate.

14. The location of the Cotton Belt has been determined by the abundance of cheap labor.

15. Most of the problems of the South are caused by a climate which is not very good for agriculture.

16. Rice probably originated in the swamps of the tropics and all of it is grown there now.

17. Rice is a popular crop in the Orient because it gives a high yield and requires little care.

18. It is hopeless to expect an improvement of living standards in the rice-growing oriental nations.

QUESTIONS FOR DISCUSSION

1. About when on the average is the last spring frost in your locality, and when is the first autumn frost? How long, in other words, is the growing season? If you have a garden, tell the class which vegetables are most easily killed by frost.

2. What would you say are the main differences between the short summer and the long summer humid continental climates? What crops are best adapted to each of these types of climate? Where do you chiefly find these climates?

3. If you had a farm in the Spring Wheat Belt, how would you operate it so that you could always be sure of making a living?

4. Why do you suppose the principal farming activity in New England is dairy farming? Do you know anything about the early history of New England? Was dairy farming always the main farming activity there?

5. How do the problems of raising food in North America and Europe differ?

6. Why can such grains as barley, oats, and rye be grown farther north in Europe than in North America?

7. Do you think that rice culture will become important in occidental agriculture as the population of the Western world increases?

8. What do you think are the chief social effects of the differences between oriental and occidental farming in the wet middle latitude lands?

THINGS TO DO

1. Make a chart showing the length of the growing season and the rainfall required for wheat, corn, rye, barley, sugar beets, oats, potatoes, and hay. Mark any of these crops which are grown in your own locality. Mark any which you believe might be grown there and state the reasons for your belief.

2. Plan the kind of vegetable garden which you feel has the greatest chance of being a success in your climate. Find out which vegetables are best adapted to your climate, when they should be planted, and when you might expect to harvest them. Make out an order for the amount of seed you will need, and tell how much yield you expect to get from the garden you have planned. You can get this information from local farmers and a seed catalogue of a large seed company. You can also find it in state and Federal agricultural bulletins.

3. If you live in a wooded or formerly wooded area, make a list of (1) the different kinds of native trees in your locality, (2) the relative abundance of the chief kinds of trees, (3) the trees which are used for commercial purposes.

4. Plan a trip from Boston to Los Angeles by either train or automobile. Write a report on this planned trip which will include the following topics, organized in any way you wish: (1) the route of the trip; (2) the states and major cities which will be visited; (3) the different climatic regions along the way; (4) the different kinds of natural vegetation which will be seen; (5) the different kinds of agricultural crops which will be seen.

5. Find out all you can about the boll weevil, its effect on the cotton industry of the South, and methods of control. The United States Department of Agriculture has pamphlets on this subject. Write a report on the effects of the boll weevil.

6. There were several newspaper accounts of the effects of a rice diet on North American prisoners of war during 1943 and 1944. See how many of these accounts you can find, and write a summary of them.

7. Make lists of all the leading crops of the humid continental and the humid subtropical lands.

BOOKS TO READ

1. Hundreds of books have been written about various phases of the geography of the wet middle latitude lands, where most of the people who write books live. The general books on weather and climate which were recommended under Chapters II and IV of this book contain excellent discussions of the weather and climate of these lands. For an unusual account of the life history of a cyclonic storm and its effects on human beings, read *Storm*, by GEORGE STEWART. The chief action of this novel is laid in northern California, but similar storms produce similar results over the lands to the east.

2. Perhaps the most significant book that was ever written on the effects of the humid continental climate on human energy and achievement is *Civilization and Climate*, by ELLSWORTH HUNTINGTON, which has already been recommended under Chapter II. If you have time to read only one book in connection with this unit, this is the book you should read.

3. For a thorough treatment of the agricultural conditions and problems of the humid subtropical regions of North America, read *The Soils and Agriculture of the Southern States*, by HUGH H. BENNETT. For a broader treatment of the geography of these regions read *Human Geography of the South: A Study in Regional Resources and Human Adequacy*, by RUPERT B. VANCE. A fine novel which will give you a vivid impression of humid subtropical Florida is *The Yearling*, by MARJORIE KINNAN RAWLINGS.

4. *Book of the Broadleaf Trees*, by FRANK H. LAMB, will give you an interesting picture of the native trees of the wet middle latitude lands, and their effects on the economic and social welfare of the people. *The Small Grains*, by MARK A. CARLETON, and *Botany of Crop Plants*, by WILFRED W. ROBBINS, are excellent works on the cultivated plants of these latitudes. Articles in the *Encyclopædia Britannica* on wheat, maize (corn), cotton, and rice are also both interesting and informative.

5. *Asia*, by L. DUDLEY STAMP, contains a full and readable discussion of the relationships between the wet middle latitude climates and man in China and neighboring regions. *Farmers of Forty Centuries*, by FRANKLIN H. KING, is another good book which discusses this vital topic.

VIII · LOW LATITUDE SAVANNA AND FOREST LANDS

THE SAVANNAS

The tropics. We have fitted together many of the pieces which go into the jigsaw picture of the climatic regions of the earth, but we have left large spaces in the middle of the picture unfilled. Most of these open spaces lie between the tropics of Cancer and Capricorn, in a belt which the ancient Greeks called the tropical, or torrid, zone. For many centuries many people have followed the ancient Greeks in thinking of the tropics as a "torrid" region of uniform, uncomfortable, and unhealthful heat.

As we explore this torrid zone, however, we discover that its climate is not so simple as its reputation makes it seem. Though often described as a zone where seasons do not exist, much of it is marked by seasonal rhythms of rainfall which we shall discuss later in this chapter. Though often described as a zone of intolerable heat, it contains high plateaus where the climate is delightful and healthful, and mountains from which the snow never melts. Nor is all the heat of the hot areas in the torrid zone the same kind of heat. The tropical lands which shall be our main concern in this chapter are rainy lands of wet heat. But we have already seen in Chapter V that desert lands of dry heat make up a large portion of the torrid zone.

The boundaries of the torrid zone, like the climate, are not so simple as the old Greek classification of climatic zones might lead one to believe. Tropical climate is not everywhere held between the tropics of Cancer and Capricorn. As we saw in the last chapter, it invades the lower middle latitudes in belts the margins of which are everywhere irregular and in many places vague. Regions with different types of tropical climate are set off from one another in the same irregular and indefinite way. In view of these facts, let us forget the old picture of the torrid zone and its climate. Let us go to the tropics and get a picture of their wet lands—as we have already got a picture of their deserts—with our own eyes.

The tropical grasslands. Earlier in this unit we studied the great deserts and steppes which lie for the most part to the north of the equator. We saw how these dry lands of bushes and short grass give way poleward and eastward to wet lands of tall grass and trees. We saw that in most areas the grassland belts are made up almost entirely of grass, with at most a few trees along the banks of the streams.

On the equatorial sides of the deserts the grasslands are not so exclusively lands of grass. Even the drier tropical grasslands have trees both along the streams and scattered through the grass between the streams. Away from the deserts and toward the equator the trees gradually increase in number. It is difficult to know which of these areas of mixed vegetation should be called grasslands and which should be called forests. Geographers solve the problem by calling them all *savannas*. All through the low latitudes, savannas mark the transition from dry desert lands to wet forest lands. (See the map on pages 70–71.)

Savanna climate. Like all other vegetation on earth, the vegetation of the savannas is a reflection of the climate under which it grows. In Chapter II we saw that because of the $23\frac{1}{2}$-degree tilt of the earth's axis the vertical rays of the sun travel back and forth from north to south during the course of a year. In June they reach the northern limit of their journey when they are over the tropic of Cancer, $23\frac{1}{2}$ degrees north of the equator. In December they reach the southern limit of their journey when they are over the tropic of Capricorn, $23\frac{1}{2}$ degrees south of the equator. Because the vertical rays are the hottest rays, they heat the air at the surface of the earth intensely, thus causing it to rise, cool, and drop its moisture as rain. *Rain in the tropics thus tends to follow the travels of the vertical rays of the sun.*

Since the equator is in the middle of the belt over which these rays swing back and forth like a pendulum, the rays which strike the equator never depart far from the vertical at any time of year. The climate of the lands that lie on or near the equator is therefore almost uniformly hot and rainy throughout the year. Away from the equator, both north and south, this uniformity diminishes. Though it never gets really cold at any point on the lowlands between the tropics of Cancer and Capricorn, rainfall becomes more and more seasonal in character away from the equator.

The peculiar mixture of grass and trees on the tropical savannas is a reflection of this seasonal character of the rainfall. The dry seasons of these regions allow only grass to grow, whereas the rainy seasons encourage trees. The vegetation of the savannas marks the transition from the dense equatorial forests, where the rainy season lasts practically all through the year, and the tropical deserts, where the dry season lasts practically all through the year. As one might expect, the savannas that lie close to the equatorial forests have a long rainy season and a great many trees. The savannas that lie close to the deserts, on the other hand, have a long dry season and relatively few trees.

The dry savannas. The drier savannas, which lie on the equatorial side of the tropical deserts, have a short rainy season each year when the noonday sun is directly or nearly directly overhead. During most of the year little rain falls on these lands, with the result that the grasses are short and the trees stunted and widely spaced. These semiarid savannas, though much less extensive, are the low latitude equivalent of the middle latitude steppes. We did not discuss them in the chapter on the steppes, because the regularity of their rainy season and their position on the globe relate them more closely to the wet regions that border the equator.

The dry savannas are famous for big game. These are the regions where the meat-eating lions, tigers, and leopards stalk the grass-eating zebras, antelopes, and gazelles; where human beings stalk both the meat-eaters and the grass-eaters; and where ants, hyenas, and vultures feed on the scraps. This simple pattern of existence, however, has already been greatly modified by civilization. White men have invaded the savannas with rifles and automobiles—and with the usual results. But even before the white men came, the natives of the dry savannas had taken the first step toward a civilized life by ceasing to be chiefly hunters and becoming chiefly herders.

The native herders of the African Sudan, western India, northern Australia, and other

Giraffes and a scattering of flat-topped trees are typical of the African savannas.
Wide World Photos

Thos. F. Lee from Ewing Galloway

Cattle find rich pasturage in the rainy seasons on the savannas of South America.

tropical grasslands are not very different from the native herders of the Asiatic steppes about whom we studied in Chapter VI. The tropical herdsmen follow the grass, which shifts with the shifting rain. They exchange their meat, hides, and dairy products for grain, vegetables, and manufactured articles. They do their trading either at the desert oases, which lie on one side of their pasture lands, or at the farming settlements of the wet savannas, which lie on the other side. Like the herders of the steppes, they are finding their traditional freedom and independence rapidly disappearing as men from higher latitudes take over their lands.

The wet savannas. On the equatorial sides of the dry savannas the grass grows taller and taller until in some areas it reaches a height of ten or twelve feet. Trees become closer and closer together, and in places they may even form thickets. The photograph on this page will give you a general idea of the appearance of many thousands of square miles of tropical landscape in South America, Africa, Asia, and Australia. Notice the luxuriance of the grass. Savanna trees vary in kind from continent to continent, and some of them shed their leaves and sleep through the dry season, just as many trees of higher latitudes shed their leaves and sleep through the season of cold.

Big game is still plentiful on the wet savannas of Africa, and more varied than on the dry savannas. Here, in addition to the lions and antelopes which roam both the dry and the wet savannas, are water-loving hippopotamuses and crocodiles, and tree-dwelling monkeys. Elephants, rhinoceroses, and a variety of wild hogs abound. The giraffe is perhaps the most typical animal of these regions of mixed trees and grass because he is built both to browse on the leaves of the trees and to graze on the grasses.

Many of the wet savannas are healthful and fruitful lands for men, where living is relatively safe and making a living is relatively easy. Little clothing is needed to keep warm there; the grass and the trees provide ready materials for shelter against the sun and the rain. Fruits, nuts, and edible roots, to say nothing of the abundance of game, provide a wealth and variety of wild food the year round.

Cultivated food is almost as easy to get because the soil is generally good and the climate close to ideal for farming. Agriculture on the wet savannas benefits greatly from the location of these regions midway between the deserts and the tropical forests. Crops are in danger neither of being dried up by drought nor of being choked off by trees and vines. Under such conditions it is not surprising that many of the native inhabitants of these regions have advanced at least a short distance into the agricultural stage of civilized life.

Native agriculture on the wet savannas, like native herding on the dry savannas, never amounted to much until the white man came with his machinery and his dreams. Some decades ago he began to realize that the savannas were the richest lands on earth which he had not yet exploited. Long out of easy reach because of their remoteness and the absence of rapid transportation between them and the centers of civilization, they resisted white colonization longer than any other desirable lands on earth. Yet even before the Second World War, people from most of the nations of Western Europe and America had begun to occupy the savannas of Africa, Australia, and South America. They had begun to build great cattle industries on the dry savannas and great agricultural industries on the wet savannas. In the future such people will come in vastly increased numbers because they will come on wings. We shall study the savannas of Australia and South America in more detail in Unit VI.

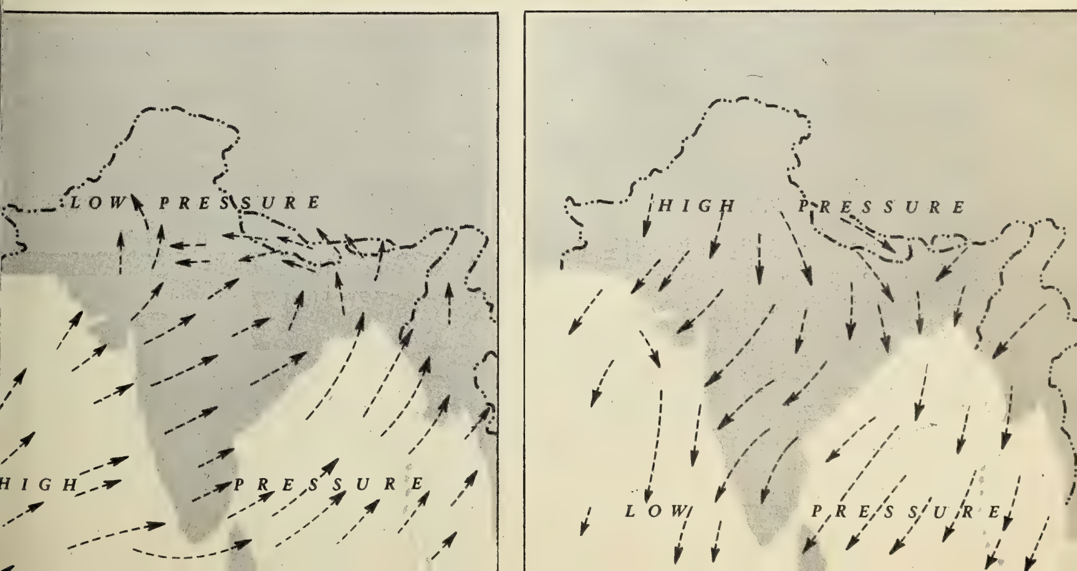
The monsoon regions. Vast areas in the tropics, especially in southern Asia, have a climate which in many ways resembles that of the savannas, and yet differs from it in one fundamental way. The rainy season on the savannas, which we have discussed above, is chiefly the result of intense heating of the air by the vertical rays of the sun. In much of India, Burma, Siam, and Indo-China, the rainy season is chiefly the result of the difference between the atmospheric pressures over the lands and the neighboring oceans.

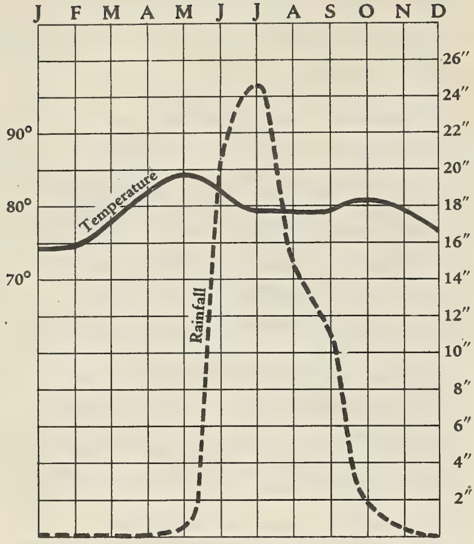
We have already seen that land areas get hotter in summer and colder in winter than ocean areas. Because Asia is the greatest land area on earth, it experiences this type of seasonal change in temperature more than does any other continent. The air over southern Asia is under low pressure in summer because it is expanded by heat from the land below. The air over the neighboring oceans, on the other hand, is under high pressure because it is cooled by the oceans below. The result of this difference is that winds blow in summer from the oceans to the land until the atmospheric pressures are equalized.

In winter just the reverse is true. The cold lands are under high, and the warm oceans under low, atmospheric pressure. At this season, accordingly, the winds blow steadily from land to sea. These seasonal winds, which are known as *monsoons*, are so strong in southern Asia that they dominate the circulation of the air in that part of the world. The maps on this page will help you to understand these winds.

The rainy season comes to regions with the monsoon type of climate when the so-called "wet monsoon" blows from the ocean to the land. The chart on page 150 will show you how greatly and abruptly the rain in-

These maps explain the general nature of the monsoon winds of India. The map on the left shows the conditions in summer, when rain-bearing winds blow from the sea to the land. The map on the right shows the conditions in winter, when dry winds blow from the land to the sea.





The wet monsoon of summer brings a sharp increase in the rainfall of Bombay, India.

creases at Bombay, India, during June and July when the wet monsoon reaches its height.

Rainfall varies considerably within the monsoon regions, chiefly as a result of the varying elevation of the land. Where high mountains help the monsoon winds to discharge their moisture, the heaviest rainfall on earth occurs. Some places in northern India get the tremendous total of more than 450 inches a year. Some places may get as much as 100 inches in July alone. One place has recorded 41 inches in a single day, which is about as much rain as far-from-dry Boston gets in an entire year. Practically all the rain of monsoon regions falls between June and October. The "dry monsoon," which blows between October and June, is as dry as the wet monsoon is wet. Many regions which average better than an inch of rain a day in July may get not a single drop in January.

Vegetation in monsoon regions. Monsoon conditions are not restricted to the continent of Asia or even to latitudes between the tropics of Cancer and Capricorn. The heavy summer rains of the middle latitude Cotton Belt in North America, and those of the middle latitude ricelands of southeastern Asia, are of the monsoon type. Within the tropics proper, the eastern portions of all the lands which are marked as savannas on the map on pages 70–71 are more or less affected by monsoon winds. These lands include thousands of square miles of upland savannas in Central and South America, where most of the world's supply of coffee is grown.

It is in southern Asia, however, that the monsoon climate is most definitely developed and where it affects the lives of the greatest number of people. Nearly 200 million human beings in India and neighboring regions to the east have the rhythm of their lives geared to the rhythm of the monsoons. But these people do not all live the same kind of lives, because the monsoon climate varies greatly from place to place. Topography varies the monsoon rainfall to such an extent that some large regions may get as little as 20 inches of rain a year, while other large regions are getting 80 inches or more.

L. Dudley Stamp, an eminent authority on the geography of Asia, made the map which is reproduced on page 151. It shows that the climate of southern Asia is really four climates, which can be separated from one another on the basis of the amount of rainfall. These climates are definitely reflected in both the wild and the cultivated vegetation, so that the following types of regions can be distinguished:

1. *The regions of very heavy rainfall* (over 80 inches a year). The native vegetation here is more like that of the equatorial forests than the savannas. Dense vine-choked evergreen forests are typical of these regions, with trees that may be as tall as 200 feet. Elephants get along much better than men in these fever-ridden wilds. The cleared lands, however, support a teeming population of human beings. Rice is the outstanding crop. Famines, which we have come to associate with India, are not common in these belts of heavy rainfall, because famines

are almost always the result of drought. Floods, on the other hand, have at times done great damage here, but flood control measures have greatly reduced this menace in recent years.

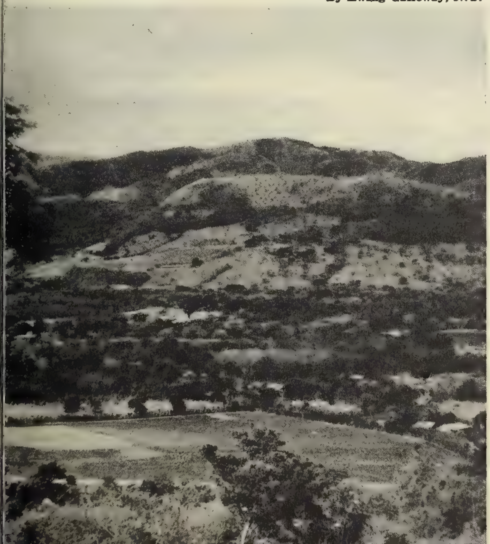
2. *The regions of heavy rainfall* (between 40 and 80 inches a year). Here the natural vegetation is of the wet savanna type, with trees that shed their leaves during the dry season. These regions take in about half of India and many millions of her people. The teak, ironwood, and sandalwood trees of the native vegetation have become valuable in world commerce. Though rice is the chief cultivated crop, a variety of subtropical and tropical crops are produced. In the drier areas, millet is most common.

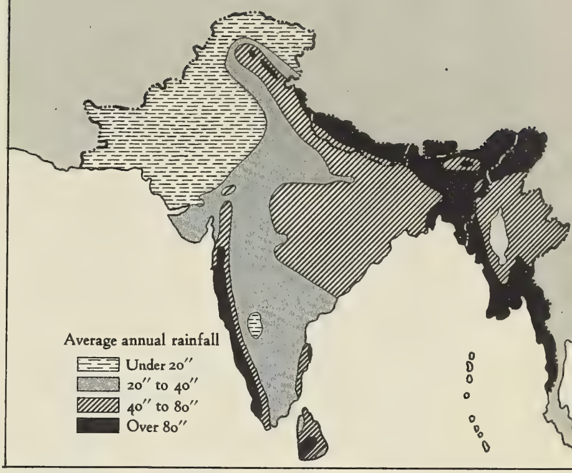
3. *The regions of moderate rainfall* (between 20 and 40 inches a year). The natural vegetation here is of the dry savanna type, with scrubby trees and short grass. Millet predominates and rice is grown only on irrigated land. These regions make up India's tragic famine belt, where millions of people depend on croplands which are subject to periodic drought. The only solution of their problem is more—and still more—irrigation.

4. *The arid and semiarid regions* (less than 20 inches a year). Northwestern India is beyond the reach of the monsoon winds. It is covered with dry grasslands that belong to the steppes, which we discussed earlier in this unit.

Coffee plantations thrive under the monsoon winds on the upland savannas of Central America.

By Ewing Galloway, N.Y.





The monsoon rains fall unevenly on India, the higher lands for the most part getting the heavier rainfall.

Men and monsoons. The geography of the monsoon lands is so varied and complex that a large library of books would be needed to do it justice. We shall return to these lands from time to time in this book as we build up the picture of the major relationships of men and the earth. You should remember, however, that no type of geographic relationship in the monsoon regions is more important than the relationship of man and rain. And the rhythm of the rain, no less than the amount, is vital in the lives of all monsoon peoples.

It is the rhythm of the rain that drives the Europeans who live under this climate to the hills during the season of the wet monsoon, because in the hills the heat and the downpour and the disease-carrying mosquitoes are not so fierce. It is the rhythm of the rain that favors rice culture on so large a scale because rice thrives in warm lands of heavy summer rains and dry autumns. It is the rhythm of the rain that stops modern warfare during the soggy season of the wet monsoon as effectively as an armistice.

Courtesy of H. L. Shantz

This native garden among the trees of the Congo forest is crude, but it furnishes one family with nearly all its food.

THE JUNGLES AND RAIN FORESTS

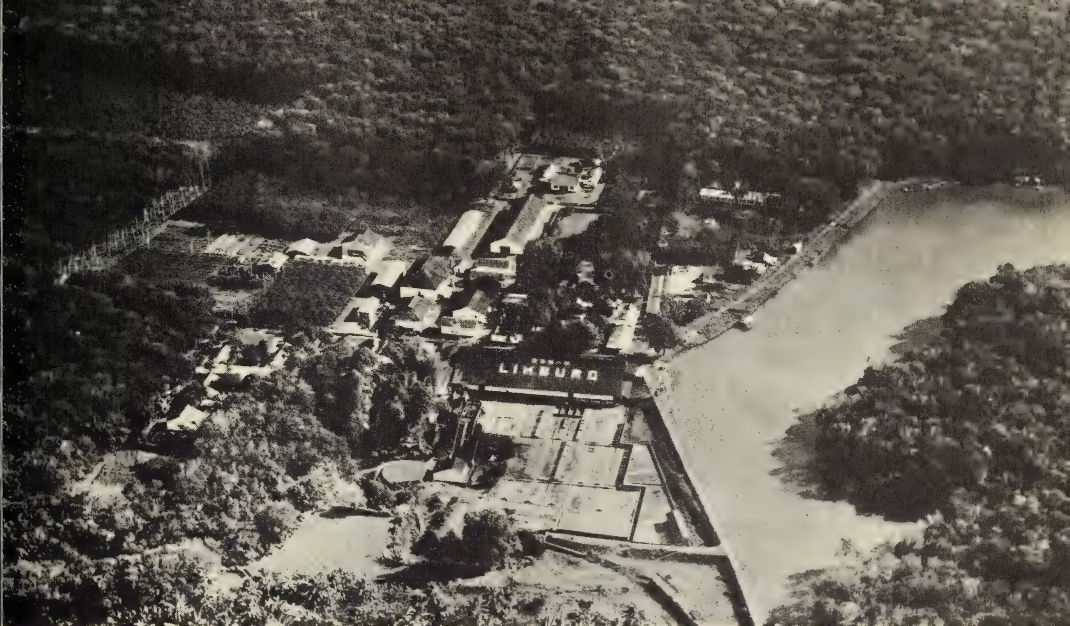
The tropical scrub forests. On their equatorial sides the savannas in many regions give way to landscapes in which the covering of low thorny trees is more conspicuous than the grass. These are the belts of *tropical scrub, or thorn, forests.* These "forests" are really only heavily wooded savannas. Like the savannas, the thorn forests are far enough away from the equator to have definite wet and dry seasons. The thorns on the trees, like those on desert trees and bushes, are an adaptation to save moisture during the dry seasons. The plant, animal, and human life of these areas is largely that of the savannas, which we have already discussed.

The jungles. Equatorward of the scrub forests the trees grow thicker and thicker as the rainy periods grow longer and longer. Several new kinds of trees appear, some of them large and valuable. Many a ship's bottom and many a library table have come from the teak and mahogany trees of these forests. With the larger trees are smaller banana and palm trees, and here and there thickets of cane and bamboo. Because the trees stand far enough apart in most areas to let the sunlight strike the ground, shrubs and ropelike vines make so thick a tangle that men must cut their way through it. Everywhere parrots and monkeys shriek and mosquitoes hum. Such are the tropical *jungles.*

So much has been written about the dangers and discomforts of the jungles that we are likely to forget that more people live in them than in any other tropical environment. Many kinds of food are free for the picking there: bananas, coconuts, wild rice, manioc and other edible roots, to mention only a few. Though animal life is less abundant than on the savannas, there are many wild pigs and other small animals on the ground, many birds in the trees, and many fish in the streams. Protection against rain is only a matter of a few palm fronds, a few poles, and a few hours' labor. There is plenty of fuel for cooking, and plenty of materials for clothing, though both are luxuries which could be foregone without any great discomfort.

The natural richness of the jungles is the basis on which their human populations rest. In many jungle areas, however, the people have passed the stage where they can rest on the natural richness alone. Men can "live off the country" more easily in the jungles than anywhere else on earth, but they can do so only as long as there is a relatively large amount of country and few men. Where human beings crowd together, agriculture becomes necessary—in the jungles, as in all other regions on the globe.

Jungle agriculture. Primitive jungle agriculture is the crudest agriculture on earth. During the short dry seasons the smaller trees are cut off a patch of jungle ground and the undergrowth burned away. With a pointed stick the seeds of gourds and other native vegetables are planted under



Netherlands Information Bureau

This rubber plantation in the Netherlands Indies proves that scientific development can render the forest lands of the low latitudes highly productive.

the ashes. Cuttings from banana and manioc trees may also be stuck into the ground because almost anything planted in almost any fashion will grow. With the coming of the rains these food plants quickly yield their treasure.

A unique form of *migratory agriculture* has sprung up in the jungles, with whole villages moving periodically from place to place. This system of agriculture is extremely destructive because the abandoned fields get choked with plants which are utterly worthless and almost impossible to remove. The chief reason for this migratory jungle agriculture may surprise you. *In spite of the luxuriance of the native vegetation, jungle soils are not naturally very fertile.* Heavy rains and heavy crops soon leach out valuable minerals from the soil of the cleared areas. Bacteria swarm in and eat up the nitrogen. Modern crop rotation and the scientific use of fertilizers can do much toward keeping jungle croplands productive, but these practices have as yet found their way into relatively few jungle areas.

The Dutch colonists of the Netherlands Indies have shown what jungle climate and soil can produce if treated with intelligence and respect. Rice, sugar, tobacco, rubber, copra, coffee, tea, cocoa, quinine, and spices are some of the products which the Dutch have made the jungle furnish in great abundance. If you compare the native jungle farm on page 152 with the Dutch jungle plantation shown in the photograph on this page, you will see some of the reasons for the Dutchman's success.

In spite of much agricultural progress at many places in the jungles, these immeasurably vast reservoirs of possible food have scarcely been tapped. The agricultural possibilities of the jungles are far greater than those of the middle latitudes, as the Japanese well knew when they seized some of the most promising of these lands at the start of the Second World War. There are drawbacks, however. The monotonous wet heat gnaws at the vital energies of men; insects gnaw at his flesh and fill his blood with disease.

That civilized man can successfully cope with these drawbacks was proved dramatically when General Gorgas drove the yellow fever mosquito out of Panama by sanitary engineering, and built cool and well-ventilated houses in which people could live in health and comfort. (See the photograph below.) In most jungle regions, how ever, the white man finds that his health and energy degenerate in spite of all he can do to preserve them. He must return from time to time to the middle latitudes, where health and energy are given by the climate rather than wrested from it.

The rain forests. In our tour of the climatic regions of the earth we began with the glaring ice fields which lie on and near the poles. We now come to the end of our tour in the gloomy forests which lie on and near the equator. These forests are in a zone of low atmospheric pressure where the air is intensely heated during every month of the year because the noonday sun is always directly or almost directly overhead. This hot air is continually rising, cooling, and dropping its moisture as rain.

In the heart of these well-named *rain forests* there are no winters and no dry seasons. Nights and days throughout the year are nearly equally long and hot. This equatorial heat is the most monotonous and oppressive heat on earth, but it is not the most intense. The almost daily rain, the cloudiness, and the high humidity hold the temperatures well below those which come to the so-called temperate regions during a summer heat wave.

Sanitary engineering and cool, well-ventilated houses have made Panama City healthful and comfortable in spite of the tropical heat and rain.

Philip Gendreau, N.Y.

The trees of the rain forests are very large and of so many different kinds that an ordinary person might get the impression that no two of them are alike. Hanging from the trees are vines which are themselves as great in diameter as some full-grown trees of the North. Gaudy orchids, worth five dollars and more apiece in New York, cling to the trunks in endless profusion. So dense is the leafy canopy of these forests that little light ever reaches the ground beneath them. Here and there large rivers slash them open and let in the sun.

The herds of grazing animals that roam the savannas stay away from the rain forests, on the dark floors of which little grass or undergrowth of any kind can get a footing. The flesh-eating animals that follow the herds are also missing. In the swampy areas, however, crocodiles, hippopotamuses, and other water-loving animals are fairly abundant; the trees are the homes of monkeys, bats, and birds. Bloodsucking, disease-carrying insects are everywhere.

Where climate is king. Rain forests blanket much of the land within 5° to 8° of the equator. In South America the rain forests of the Amazon Basin cover an area which is almost as large as the continent of Australia. Areas not very much smaller are given over to rain forests in the Congo Basin of Africa, and on the Malay Peninsula and nearby islands of the Southwest Pacific. In most of these lands of lush vegetation men are as scarce as they are on the barren deserts.

There are good reasons why this is so. In the rain forests the sultry heat never lifts its weight, not even for a day, from the shoulders of man. Mosquitoes, flies, and leeches never stop pestering and poisoning him.

Rats, cockroaches, and snakes share the shelter of his hut, while ants and termites do their best to destroy it.

The deadly tsetse fly and the lack of grass make it all but impossible to keep cows or horses. The riotous growth of almost every kind of vegetation but grass makes it all but impossible to clear land for farming and to keep it cleared long enough to raise a crop. With handicaps such as these it is no wonder that the colored natives of the rain forests have failed to rise far above the lowest levels of existence. Whether wearily stalking game with poisoned arrows or listlessly watching the muddy river glide past their doors, they make a picture of people whom climate has defeated.

White men, on the other hand, aided by science, have begun to exploit the natural riches of these dark unfriendly lands, in places with considerable success. With modern sanitation and serums they have found it possible to live and work there with some degree of health and vigor. They have even found it possible to wage modern war there. But it is doubtful whether many of the white soldiers who won military victories in the steaming foxholes of the rain forests will care to remain and fight for a permanent victory over the climate. This is just as well because most rain forest regions are not fit for human habitation, and it is doubtful that man with all his ingenuity can ever make them so.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. The tropics are a region of constant heavy rainfall and very uncomfortable heat.

2. The savannas lie on the equatorial sides of deserts and are covered exclusively with grass.

3. The savannas have a very long dry season and are therefore not good regions for agriculture.

4. If you wish to hunt big game in Africa the best place to go is into the jungle or rain forest.

5. Monsoon winds in India blow from the ocean and bring heavy rain at all seasons.

6. Monsoon conditions occur only in India, Burma, and neighboring regions.

7. Migratory agriculture is practiced in jungles because the wild vegetation grows very fast in the fertile soils of jungle regions.

8. The only serious disadvantage of living in a jungle or rain forest is the intense humid heat.

9. The dense undergrowth in tropical rain forests makes travel there practically impossible.

The rain forests of the Amazon Basin are vast, dark, and hostile to men.

James Sawders

QUESTIONS FOR DISCUSSION

1. Have you ever experienced several days or weeks of very hot weather? What was the effect on your energy and ambition? What do you think is the effect of constant tropical heat on men's energy and mental outlook?

2. "High sun rains" is a phrase applied to the savannas. Why do the rains come at the time of "high sun"?

3. If you had to live off the food which you could grow in a jungle, what difficulties should you have? How would you overcome these difficulties? What foods would you grow?

THINGS TO DO

1. Assume that you are going to start a plantation to raise cacao, rubber, or quinine in a jungle region. Write down a list of the preparations you would make. Make a list of the obstacles you would expect to meet and tell how you would overcome them.

2. Malaria is the most widespread of the tropical diseases. Read about malaria in a good encyclopedia and write a report on it. This report should include the following topics: (1) symptoms of malaria; (2) how malaria is spread; (3) prevention of malaria; (4) treatment of malaria; (5) the aftereffects of malaria; (6) malaria and the Second World War.

You can get information on the last topic from items in 1943 and 1944 newspapers. If you know a soldier who was in the South Pacific during the war, you may get more information from him than from the newspapers.

3. The Alaska Highway and the Panama Canal were great engineering projects which were successfully undertaken in regions of very different climates. Look up and write a report on the obstacles which climate placed in the way of these undertakings. Show how the obstacles to the two undertakings differed as a result of the different climates under which they were performed.

4. Quito is the capital of Ecuador and is located in the Andes Mountains close to the equator but more than 9000 feet above sea level. Look up information about this city and its surrounding country. Imagine that you are a member of the Quito Chamber of Commerce, attempting to induce businessmen from North America to undertake business ventures in Quito. Write a truthful statement of all the advantages which Quito has to offer.

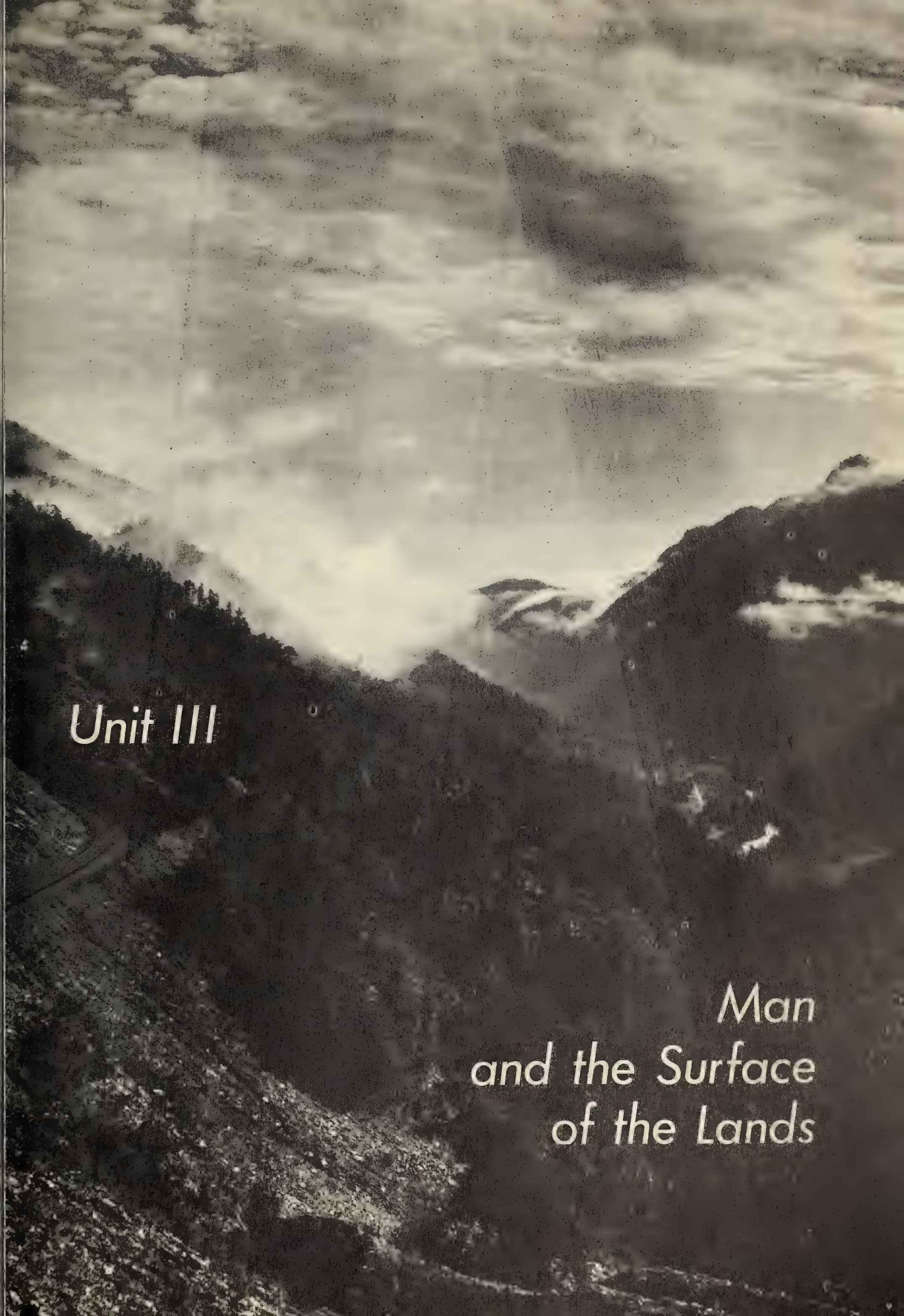
5. Select the climate discussed in this unit in which you would prefer to live. Describe the climate and tell why you would like to live in it.

BOOKS TO READ

1. Far places with strange people and hard climates stimulate the spirit of adventure and the production of books among novelists and travel writers from the middle latitudes. Many books on the low latitude lands are inexcusably sensational and inaccurate. Many others (and among them several which were not written by professional geographers) contain much sound geographic information. Several of the short stories, sketches, and novels of JOSEPH CONRAD, W. SOMERSET MAUGHAM, W. H. HUDSON, and HERMAN MELVILLE give vivid pictures of tropical peoples and places which are also fundamentally true.

2. Many descriptive books by lay travelers are also both readable and reliable. *The Sea and the Jungle*, by H. M. TOMLINSON, will give you a picture of the Amazon rain forests which you will never forget. *The Jungle Tide*, by JOHN STILL, is an excellent description of Ceylon. *Focus on Africa*, by RICHARD U. LIGHT, is illustrated by remarkable aerial photographs. Of the many good books on the islands and peoples of the Southwest Pacific, *White Shadows in the South Seas*, by FREDERICK O'BRIEN, *Faery Lands of the South Seas*, by JAMES N. HALL and CHARLES B. NORDHOFF, and *Head Hunting in the Solomon Islands*, by CAROLINE MYTINGER, are among the best.

3. Geographers and other scientists have also given us readable books on the wet low latitude seas and lands. A classic study (which is also good reading) on the migratory life of the natives of equatorial Africa is contained in Chapter V of *Human Geography*, by JEAN BRUNHES. *In Darkest Africa*, by CARL E. AKELY, is a fascinating travel book by a distinguished student and collector of African wildlife. *In the Wilds of South America*, by LEO E. MILLER, is a somewhat similar book on the tropical wildernesses of South America. Several of the books of WILLIAM BEEBE deal charmingly and instructively with the tropical wildlife of Central and South America.


Unit III
Man
and the Surface
of the Lands

IX · THE ROUGH LANDS

AN ANALYSIS OF LANDSCAPE

The problems of focus. Anyone who has ever used a camera knows that if the focus is set so that near objects will be sharp, then distant objects will be fuzzy. If the focus is set so that distant objects will be sharp, then near objects will be fuzzy. There is simply no way of taking a picture so that all objects will be equally clear.

The same thing happens when we look at a scene with our own eyes. Before us, let us say, lies a landscape with a house, a pasture, a wood, and a lake. We see all these things clearly enough, but only by shifting our gaze —and with it the focus of our eyes—from one object to another. Because we cannot possibly see all the objects clearly at the same time, we must piece together the details with the help of our memory and imagination if we are to get a clear picture of the landscape as a whole.

Similarly, there are many things to look at in the great landscape of human geography but no way of seeing them all clearly at the same time. We must build up our picture of the relationship of man and earth piecemeal, by focusing first on one kind of relationship and then on another kind. In the last unit we focused our attention on the important relationship between climate and man. What we saw was clear, but it was not complete, because it left other important types of relationships between the earth and man either vague or entirely blank.

In this unit we shall focus on one of the other types of geographic relationship: the relationship between man and the surface of the lands. The picture we shall get must be fitted, with the help of memory and imagination, into the picture we already have of the relationship between man and climate. Only in this way, unit by unit, can we build up a clear and complete picture of the relationship between man and earth.

The surface of the earth and you. Men never get very far from the surface of the globe on which they live. They can penetrate the oceans in submarines and diving devices only a few hundreds of feet. They can burrow into the land in mines only a few thousands of feet. They can rise into the air in planes only a few miles. And even from such slight excursions they must always return to their natural home on the surface.

Because men are held so closely to the surface of the earth, the nature of that surface is a very important influence in their lives. You know from your own experience that certain types of activities go naturally with certain types of earth surface. When you want to swim, for example, you obviously must go to a water surface; when you want to hike you must go to a land surface.

Similarly, you vary your activities to fit different kinds of water and land surfaces. If you want to take a canoe trip with the least expenditure of effort, you go to a stream and travel with the current. If you want to sail a boat with the least danger and inconvenience from winds, waves, and tides, you go to a fresh water pond. If you want to ride a surfboard, you go to the ocean. On land you seek a level field for baseball or football, a hill for skiing or sliding, and a mountain for a climb or a breath-taking view.

All human activities are geared like yours to the appropriate kinds of water and land surfaces. Let us see exactly what these surfaces are and how they fit into the general picture of geography in action.

The lands in general. One of the most striking aspects of civilization is the steady progress which men have made in extending their activities over the oceans and into the air. We should not forget, however, that man is first and last a creature of the land. Everything he does on the sea and in the air is directed by what he is doing or wants to do on the land. Though the lands of the globe make up less than 30 per cent of its surface, they are more important in human life than the much greater oceans of water, which lie between them, and the all-embracing ocean of air, which lies above them.

We have already seen that most of the land areas of the globe are clustered round the north pole; that most of the continents are roughly triangular in form, with their broad ends to the north and their apexes to the south. We have seen that most of the oceans cluster round the south pole, with their broad ends to the south and their apexes to the north. There are still other striking contrasts between the lands and the oceans. *The oceans are more than two times as extensive as the lands and they are on the average more than five times as deep as the lands are high.*

If the lands were made of putty and a giant hand could smooth out their irregularities, they would rise to a level of about 2300 feet above the surface of the sea. If the same thing were done to the ocean bottoms those surfaces would lie at a level of about 13,000 feet below the surface of the sea. In other words, the average height of the lands is 2300 feet; the average depth of the oceans is 13,000 feet, which is more than five times as much as the average height of the lands. If we add these two averages we get 15,300 feet, or less than three miles, for the vertical difference between the average level of the ocean bottoms and the average level of the lands. Less than three miles is therefore the average amount of unevenness on the solid surface of the globe, or, as geographers call it, the *average relief*.

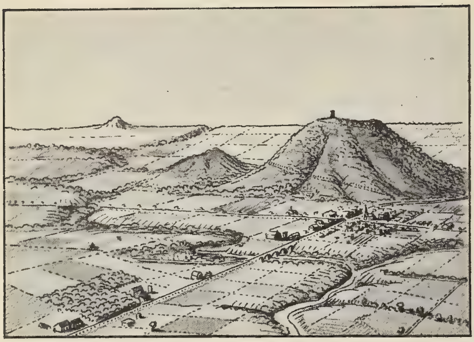
The *maximum* relief of the earth's surface, of course, is much greater than the *average* relief. The difference between the highest point of land (Mt. Everest, about 29,000 feet above sea level) and the lowest hole in the ocean (the Japan Trench, nearly 35,000 feet below sea level) is about 12 miles. But even this amount of irregularity is slight when we compare it with the 7926 miles which is the diameter of the earth at the equator. In proportion to the size of the globe its major relief features are no more important than the irregularities on the surface of an egg!

Though relief features are of no importance in the picture of an uninhabited earth, they become of immense importance when man enters the picture. Minor irregularities of surface which are negligible in a broad picture of the earth loom large in a picture of man's adjustments to the earth. The amount and character of the unevenness of land surfaces greatly influence what men do on these surfaces, as we shall see.

Elevation and relief. Before we begin a detailed study of the relationship between men and the land surfaces on which they perform most of their activities, we must clearly understand the difference between elevation and relief. All places on the land can be located with reference to the level of the sea, even though they lie thousands of miles from the shore. Your home may be in New York or Montreal, a few tens of feet above sea level. It may be in St. Louis, a few hundreds of feet above sea level; or in Denver, a full mile above sea level. Such figures give what is known as the *elevation* or *altitude* of these places.

In a broad way, elevation is a measure of relief because it measures the unevenness of the land with reference to the flat expanse of the sea. We have seen that in some places elevation has an important influence on climate, and through climate on the types of vegetation and the activities of men. But mere elevation above sea level does not affect the activities of men directly, except in extreme cases. It is the *difference* in elevation between the high and low levels of the landscape on which men actually live that is of direct importance in their lives. *Relief, as we shall use the term in this book, is the measure of this difference of elevation in related land surfaces.*

The importance of relief as distinct from elevation can be illustrated from the lives



Landscapes with the same amount of relief may have widely different amounts of sloping land.

of us all. The author of this book spent his boyhood in a town that nestles in the hills along the upper Mississippi River. The business center of the town was built on flat land along the river about 600 feet above sea level. This fact made little difference in what your author did; he would have done much the same things if the elevation had been 60 or 6000 feet. But the fact that all round him were hills that rose from 200 to 300 feet above the lowest levels of the town played a large part in his daily life. These hills helped him when he went sliding but got in his way when he visited a friend at the other end of town. They entered his life in dozens of other ways. In short, the 200–300 feet of relief in the local landscape was immeasurably more important than the 600–900 feet of its elevation above the sea.

Proportion of flat and sloping land. When we study the relationship between men and the land surfaces on which they live we find that the *amount of relief*, as measured in feet, is not all there is to relief. The *character of relief*, as measured by the relative amounts of flat and sloping land, is also important in human life.

Study the two diagrams on this page. In both landscapes the maximum relief is 300 feet. In one landscape, however, there is only one height of land that brings out this maximum relief; most of the landscape is gently rolling or flat, with little or no relief. In the other landscape just the reverse is true; there is little flat land but the many hills bring out the maximum relief in several places. Though the maximum amount of relief in feet is the same in both landscapes, human adjustments are very different because the proportions of flat and sloping land are very different.

The four main types of landscape. If you should cross North America from east to west you might well be confused by the variety of landscapes you would see. But if you remembered what you have just read about the proportion of flat and sloping land, you could easily separate all the landscapes you see into two main groups. One group would contain *rough lands*, which are marked by a large proportion of sloping surfaces. The other group would contain *flatlands*, which are marked by a large proportion of flat surfaces.

As you examined the relief features of these two types of landscape you would see that the rough lands fall naturally into two broad and relatively simple divisions: mountains and hills. Similarly, the flatlands fall naturally into plateaus and plains. "Mountains," "hills," "plateaus," and "plains" are common terms which everybody uses, generally in a very loose way. As geographers we can define them more precisely (with the help of the diagrams on the following page) as follows:

1. *Mountains* are land forms that have high relief (generally over 1000 feet) and much more sloping land than flat land.

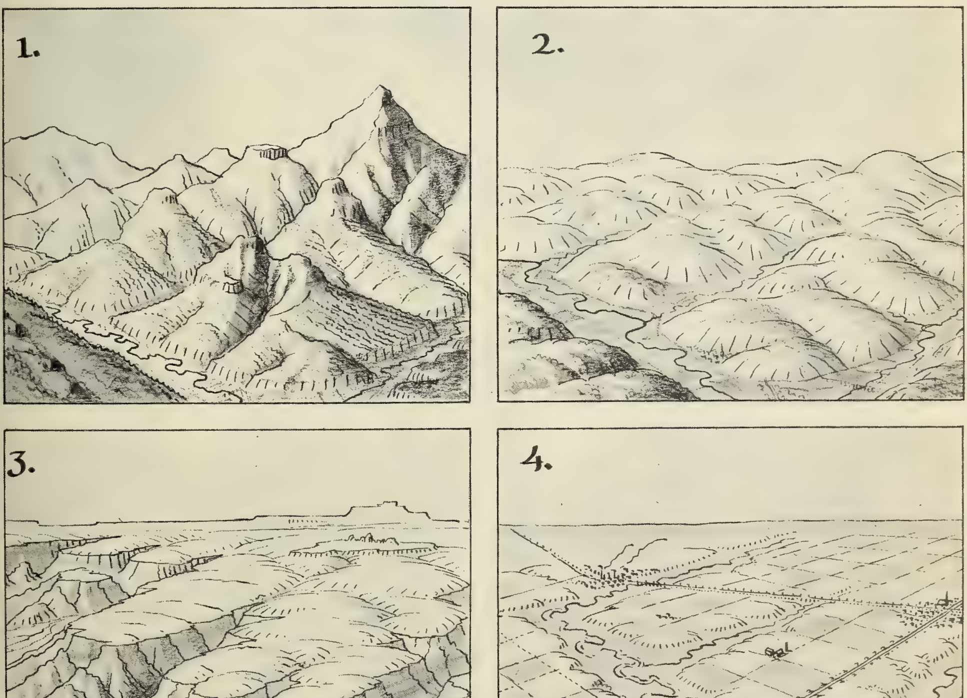
2. *Hills* are land forms that have moderate relief (generally under 1000 feet) and much more sloping land than flat land.

3. *Plateaus* are land forms that at least on one side rise sharply above the level of neighboring areas; that for the most part have low relief (generally under 500 feet), with much more flat land than sloping land; that are trenched by a few deep steep-walled valleys which produce high relief in their immediate vicinity.

4. *Plains* are land forms that have fairly uniform low relief and much more flat land than sloping land.

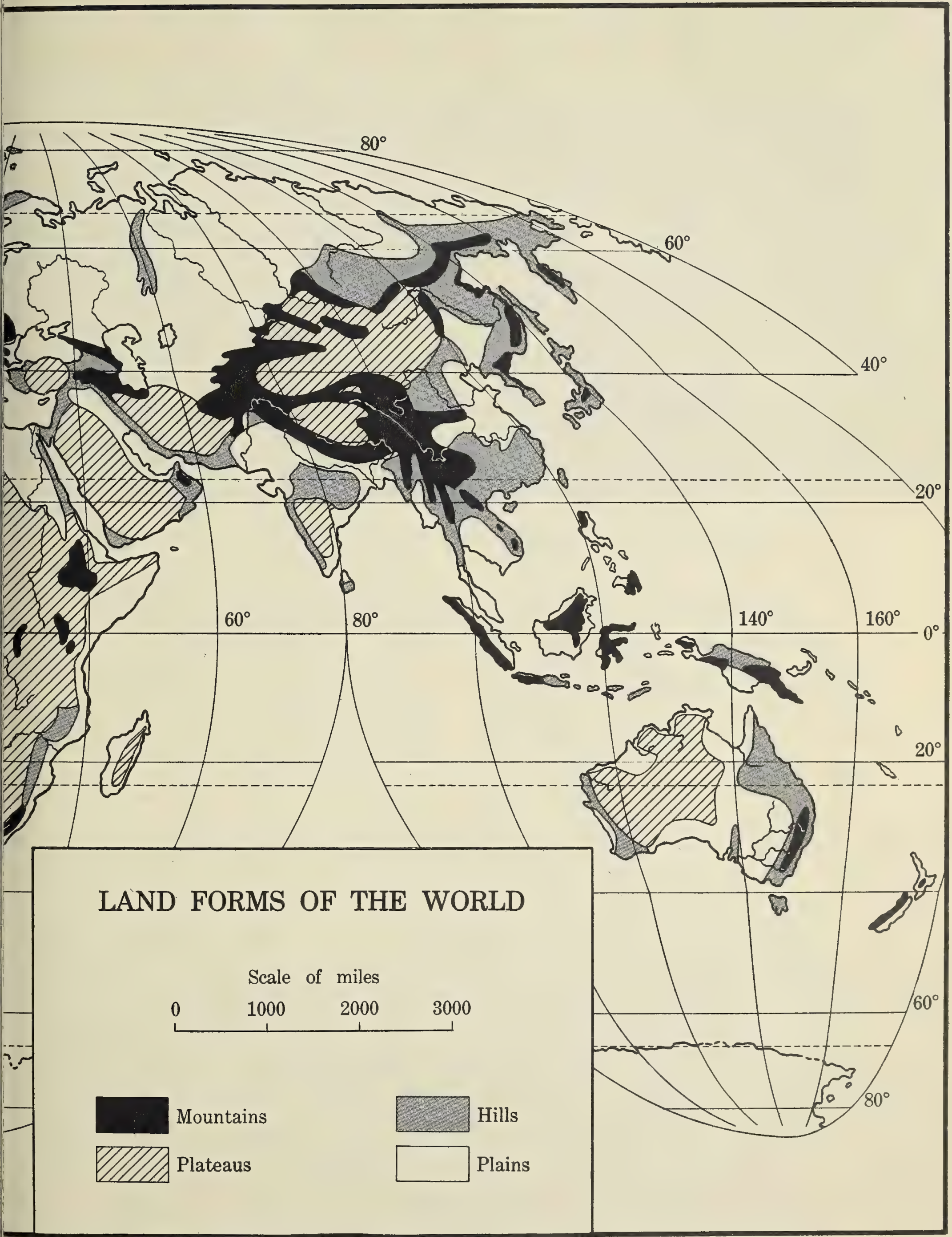
You will notice that in this classification of landscape, elevation as distinct from relief plays little part. It is true, however, that mountains and plateaus rather generally stand higher above sea level than do hills and plains. The Great Plains, which are higher at their western edge than the Appalachian Mountains and the Columbia Plateau, make a notable exception to this rule.

Now that we have a general idea of the four main types of landscape, let us look at each type in detail.



These sketches show the distinguishing features of the four main types of landscape: (1) mountains; (2) hills; (3) plateaus; (4) plains.


140°
120°
100°
40°
20°
0°


80°
60°
40°
20°
60°
80°
140°
160°
0°
20°
60°
80°
LAND FORMS OF THE WORLD
Scale of miles
0
1000
2000
3000
Mountains
Hills
Plateaus
Plains

Courtesy of Northern Pacific Railway

Many switchbacks characterize the spectacular Red Lodge Highway in the Montana Rockies.

MOUNTAINS AND MEN

Mountains and mountain ranges. If we were to select only one characteristic of mountains to distinguish them from other land forms we should have to select their boldness. Mountains always stand boldly above their surroundings. Where they occur in long narrow ranges, the peaks stand out boldly from the valleys and canyons which the glaciers and streams have carved in their sides. Where they occur in groups of ranges, the ranges stand out boldly from the basins that separate one range from another.

Aside from the boldness which all possess, mountains seem almost endlessly varied. Some mountain peaks stand in lonely grandeur above undistinguished country at their feet. Fujiyama in Japan, classic example of this kind of mountain, was built up from volcanic materials that were blown and poured out of a crack in the crust of the earth. Other less striking lone mountains are the buttes and mesas that rise abruptly above the high plains and plateaus of western North America. These mountains exist because of their superior resistance to the forces which gnawed away the softer land surfaces that surround them.

Lone mountains have little importance in human geography. It is the mountains that stand in ranges or groups of ranges that are most impressive, both in the landscape and in the lives of men. Such mountains are in most cases the result of weakness in the crust of the earth and they mark the belts where the crust has cracked and wrinkled. If you look at the map on pages 162–163 you will see that the great mountain belts of the earth are all long and comparatively narrow, which emphasizes their ruggedness.

When you enter one of these belts you enter a different world. Most people live in flat or nearly flat regions, where the landscape has length and breadth, but for all practical purposes no height. When such people first visit a mountainous region the dimension of height springs up on all sides of them. They must deal with this new and confusing dimension through the roads that climb and twist and "switchback" over the slopes. They must face the sudden changes of weather that come with sudden changes in elevation and exposure to the sun and wind. They must get used to the abrupt passage from thickly settled towns in the basins to empty wildernesses on the peaks. If they are to fare well in the mountains and understand the people who live there they must learn to think in terms of vertical rather than horizontal relationships.

The vertical distribution of mountain climates. In the last unit we looked at the relationship of climate, vegetation, and man through the eyes of a dweller on the plains. Since most of the land surfaces of the earth are not mountainous we were able to chart the horizontal pattern of the world's chief climatic regions without too much interference from the vertical pattern. But when we came to regions of rugged mountains we were stopped. In these regions latitude ceased to be the chief determining influence on climate. Elevation and relief stepped in to make the climate of the mountainous areas very different from that of the surrounding country.

When we study the climates of mountains in detail we find them as complicated as the forms of mountains are diverse. Conditions on one mountain peak are not exactly duplicated on any other peak. Altitude, relief, and the way various surfaces are exposed to the wind and sun, all affect the climatic conditions on any given peak. The result is that every peak has its own peculiar arrangement of climatic zones. Nevertheless, two things are broadly true of the climate of mountains in general:

1. *Mountains get colder from their bases to their tops* because with altitude the atmosphere grows less dense and therefore less able to hold heat. The rate of decrease in temperature is 1° F. for every 300–400 feet of altitude, and is more rapid in summer than in winter.

2. *Mountains grow wetter from their bases upward* because, as the atmosphere grows steadily cooler with altitude, more and more moisture condenses into rain or snow. On very high mountains most of the moisture in the air may condense and fall at levels below the summits. The tops of such mountains, towering above the highest rain clouds, are dry.

The vertical distribution of mountain vegetation. The vegetation on mountains varies with altitude, in keeping with the

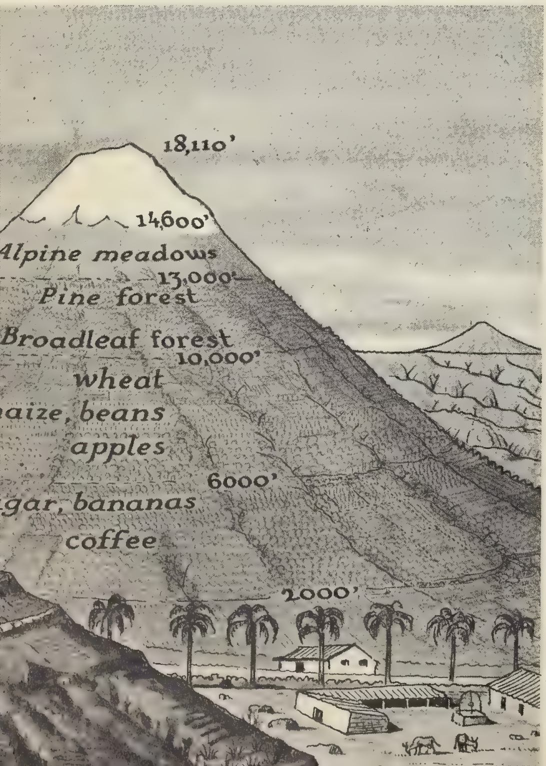
The tops of many high mountains far from the poles have a glacial climate and little or no vegetation.

Photograph by Grant

variation in temperature and moisture. *One mile of altitude on a mountain may bring as much change in climate and vegetation as 1000 miles of latitude.* Such change can best be studied on the high mountains of the tropics, where vegetation may extend upward as far as 15,000–20,000 feet before it is shut out by the caps of ice and snow which a great many high mountains wear. In climbing from the base to the icecap of a tropical mountain you can get a rapid summary of the main belts of vegetation which lie between the equator and the poles.

The people who live in southern Mexico have given names to the climatic zones that lie at different elevations on their mountainous lands. The diagram on this page shows how these zones are developed on the slopes of Mt. Orizaba, 19 degrees north of the equator. Notice that from sea level to the snow line, at 14,600 feet, most of the main climatic-vegetation regions which we studied in the last unit are represented by characteristic native or cultivated vegetation. Can you identify the belts of wet savanna, humid subtropical, humid continental, taiga, and tundra vegetation? They are all present, within a vertical distance of less than three miles.

Most of the chief climatic-vegetation regions of the world are represented between sea level and the snow line on Mt. Orizaba, Mexico.



Agriculture in the mountains. If you are familiar with any of the great mountain ranges of the United States or Canada, you are probably surprised to learn that on similar mountains in Mexico crops are raised at elevations as great as 10,000 feet above sea level. Most North American mountains have never felt the plow, because flatter and more fertile fields at much lower elevations have been more than sufficient to supply the needs of the people. But all through the tropics and in the thickly settled Orient, mountains have been turned into croplands.

Farming on the side of a mountain is the hardest kind of farming. Plowing, planting, cultivating, harvesting, and irrigating are never easy tasks; they are clumsy and backbreaking tasks on steeply sloping land. Then, too, rains quickly gouge out gullies on mountain slopes when the protective mat of native vegetation has been plowed under; the soil, which was thin and stony enough to begin with, becomes steadily thinner and stonier. The farmers of China, Japan, and other oriental countries have built terraces on their mountains to provide flat spaces for cultivation and to check the thievery of the soil by running water. In places whole mountainsides are covered by such terraces, as you can see in the photograph on page 167. Imagine how much labor is needed to keep these terraces in repair!

Wherever the sides of mountains are intensively cultivated a vertical distribution of crops can be observed. All through the mountainous tropics the croplands of the lower slopes are given over to such rain forest and savanna crops as bananas, rubber, and coffee. Above these are such tropical

From Ewing Galloway

These terraced rice paddies in the mountains of the Philippine Islands are the most unusual farmlands on earth.

and subtropical crops as rice and sugar cane. Lower middle latitude corn and wheat occupy the next higher levels; hardy high middle latitude rye, barley, and potatoes move up in succession to the highest levels of cultivation. On middle latitude mountains, where the climatic range is not so great, the tropical levels of cultivation are missing, but otherwise the vertical distribution of crops is much the same.

In regions where hungry populations do not press heavily upon the land, only the mountain valleys and basins are cultivated. Some of the larger of these mountain-rimmed flatlands are remarkably rich. The great Shenandoah Valley of Virginia was one of the first large mountain valleys in the United States to be intensively farmed. With its deep fertile soils, which are steadily renewed by wash from the streams; with its long growing season, which its sheltered position ensures; with its nearness to great markets and relative ease of reaching them, the Shenandoah Valley could hardly have been better equipped for farming if it had been made to order.

Similar mountain-walled flatlands were opened up to agriculture as civilization pressed into western North America. The San Luis Valley in Colorado, the Gallatin Valley in Montana, and the immense San Joaquin Valley in California are examples of the basins which were formed when blocks of the earth's crust sank while surrounding blocks rose. These basins are rimmed by mountains and in a sense are mountain valleys, but their rich agricultural resources and their broad flat expanse relate them more closely to the plains.

More typically mountainous are the small river-carved valleys and the small flat areas which occur *within* rather than *between* the mountain ranges. In such places the farmer must solve problems which the plains farmer

Photograph by J. F. Unstead

A valley in the Swiss Alps. Notice the native vegetation which grows far down on the shady slopes at the right, and the cultivated croplands on the sunny slopes at the left.

does not even know exist. Fields that are hemmed in by high steep slopes are in shade most of the time. Crops must be planned with reference to the angle at which the sunlight strikes the cultivated areas during the growing season.

Farming on the slopes above the flat areas is also greatly affected by the angle of sunlight. All through the Northern Hemisphere the north and east slopes of mountains are colder and wetter than the south and west slopes. Native vegetation, accordingly, extends farther *down* on the north and east slopes, and croplands extend farther *up* on the south and west slopes. Striking contrasts in mountain landscapes result from this condition, as the photograph on this page shows.

Perhaps the greatest obstacle in the way of large-scale mountain farming in the Occident is the difficulty of selling any surplus produce. Most mountain settlements are small; most of the great markets for farm products are far away on the plains. In most mountain districts transportation facilities are poorly developed and expensive. There are a great many reasons why the mountain farmer is not tempted to raise more than the so-called "subsistence" crops which he consumes himself. He is rather generally willing to leave the raising of money crops to the plainsman, who is in a much better position to do it.

Other occupations in mountains. With the exception of the tropics and the Orient, *herding* is much more common in mountainous regions than farming. Above the levels where agriculture is practicable, where the climate is too cold and the slopes too steep for cultivation, cattle and sheep can be grazed. Lovely green mountain meadows (called "parks" in western North America) make fine pastures for cattle. On still higher levels, where the grass is shorter and less abundant, sheep can scratch a living. Mountain herding in the middle latitudes is strictly a summer business. With the cold winds and snow flurries of autumn, the animals must be driven into the valleys for the winter.

Lumbering, like herding, is an important mountain industry in the middle and higher latitudes. Much of the timber reserves of the world is in the mountains. The slopes, the streams, and the winter snows greatly help with the heavy task of getting the logs to the sawmills in the valleys. But even so, lumbering in the mountains has been held back by poor transportation facilities, and by the long haul to the great markets on the plains.

This may be distressing to the lumberman, but it is a blessing to the rest of the mountain people. Trees are their best insurance against both floods and drought, as we shall see in a later chapter. With time the mountains will be called on to produce more and more of the world's lumber. Mountain people must find ways of cutting the trees without destroying the





Ewing Galloway, N.Y.

Herding, lumbering, mining, recreation, and the development of water power are the most typical activities of men in mountainous regions.

forests if they are not at the same time to destroy themselves.

Most mountains are the result of convulsion in the crust of the earth. The old body of the earth was broken and bled with their building. The "blood" consisted of hot juices from the interior, which rose and hardened in the cracks near the surface. Today these fillings of cracks in the rocks are veins which are rich in a variety of minerals. They are the basis of the *mining* which is one of the chief industries in mountain lands.

On many a lonely mountain peak, in some cases above the levels where trees can grow, are not a few of the mines that help to keep modern civilization alive. In many a mountain valley are the smelters that separate the valuable minerals from their ores. Some of the leading mountain settlements of the world (like Butte, Montana) exist because of the mineral wealth in the rocks beneath them. Other once important mountain settlements (like the ghost towns of Nevada and California) are dead because minerals once mined are gone forever.

Yet another valuable resource of the mountains is *water power*. Because mountain streams fluctuate in volume from season to season and are therefore hard to harness, and because many of them are far from the great industrial centers, their power is at present very largely going to waste. In Switzerland and northern Italy, however, the streams of the Alps are widely used to supply nearby cities with electricity. As coal and oil reserves dwindle with time, water power—and with it the mountains that create it—will become more and more important in world affairs.

Last, but in many regions not least valuable, of the resources is the *recreation* which mountains afford. These last frontiers of abundant wildlife are paradises for the sportsman and the lover of nature. By protecting the native game and fish from heedless destruction, many mountain communities attract large numbers of tourists from distant places. Such tourists are the most valuable money crop of many a mountain area.

Mountain populations. With all these varied advantages of mountains, why do so few people live in them? The answer to this question begins far back in the Middle Ages, when people were afraid of mountains. Many of the witches and ogres you read about as a child were thought to have lived in the mountains; they were born of the fear which mountains for ages have raised in the hearts of men. Before the days of good roads and rapid transportation many people thought of mountains as dark and dangerous places that God-fearing men should avoid. Many other people thought of them as holy places which only the gods and the unusually godly dared enter. Such beliefs long retarded the development of mountainous regions.

Today it is relief rather than belief that holds back the development of the mountains. In most mountainous regions there is too much rough land that cannot be used, and too many difficulties in exploiting the areas that can be used. Mountain populations are therefore seldom dense, and always spotty in distribution. In rugged Norway only 4 per cent of the land is cultivated, in Japan only 12 per cent, in Switzerland only 30 per cent.

If you compare the maps of Switzerland on page 171 you can see how a progressive people have arranged themselves on a mountainous surface. Notice first that the distribution of people is extremely uneven. Notice that much of the southeastern half of the country has fewer than 5 people to the square mile. This is the belt of the main chain of the Alps, with high relief, little flat land, thin soil, and severe climate. Notice, however, that fingers of denser population reach into the central mass of the mountains from the outer edges. These fingers mark the wider valleys that radiate away from the great mountain core, where stock

This map of Switzerland shows that roughly parallel zones of different elevation and relief cross the country in a southwest-northeasterly direction.

If you compare this map with the map at the left, you will see that the population of Switzerland is densest where elevation and relief are lowest.

raising and a certain amount of agriculture are possible.

Most of the people of Switzerland live in the northwestern half of lower mountains, ridges, and valleys. In the valley of the Aar River and its tributaries, between Lake Geneva and Lake Constance, where relief is lowest and climate mildest, the population rises to more than 300 people to the square mile. Everywhere in Switzerland, as you can see, *the density of population varies with the amount of relief*. The mountain ranges give a decided grain to the land, and the distribution of people follows the grain.

Mountains and civilization. If you have ever traveled through a region of rugged mountains you have seen how the larger settlements cling to the flatter lands; how in many areas one settlement is separated from another by physical barriers which are hard to cross. Such physical barriers lead to mental and spiritual barriers between mountain peoples. People in isolated mountain communities tend to think, feel, and act independently of one another.

In ancient history you study the great city-states which developed round Athens and Sparta in Greece before the Christian Era. Separated by rugged mountains and with only the crudest means of land transportation, the people of these cities never really got to know one another. As a result, they viewed one another with suspicion and in time became mortal enemies. Since ancient times the same sort of thing has happened again and again in many mountainous regions. The feuds between isolated clans in the southern Appalachian Mountains are known to everybody. The bloody local rivalry among the people of mountainous Yugoslavia, even at a time when a common enemy was at their throats, is an unhappy example from the Second World War of how mountains can divide the people who inhabit them.

Such internal division of mountain people has tended to make them independent, bold, and resourceful as individuals but backward as groups. Civilization, to be sure, has cleared the obstacles of relief with remarkable success in such nations as Norway, Switzerland, and Japan. Generally, however, relief has put hurdles in the path of social living which have definitely slowed down the advance of civilization in mountainous lands.

Mountains are not only barriers between people who live in them; they are also bar-


By Ewing Galloway, N.Y.
A village in the Cumberland Valley nestles on the flat land at the foot of the hills.

riers between mountaineers in general and people of the adjoining plains. Mountain people and plains people live very different lives, which has often led to mutual distrust. Mountains are likewise barriers between people who live on opposite sides of them. The high mountains which separate Chile from Argentina, Germany from Czechoslovakia, Austria from Italy, and Tibet from India have separated the people of those countries culturally as well as geographically. The course of history has repeatedly been influenced by lofty mountain ranges. In peacetime such ranges have been one of the chief causes of the division of peoples into nations with different customs, languages, and mental attitudes. In wartime the low places, or *passes*, through mountain ranges have many times determined the outcome of battles and even wars. A book considerably longer than this one could be written on the role of mountains as barriers between men. We shall return to this subject in the last unit of this book when we discuss the political geography of nations.

HILL COUNTRY AND HILL PEOPLE

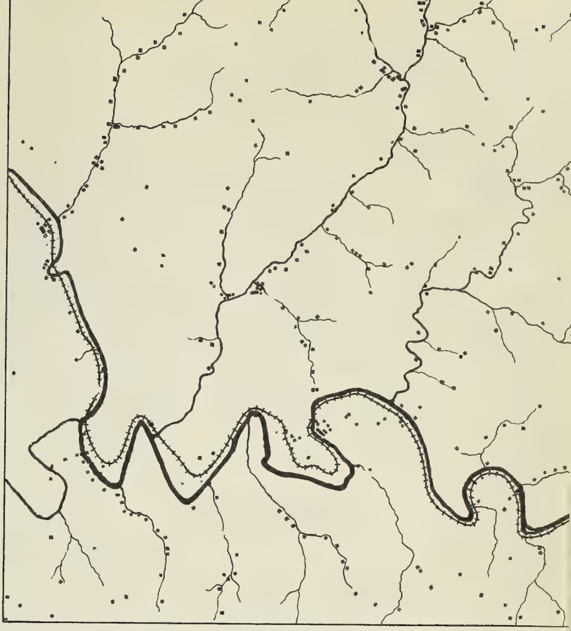
What is hill country? We all have our own definitions of hills. When the prospector in the rugged Rockies made his famous remark (if he ever made it) about "gold in them thar hills," he may have been wrong about the gold and he was certainly wrong about the hills. If any land forms are to be labeled "mountains," the Rockies must be listed among them. Similarly, when the residents of the Cumberland Valley in Tennessee and Kentucky refer to the rough lands that surround them as mountains, they do away with one of the best illustrations of what geographers call hills.

Anybody who has traveled much on any continent knows that there are many land surfaces which are too flat to be called mountains and too rough to be called plains. We can all agree to call such land surfaces hills, with the understanding that in some regions high hills are difficult to distinguish from low mountains, and low hills from plains. Hill country, by the definition which we used earlier in this chapter, includes regions the relief of which is on the average greater than 500 feet and less than 1000 feet, and in which the sloping surfaces are much more abundant than the flat surfaces. By this definition most of the Cumberland "mountains" are hills; so are many of the "mountains" of New England, and the more accurately labeled "foothills" which border high mountains in many places.

The cultivated landscape in hill country. Mountains and hills have much in common, both in their physical appearance and in the way men live their lives among them. But there are certain differences between mountains and hills which are not wholly differences of degree. The cultural environment in mountainous regions, as we have seen, is influenced partly by elevation and partly by the amount and character of the relief. Elevation determines the vertical distribution of climate, vegetation, and many human pursuits; relief holds most of the people to the lower and flatter areas, and keeps them from spreading evenly over the land.

In hill country, on the other hand, elevation has little to do with the variations in the cultural environment, because the climatic differences between the highest and lowest elevations are slight. Relief is much the most important physical influence on the pattern of the cultural environment. Though climate may favor agriculture all through a region of hills, relief discourages it in many areas. The steeper slopes of hills are generally abandoned to the natural vegetation or given over to grazing. Settlement therefore tends to concentrate in the valleys, as it does in mountainous country.

Because the valleys in hill country are ordinarily less precipitous and more numerous than the valleys in mountain country, more people ordinarily live in hill country than in mountain country. Because the valleys in hill country are ordinarily more evenly dis-



This map shows the arrangement of dwellings along the valleys of a district in hilly Kentucky. Compare this map with the maps on page 171.

tributed than the valleys in mountain country, hill people are ordinarily more evenly distributed over the land. Mountain people, as we have seen, are likely to be arranged in a pattern that resembles the grain in wood. Hill people are likely to be arranged in a pattern that resembles the veins in a leaf. This is because the river systems of hill country are likely to make veinlike patterns on the land, and the people cling to the rivers. The map on this page shows this veinlike distribution of people on a hilly landscape. Compare it with the grainlike distribution of people in Switzerland, as shown in the map on page 171.

The handicap of slope. Slope is even a greater drawback to human progress in hill country than in mountain country because there are more people in hill country to be affected by it. Railroads and highways are severely limited in number by the expense of bridges, trestles, cuts, embankments, and tunnels. Floods are a constant threat, particularly where the native vege-

By Ewing Galloway, N.Y.

This farm in the hills of West Virginia is severely handicapped by the small amount of flat land available for cultivation.

tation has been removed. Nearly all human activities are made more difficult by slope.

This handicap is felt in a great many ways in a great many hilly regions. Many hill people are poor and backward because they use up all their energy in the struggle to live. Over and over again in history, more vigorous people have pushed less vigorous people from the more desirable plains to the less desirable hills. There they have remained,—the Bretons of France, the various hill tribes of India and the Philippines, the hill dwellers of our own Southern hills, and many similar people elsewhere,—isolated, ignorant, and unprogressive.

This does not mean that the handicap of slope cannot be overcome. It has been overcome in several regions. All along the northern shore of the Mediterranean Sea people have learned how to live well and in large numbers on hilly land. *The secret of their success is that they do not treat the hills as if they were plains.* They raise such tree crops as olives and oranges on the sloping land; where they use the hillsides for grain or grapes they carefully terrace the plowed fields so that the rain will not carry off the valuable soil. (See the picture on page 78.) The silkworm, tea, and rice cultures of oriental hill country also illustrate the proper use of hilly landscapes.

In North America we have been less wise. With ax and plow we have laid open our hillsides to the deadly wash of the rain, our valleys to the ravages of flood. In relatively few hilly regions have we put the emphasis on tree crops rather than on crops which require plowing of the land. In these few bright areas the people are prosperous because the land is healthy. One of the tasks of the future will be to teach the lesson which these few hill people have learned to the many hill people who will suffer until they have learned it.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. Airplanes are steadily making men less and less dependent upon the surface of the earth.

2. The surface of the lands is important because land accounts for most of the surface of the earth.

3. The maximum relief of the earth's surface is great.

4. The average elevation of the lands is a little less than the average depth of the oceans.

5. Elevation is the most important feature in man's relationship to land surfaces.

6. The relief of a mountain is the number of feet it lies above sea level.

7. Mountains are not good land surfaces for agriculture and they are never used for this purpose.

8. Mountains provide excellent pastures for year-round grazing.

9. No progressive nation has grown up in a mountainous country, because of the difficulties of the mountain environment.

10. People who live in mountains are always poor because of lack of good farm land.

11. Hills are any lands which have a relief of more than 500 feet.

12. Agriculture is more widespread in hill lands than in mountains because the slopes are not so steep.

13. Successful farming is difficult or impossible in hill lands because of the large amount of steep slope.

QUESTIONS FOR DISCUSSION

1. Are there any mountains in your neighborhood which you believe should be called hills? If so, discuss in class the reasons for your belief.

2. How do the different kinds of land surface round your home affect you personally? Do you get a different feeling in a hill or mountain country than in a plains country?

3. Why is so much mountain agriculture practiced in oriental lands and so little in the United States? Under what conditions does mountain agriculture become practical?

4. If you have traveled in a mountainous or hilly region, perhaps you can tell the rest of the class your observations on where the farms are located. What do you think are the chief problems of farming in a mountainous or hilly region?

5. Why does hill country generally support a larger population than mountain country? Can you give any proof for your answer from your own observations?

THINGS TO DO

1. Study your community and determine the way in which the people, their activities, and their buildings are related to the surface of the land. Make a summary of your findings under the following headings:

a. Locations of houses and other buildings with reference to slope.

b. Locations of streets, highways, railroads, and airports.

c. Locations of cropland, pasture land, and woodland areas.

d. Modifications of the land surface by highway and railroad cuts, excavations of other kinds, filling of holes and swamps, etc.

2. On an outline map of the world, color in and name the great mountainous regions of the earth.

3. Investigate and write a report on the mountains which are nearest to your home. (If you cannot visit them ask your librarian for maps and reading material.) Include in your report (*a*) a description of the extent, elevation, and relief of the mountains, and (*b*) a brief discussion of how men have adapted themselves to the land surface.

4. Mt. Orizaba is in the tropical region of Mexico. Look up its position in an atlas and read everything you can find about it in a good encyclopedia. Then plan a trip to the summit of Mt. Orizaba. Make a list of all the things you would expect to see on this trip, paying particular attention to the relationship between areas of native vegetation and areas of cultivated crops. Make another list of the kinds of food, clothing, and other equipment which you would take with you on the trip.

5. Gather information in the library on one of the following regions: (*a*) the Ozark Mountains (which are really hills) of Missouri, Arkansas, and Oklahoma; (*b*) the Cumberland Mountains (which are also really hills) of Kentucky and Tennessee; (*c*) the hill country that flanks the valley of the Connecticut River in Vermont and New Hampshire. Make a list of the handicaps which slope has placed in the way of the region's development, and write a short account of how the people have met these handicaps.

BOOKS TO READ

1. Though the ocean basins help to produce the major relief features of the globe, they are important to man chiefly for other reasons than their relief. Nevertheless, here is as good a place as any other to recommend an interesting modern book on the general geography of the sea, *The Sea*, by Harry A. Marmer.

2. If you are curious to learn how the rough lands of the earth became rough, read *Our Mobile Earth*, by R. A. Daly, which is an interesting and nontechnical book on a subject that has inspired many dull and difficult books. A scholarly book which contains readable information on the geography of rough lands is *Forest Physiography*, by Isaiah Bowman. If you want to study the climate of the rough lands in some detail, you will find no clearer account of it than in *Climate*, by Robert de C. Ward.

3. The physical aspects of United States lands are clearly analyzed in *The Physiographic Provinces of North America*, by Wallace W. Atwood, and in *Physiography of Western United States* and *Physiography of Eastern United States*, by Nevin M. Fenneman. The broad effects of rough land topography on the peoples of North America are most entertainingly set forth, by regions, in *North America*, by J. Russell Smith and M. Ogden Phillips.

4. Some of the most entertaining and informative books on the geography of rough lands were written by men who were not professional geographers. *The Mountain*, by John C. Van Dyke, is both delightful and instructive. The books of John Muir, Enos Mills, and Mary Austin are rich mines of information about the rough lands of the Far West; those of John Burroughs and Donald C. Peattie contain fine descriptions of the wildlife of the rough lands of the East.

5. Some of the travel books of Harry Franck deal reliably and entertainingly with the rough lands of South America. *The Native's Return*, by Louis Adamic, is an excellent book on the lands and peoples of mountainous Yugoslavia. *Altai Himalaya*, by Nicholas Roerick, is an artist's account of a saddle trip in Asia across some of the roughest and least known lands on earth. And if you are especially interested in the ways of mountain and hill people, do not neglect the files of the *National Geographic Magazine*.

X · THE FLATLANDS

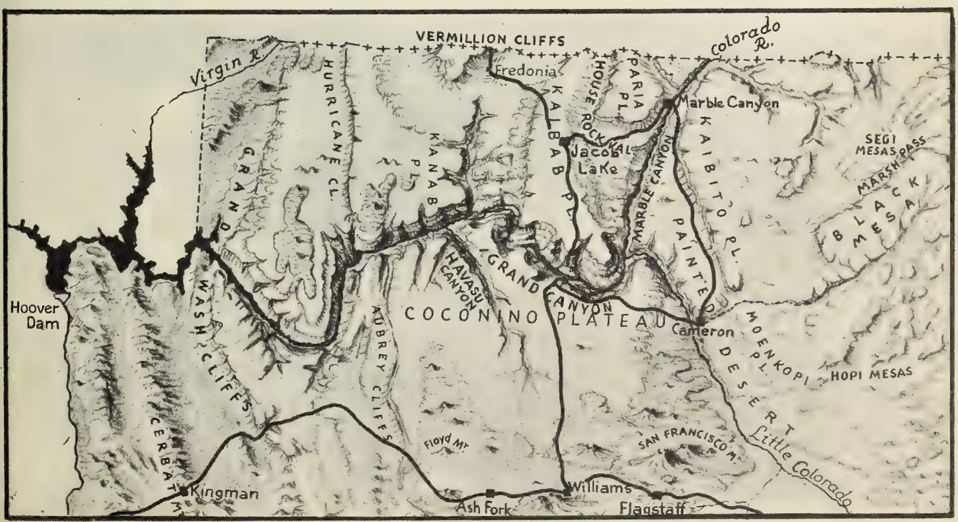
THE NATURE OF PLATEAUS

A sight-seeing trip. Many travelers from the Middle West to California break the monotony of their long journey with a sight-seeing trip in northern Arizona. At the town of Williams they turn sharply north from the east-west route which they have long been following. They are over a mile above sea level, but there is little in the monotonously rolling landscape to indicate this fact except the sign at the railway station which reads, "Elevation 6762 feet." Small dark juniper and piñon trees are sprinkled like pepper over the tawny land. Here and there a sheep ranch recalls the fact that this country is fundamentally a semiarid steppe, in spite of its spattering of trees. Northward the trees grow larger and thicker and take on something of the appearance of a forest.

After a two-hour ride the road ends in a collection of camp grounds, service stations, cottages, and hotels. The land here is wooded and hilly but not very exciting. It gives no clue to the reason for the presence of so many buildings and people in an otherwise almost empty wilderness. But when the travelers walk onto the porch of the El Tovar Hotel they discover the reason with the suddenness of a shot. They break into "Ohs" and "Ahs" as the dull rolling landscape breaks at their very feet into a scene of unbelievably brilliant and rugged grandeur. (See the photograph on page 14.)

Many have tried to describe the beauty and immensity of the Grand Canyon, but nobody has ever come near to doing with words, paint, or even a camera what nature has done with light, color, and sculptured stone. For over two hundred miles the Colorado River has carved a gash in the rolling uplands of northern Arizona the average depth of which is a good mile. In places, desert vegetation grows at the bottom of the gash and evergreen trees on the highlands above. Between the sheer walls of the gash, which vary from four to eighteen miles apart, countless many-colored

Except for the canyon of the Colorado River, the Colorado Plateau is a land of general low relief.



U.S. Geological Survey

A steep escarpment marks the edge of this Utah plateau.

buttes rise like mountains from the canyon floor. Round the feet of these monsters the river and its tributaries wind, almost invisible in the midst of their mighty works.

The physical character of plateaus. Travelers who visit the Grand Canyon see one of the truly grand sights on the face of the globe; they also see an excellent example of a plateau. In going from Williams to the edge of the canyon they cross a land surface the relief of which is low enough in most areas to warrant calling it a plain, but high enough in some areas to warrant calling it hill country. At the brink of the canyon the relief suddenly becomes great enough to warrant calling the land surface mountainous. *This peculiar intrusion of a steep-walled valley of high relief on a land surface of general low relief is the key to the recognition of a plateau.*

As you look across the east-west trending Grand Canyon from the south "rim" to the north "rim," you notice that the north rim stands higher than the south rim and is much more heavily timbered. The north rim, as a matter of fact, is over 1000 feet higher than the south rim. It is a plateau in its own right, and distinguished from the plateau on which you are standing. Indeed, the two rims have different names; the north rim is called the Kaibab Plateau, the south rim the Coconino Plateau.

This brings out another striking feature of plateaus. They occur in many cases in series, and are related to one another as are the steps in a gigantic staircase. Where there is no river canyon to mark the boundary between two plateaus they are set off from each other by a long line of steep cliffs (known as an *escarpment*), as you can see in the photograph above.

Most of the intermountain steppes of North America which we studied in Chapter VI are plateaus. They stand high above sea level because they were pushed upward by the same forces that elevated the mountain ranges with which they are associated. As the earth cooled through the ages, its body shrank and its surface slowly cracked and puckered like the skin of a dried apple. Mountains were formed where the rocks of the crust buckled and wrinkled. Plateaus were formed where stronger slabs of the crust were pushed up to different elevations with little or no wrinkling. The tilting of these slabs as they were elevated made the rivers on their surface flow fast and carve the deep valleys which are so characteristic of plateaus.

Many plateaus in other parts of the world came into existence in this way. Others, the Columbia Plateau, for example, have resulted chiefly from the piling up of great lava flows which oozed out of fissures in the crust. Plateaus, as a matter of fact, have been formed in a variety of ways, but their origin is of more concern to the geologist than to the geographer. As geographers, we are chiefly interested in discovering what the peculiar surface conditions of plateaus do to men.

Plateaus and men. Plateaus account for large areas on every continent. Most of them stand high above sea level for the reasons just mentioned, though a few are lower than some of the higher plains. Because of their high elevation most plateaus of high latitudes are cold, windy, and unfriendly to man. Most (but not all) of the high latitude plateaus have a desert or semiarid climate, and are sparsely populated.

If you examine the map on pages 162–163, you will see that large portions of Brazil, Bolivia, Central America, and Mexico are plateaus. Most of the people of these tropical countries live on these cooler, more pleasant, and more healthful uplands. Most of the agricultural and herding activities are carried on there.

The same thing is true in Africa and India, where nearly half of all the land surface can be classified as plateaus. In India one of the densest agricultural populations on earth (on the average about 200 people to the square mile) occupies the surface of the huge pile of lava flows which is known as the Deccan Plateau. In the more favorable districts there are more than 500 people to the square mile. By comparison, the plateaus of higher latitudes are bleak and

This photograph shows the edges of some of the great lava flows which make up the Columbia Plateau of Idaho, Oregon, and Washington.

Though located in the tropics, the Mexican Plateau is a cool, healthful, and well-populated land.

empty. The vast semiarid steppes of Asia and western Australia, like those of the American Southwest, are chiefly plateaus in which prairie dogs are far more abundant than men.

The drawback of plateaus. Though climate generally favors the human occupation of plateaus in the tropics and generally discourages it in the higher latitudes, the relief features of plateaus are everywhere a drawback to human progress. The deeply entrenched rivers, with their rapids and quicksands, are difficult to bridge and almost impossible to navigate. They are a serious handicap to the social and economic development of plateaus. They divide the people who live on plateaus almost as effectively as mountains divide the people who live in mountainous country.

Many visitors to the south rim of the Grand Canyon get a convincing taste of this fact. After looking at the north rim, only a dozen or so miles away, they may want to visit it and see the Canyon from the other side. But to do so they must face a hard day's trip on a mule, winding slowly down to the bottom of the Canyon and then wearily up again.

If they decide to drive their cars they face an almost equally hard trip. They must first go 55 miles east to Cameron, then 112 miles north to Marble Canyon, where they find the only bridge over the Colorado River in hundreds of miles. From there they must drive 41 miles west to Jacobs Lake, then 44 miles south before they reach their destination on the north rim. They must thus travel 252 miles to reach a point which is just a dozen or so air miles from their starting point. (See the sketch on page 177.)

Before the day of the airplane, air miles did not enter into the business of developing the world's plateaus. Ground distances and difficulties have almost everywhere been a serious handicap to civilization on this type of land surface. Most plateaus are not only difficult to cross because of their sunken rivers; they are also far from the plains and seacoasts where civilization centers. Plateau cultures, like mountain cultures, have suffered through the isolation of the people. In the not too distant future, however, the airplane will certainly break down many of the barriers of relief and remoteness which in the past have tended to hold back the march of progress on plateaus.

More than two miles above sea level, Tibet is the highest and most isolated plateau on earth.

PLAINS AND THE CULTURAL ENVIRONMENT

Water's gift to the land. Nearly 90 per cent of all the people on earth live on the flatlands of low relief which go by the name of plains. Plains have been more important in human history, and are more important in the human geography of the present time, than all other land forms combined. On plains men find it generally easier to do most of the things which make for a high and complicated type of civilization. Let us see if we can discover why.

When you look at the map on pages 162–163 you see that most of North America, South America, Europe, and large parts of Africa, Australia, and Asia are made up of plains. All these plains regions have slight relief, in most areas less than 500 feet; most stand at less than 2000 feet above sea level. Within these broad limits, however, plains differ widely from one another, and the differences produce differing effects on men.

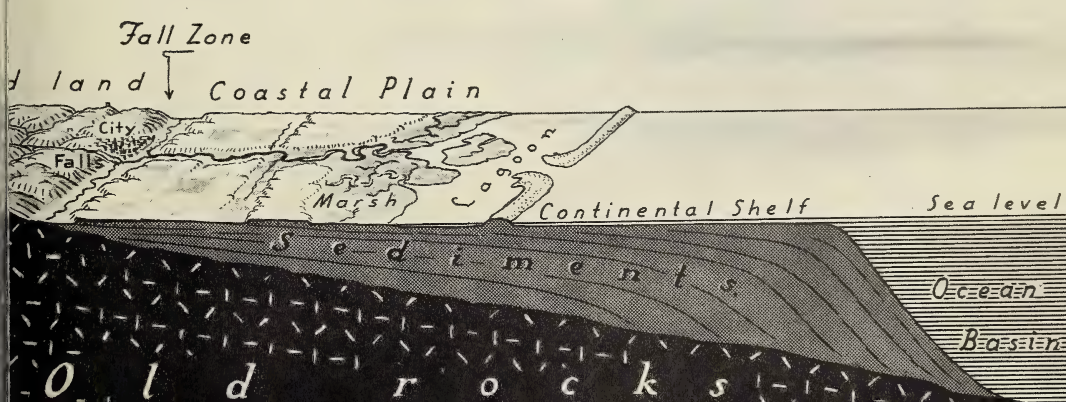
Plains are formed (1) when any kind of rough land surface is worn down to gentle relief by the various workings of wind and weather which geologists call *erosion*; (2) when the irregularities of a rough land surface are smoothed out by the *deposition* of broken rock materials which have been brought down by geological forces from higher land surfaces; (3) by a combination of erosion and deposition as defined above. In both these processes water plays an extremely important part. Herodotus, with a scientist's observant eye, once said that "Egypt is the gift of the Nile." We can expand this statement to say that "most plains are the gift of water."

Coastal plains. The most clearly defined plains on earth have been formed along the margins of the sea in very recent geological time. Continents do not pass into ocean basins abruptly. They are surrounded by *continental shelves*, which slope gently away from the shore line for considerable distances before giving way sharply to the ocean basins proper. These continental shelves are covered with sand and mud which the rivers have brought down from the land, and which the currents and waves of the sea have spread out in smooth layers.

Along many coastlines in many different parts of the world, earth movements have elevated the shallow landward edges of the continental shelves above the level of the sea. The resulting land surfaces are known as coastal plains. Study the diagram on this page, which explains the position and construction of a coastal plain.

One of the widest and longest coastal plains on earth edges the eastern and southeastern coasts of North America. Following

A coastal plain is built of sand and mud which rivers and waves have deposited along the margins of the sea.



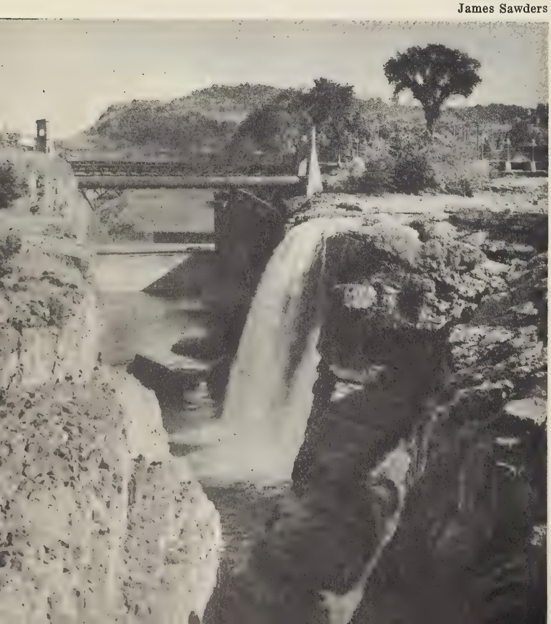
the Atlantic shore line from Long Island, this plain extends southward, widening as it goes, across the eastern portions of New Jersey, Pennsylvania, Delaware, Maryland, Virginia, the Carolinas, and Georgia. It takes in all of Florida, most of Alabama, all of Mississippi and Louisiana, much of Arkansas and southeastern Texas, and fringes of eastern Mexico as far as Yucatan. Where it borders the Atlantic Ocean it is known as the Atlantic Coastal Plain; where it borders the Gulf of Mexico it is known as the Gulf Coastal Plain. All told, these coastal lowlands account for about 11 per cent of the land area of the United States.

You can find evidence of the extreme geological youth of this region almost anywhere you choose to look for it. The gravels, sands, and clays of which the land is made were laid down so recently that they have not yet had time to become cemented into rock. Everywhere they contain fossil sea shells which resemble creatures of the sea that are still living in the bordering ocean.

Erosion has not yet had time to roughen very much the newly made surfaces of these

This waterfall in New Jersey is in the Fall Zone of the Atlantic Coastal Plain.

James Sawders



coastal plain formations. In very few places does the relief amount to as much as 200 feet. In most places it is less than 50 feet, and this is brought out, as a general rule, only by the bluffs which line the broad-bottomed rivers that flow across the plains. Mile after mile, railroads and highways run in straight lines over land surfaces that would seem as smooth as a pool table if they were not covered with pine woods in so many areas.

The only really striking element in the monotonous landscape of a coastal plain occurs along its inland edge. Rivers flowing eastward to the sea across the Atlantic Coastal Plain develop rapids and falls where they pass from the hard rocks of the old land to the soft rocks of the new land. A north-south line drawn through the falls and rapids of these rivers marks the western edge of the coastal plain. This line is called the Fall Line or Fall Zone, and is extremely important in the human geography of the Atlantic coast.

Below the Fall Zone the rivers are navigable, in some cases by ships as large as ocean liners. Above the Fall Zone the rivers are not navigable by ships from the sea. Because of these facts the places where the rivers cross the Fall Zone are natural sites for cities. Cities built on these sites have three great advantages: (1) they lie at the head of navigation for ships bearing goods from foreign lands; (2) they are natural trading centers for the hill and mountain people to the west and the seaboard people to the east; (3) they are natural industrial centers because the rapids and falls in the rivers are a source of water power. Trenton, Philadelphia, Baltimore, Washington, Richmond, Raleigh, and other important cities are located on the Fall Zone of the Atlantic Coastal Plain, and owe much of their importance to this fact. (See the diagram on page 181.)

Because of the flatness, drainage is poor on much of the Atlantic and Gulf Coastal Plains. Many square miles of land along their seaward edges are abandoned to salt marshes and mosquitoes. Here and there, however, seashore towns and resorts have grown up along the many fine beaches. The Middle Atlantic Trucking Belt, about which we studied in Chapter VII, is located on the sandy, easily cultivated flatlands around and behind these marshes. Between the landward and seaward borders of the coastal plain, the population is nowhere crowded. This region of conveniently low relief will someday doubtless have many more residents than live in it now.

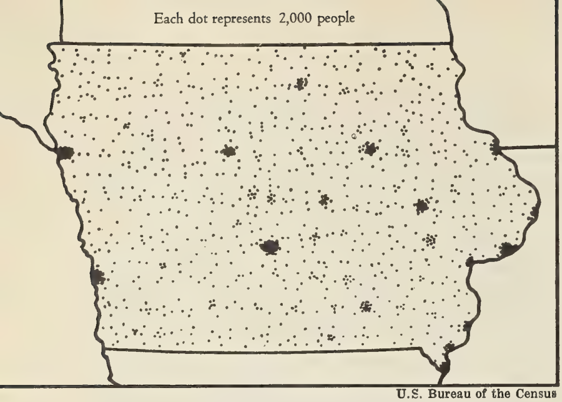
Narrower coastal plains occur on other continents, notably on the west coast of South America and the east coast of India. There too we find that this type of plain is marked by a "fall zone" on one side and tidal marshes on the other side. Some of the flatlands of the Netherlands and neighboring areas in Belgium might be called *artificial coastal plains* because they are sea bottoms which men have turned into dry land by draining off the water with pumps and holding back the sea with dikes.

Glacial plains. Some of the widest, most heavily populated, and most valuable plains on earth are chiefly the result of the action of water in the form of ice. Great ice sheets pushed out of the north well into the middle latitudes of North America and Europe during the Glacial Period of geological time, which has just passed. These ice sheets were responsible for much of the present condition of the land surfaces in those regions. They reduced the irregularities of the ground over which they moved in two ways: (1) They rubbed away projecting rocks, much as a file rubs away a projecting fingernail. (2) They picked up loose rock materials as they moved and then dropped them when they melted in places far away.

In large sections of Finland, Norway, Sweden, and Canada, moving ice sheets not only wore down the rocks but also scraped off a large percentage of the soil. Great bare areas of flat and rolling land were left after the ice melted away. Such *ice-scoured plains* are marked by hundreds of lakes, which fill hollows scooped out by the moving ice.

Many of these regions are now clothed in mantles of small evergreen trees, which have somehow been able to gain a footing on the barren ground. Such regions are

The ice-scoured glacial plains of high latitude lands are poor in soil but rich in lakes.



U.S. Bureau of the Census

Population is evenly distributed on the fertile plains of Iowa.

largely untouched by man because of their infertility, their severe climate, and their remoteness from the important centers of world trade. Much of the tundra and taiga belts of vegetation which we studied in Chapter III lies on this type of ice-scoured land surface.

Though the ice sheets robbed Peter in the regions where they rubbed the landscape bare, they paid Paul in the regions where they dropped their loot of gravel and clay in the hollows of the land. In some places such *ice-built plains* are made of coarse gravel and boulders piled in ridges which geologists call moraines. These lands are generally too rocky and lean for crops, though they can be used for pastures. In other places the glacial deposits smoothed out the irregularities of the ground with a covering of deep rich soil. The flatness and fertility of the Corn Belt in North America are the gifts of this type of glacial action.

As the ice sheets slowly melted and retreated northward, large lakes were formed in several places between the margin of the shrinking ice and the irregularities of the land in front of it. Rivers flowing off the ice brought in tons and tons of fine fertile silt, which settled in layers on the bottoms of the lakes. When the ice completely melted away and the water drained out of the lakes, their flat bottoms—in some cases hundreds of square miles in extent—became *glacial lake plains*. The Red River district in Manitoba and North Dakota, one of the richest wheat-producing regions on earth, is such a plain.

Also closely linked with the ice sheets of the Glacial Period are plains which were built up by immense deposits of wind-blown dust. This dust came partly from the deserts and partly from the finer particles of rock material which the ice sheets had ground out in their journey over the land. In northern China and the northern Mississippi Valley of North America, great dust plains of this sort occur. They are called *loess plains*, after the German name for similar deposits along the Rhine, and are among the most fertile lands on earth.

Ice-built plains, together with the related glacial lake plains and loess plains, are in most cases flat or rolling lands. Their cultural developments are chiefly agricultural, with the people distributed evenly but thoroughly over the fertile ground. The even distribution of people on the ice-and-wind-built plains of Iowa is typical of such plains. It makes the strongest possible contrast with the spotty distribution of people on the mountainous surface of Switzerland, as comparison of the map on this page with that on page 171 will show.

River plains. Many plains in the interior of continents were once portions of the bottoms of shallow seas which have invaded the lands from time to time throughout the history of the earth. Rivers begin to modify such plains as soon as earth movements elevate them enough so that the sea water drains away. *Rivers, indeed, modify every type of plain.* In doing so they develop new types of plains which show the handiwork of the rivers much more than that of any other forces which took part in the creation of the plains before the rivers came.

In many arid and semiarid countries the streams flowing out of high mountains are suddenly checked when they reach the bases of the mountains. The sediments carried by such suddenly slowed-down streams are

Different crops occupy different positions on the piedmont plains of Southern California.

dropped and spread like great aprons by fingering rivulets along the front of the mountains. The water then partly evaporates into the thirsty air, and partly sinks and disappears in the rocky aprons of its own creation.

Such aprons, or "alluvial fans" as geologists call them, make a type of land surface which geographers call a *piedmont* (*"foot of the mountain"*) *plain*. In Southern California and many other places, piedmont plains are widely used for agricultural purposes. Water for irrigation is obtained either from wells in the gravelly aprons or from reservoirs in the mountain canyons above them.

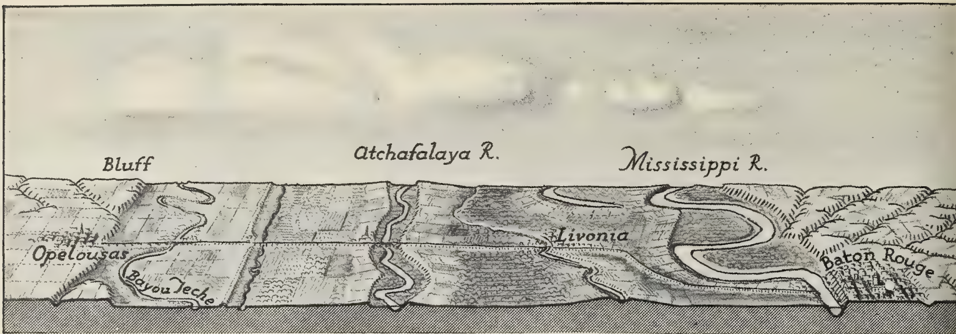
As the diagram above shows, agricultural developments on the sloping piedmont plains of Southern California tend to be of three different types, which are located in three different zones. Citrus orchards occupy the highest levels of the plains. Below these orchards is a zone of hardier fruits, and below this zone is a zone of still hardier grains, alfalfa, and other crops. This arrangement is the result of the relationship between the piedmont plains and the mountains. The heavy cold night air off the mountains settles along the lower elevations, with the result that the threat of frost is least at the head of a piedmont plain and most at its foot.

Rivers of humid lands generally flow over plains which they have made by a double process of erosion and deposition. Shifting their courses from time to time, the rivers widen the space between their banks by erosion. When their waters are low they occupy only a small portion of this widened area. In flood, however, they spread beyond their low-water channels and fill the whole area between their banks When they drop back into their low-water channels they leave rich flat deposits of mud and silt on the flooded areas. These belts of flooding along rivers in humid countries are known as *flood plains*. (See the diagram on page 186.)

Flood plains are among the most fertile regions on earth. Unfortunately, they are

Orange trees thrive on the upper levels of the piedmont plains of Southern California.

From Ewing Galloway



The flood plain of the Mississippi at Baton Rouge, Louisiana. Though the richest croplands are on the flood plain, the densest population is on the higher and safer land at either side.

likely to be too marshy and in too constant danger of flood to be easily and safely used. Where they have been drained and protected from floods by dams and embankments, they may support dense agricultural populations. This is the case along the Mississippi and the Nile. Large cities, such as Baton Rouge, Louisiana, and Cairo, Egypt, spring up along the higher banks of such intensively cultivated flood plains.

At the mouths of such rivers, where they drop their sediments in the sea, great *delta plains* may be formed, much as piedmont plains are formed at the mouths of rivers in arid and semiarid lands. On the fertile soils of delta plains in China, India, and Egypt the population has thickened in places to as many as 1000 people to the square mile. Delta plains, like flood plains, do not bestow their blessings without a price. They hold over the heads of the people who occupy them the terrible menace of flood. Millions of orientals have died when the rivers which had been obediently giving them life suddenly rose up and took it away.

PLAINS AND THE DESTINY OF MAN

Differences among plains and plainsmen. The word "plain" suggests a lack of variety, both in the landscape and in the lives of the people who inhabit it. A few plains and plainsmen, to be sure, are marked in this way. In Africa, for example, there are plains where huge anthills are all that varies the flatness of the land; where the infrequent visits of white hunters or explorers are all that breaks the monotonous rhythm of age-old ways. Such conditions, however, are exceptional. Plains vary greatly in origin, relief, and general appearance, as we have just seen. They also vary in other ways, and the lives of plainsmen vary in accordance.

Some plains are naturally more fertile than others. Some have minerals and power resources which others lack. Some are favorably, others unfavorably, located for the development of industry and trade. Plains such as those of the frozen North and the torrid tropics have climatic obstacles which keep their inhabitants few in number and low in culture. But barring only the plains which have climates extremely hostile to man, plains and plainsmen have certain common characteristics. We find in these characteristics some of the chief reasons why plains have played so important a role in the destiny of men.

Agriculture on plains Here and there in this unit we have touched on the various advantages which men derive from land surfaces of slight relief. We can sum up these advantages under three heads: (1) agriculture, (2) industry, (3) transportation and trade.

Where climate and soil are favorable, plains offer man many more agricultural advantages than does any other type of land surface. Low relief is a help to nearly all kinds of farming; it is absolutely essential in large-scale modern farming with machinery. Such agriculture is the basis of modern civilization. Most of the great nations of today embrace or control large areas of plains where large-scale agriculture is possible. The Second World War was in no small measure a struggle for the possession of such regions.

Denmark has proved that even a small nation with few natural resources can develop a high and prosperous civilization if it is located on a plain with a climate favorable to agriculture. All Denmark is a plain of very low relief which has been turned into one mighty pasture. Making the fullest possible use of their flat landscape and wet climate, the Danes have become the finest dairymen on earth. Their country is distinguished neither in size nor scenery nor fertility of soil, but the cows that graze on it help to butter the bread of all Europe.

Industry on plains. Large-scale manufacturing, like large-scale agriculture, is extremely important in the modern world. The industrial advantages of plains are great, but they are more difficult to measure than the agricultural advantages. Industry is much more affected than is agriculture by social and historical forces which have little basis in geography. A Swiss watchmaker, for example, may manufacture watches because his father before him did so; because he was educated from early youth to be a watchmaker, and neither knows how nor cares to be anything else; because he has

Dairy farms reach in all directions on the flatlands of Denmark.

James Sawders

From Ewing Galloway, N.Y.

Factories, like farms, do best on plains.

access to the special machinery and skill that watchmaking demands. Under such conditions he would be a watchmaker, regardless of climate, slope, or any other conditions in his physical surroundings.

It is nevertheless true that most factories, like most farms, are located on land of low relief. Why should this be true? Factories have certain common needs: fuel and labor to run the machinery, capital to buy it and keep it going, raw materials to feed into it, transportation to distribute the finished products, and markets to absorb them. As we all know, these common needs are met in thousands of ways by the millions of factories in the world.

Underneath these needs and the various ways of meeting them, however, two general conditions are absolutely essential to large-scale industrial activity. There must be (1) large concentrations of people and ability, and (2) highly developed transportation facilities. If these two conditions are present, factories can hum whether the necessary fuels and raw materials are near at hand or not. We have already seen that these conditions are much better fulfilled on plains than on any other type of land surface. Much of the skill and transportation facilities, and most of the people, of the world are concentrated on the plains. All the greatest cities are there and with them practically all the greatest industries.

Transportation and trade on plains. Modern civilization is like a living body, with many organs that work together in a highly complicated union. Agriculture and industry are the chief sources of the blood that nourishes this body, but transportation and trade must carry the blood to the various organs. Transportation and trade are thus absolutely vital to modern civilization.

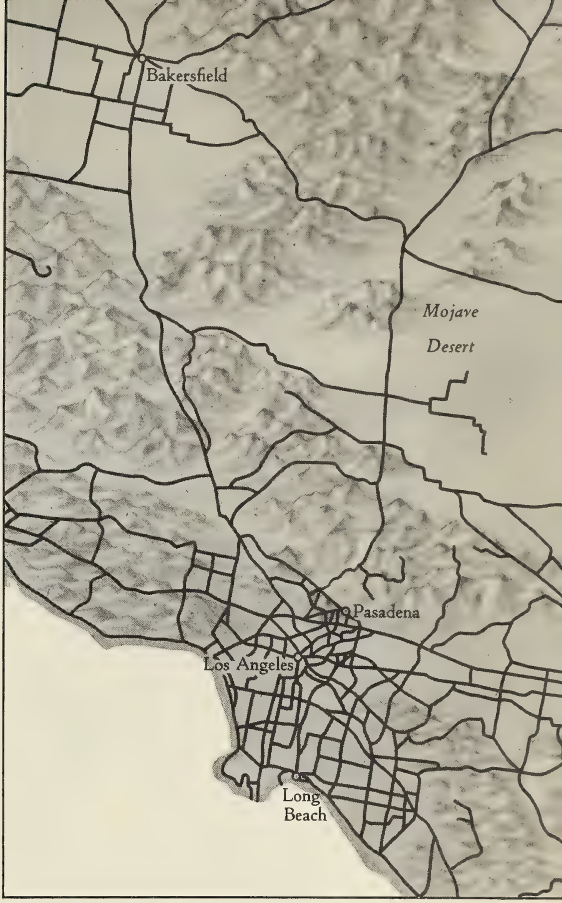
We have already had abundant evidence of the superior advantages of plains for transportation and trade. The map on page 189 will give you a typical illustration of how these advantages have been developed. Everywhere you go you will find the same conditions: better transportation facilities and therefore more trade on plains than on any other type of land surface. The abundance of navigable rivers and straight roads which low relief makes possible is one of the outstanding reasons for the popularity of plains and their importance in the modern world.

Plains in history. Modern civilization was born on the plains and for the most part continues to reside there. Widespread circulation of goods and ideas is the very essence of modern civilization, and it first developed on lands of low relief. Before modern means of transportation were invented, space was a mighty obstacle to the economic, social, and political development of people everywhere. With modern transportation the obstacle of space was reduced on all land surfaces, but especially on plains where the obstacle of relief did not also have to be overcome.

We might expect from this that plainsmen would tend to unite in strong nations with uniform economic, social, and political systems. When we examine the nations of the modern world we find that this is exactly what has happened in more than one region of plains. The prosperity and peace of the Danish plain before the Second World War were furthered by the strong social and political unity of the Danish people, which in turn were furthered by the conveniences of low relief. The poverty and strife of the Balkan mountains, on the other hand, were furthered by the social and political differences among the Balkan people, which in turn were furthered by the barriers of high relief. The strong modern democracy of the United States and the strong totalitarian government of Russia are both due in no small measure to the fact that plains make up much of the land area of these two nations.

Though in several instances the inhabitants of plains have worked toward union and peace, in other instances they have worked toward disunion and war. Germany, Belgium, and northern France occupy parts of essentially the same plain. This land surface is an ideal stage for cooperative undertakings. It is also, unfortunately, an ideal stage for war, and the inhabitants have all too often used it for that purpose. Tanks, antitank guns, armored cars, and many of the other terrible instruments of modern war were designed by plainsmen to be used on plains against other plainsmen.

This fact illustrates a general truth which we must never forget if we are to understand the relationship of men to the earth and to one another. *The use that men make of the earth may be determined more by cultural than by geographic influences.* Peace and war spring less from the ground than from the desires and traditions of men. But if the peoples of the plain of northwestern Europe should ever really decide to live at peace with one another, they would find much in their physical surroundings to further that end.



Good highways are much more numerous on the plains than in the mountains round Los Angeles.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. Plateaus are flat on top and are cut by many deep valleys.

2. Plateaus are always sparsely populated because they are high and difficult to reach.

3. It is easy to cross most plateaus because they have fairly smooth surfaces.

4. Most of the world's people live on plains because plains provide the most healthful environment on earth.

5. The Atlantic and Gulf Coastal Plains contain many large cities and everywhere have a dense population.

6. The state of Iowa and all other glacial plains of the world are important agricultural regions.

7. The piedmont plains of Western Europe produce most of the food for the people of that continent.

8. Flood plains are useless because of the danger of flooding.

9. Great industrial centers are located on plains because rough lands contain no raw materials or power.

10. Large areas of plains promote peace among nations because of the industry and agriculture which are located there.

QUESTIONS FOR DISCUSSION

1. Why do you suppose that most plateaus have an arid or semiarid climate? (Study the location of the earth's great plateaus with reference to the surrounding mountains and the prevailing winds.)

2. Why does Ontario have so many lakes and Iowa so few when both are glacial plains?

3. The Allied invasion of Normandy, France, in 1944 made military use of the plains of that region. What kind or kinds of plains occur there and how were they helpful to Allied operations?

4. Study the map on pages 162–163. Approximately how much of the United States consists of plains? How do you think this has affected the development of that country? How much of the Soviet Union consists of plains? How has this affected the inhabitants?

THINGS TO DO

1. Examine the map on pages 162–163, which shows the world distribution of different types of land surface. Observe where plateaus and plains occur in the tropics and make a list of them and their locations. Now look at the map of population distribution on pages 18–19. See what relationships exist between the distribution of population in the tropics and the distribution on plateaus and plains. Compare the distribution of population in middle latitude lands and the distribution on plains and plateaus in the same way. On the basis of your findings write a report entitled "Where Most People Live in Tropical and Temperate Regions."

2. Tibet, located on a high plateau in central Asia, is one of the most isolated countries in the world. Look up the location of Tibet on the map of Asia on pages 390–391 and read about it in a good encyclopedia. Write a report on life in Tibet and tell how it is affected by the surface of the land.

3. The highest lake in the world with steamboat navigation is Lake Titicaca on the Plateau of Bolivia. Look up information on Lake Titicaca and write a report on it.

4. Compare the map of land forms on pages 162–163 with the map showing the distribution of railroads on page 275. Write a report on the relationship between land forms and the density of railroads.

BOOKS TO READ

1. If you want to learn more about the forces which have shaped the land forms of the earth, you should read a good up-to-date textbook of physical geography. Such a book, written for high-school students, is *The Earth and Its Resources*, by Vernor C. Finch, Glenn T. Trewartha, and Merle H. Shearer. Other readable books which contain information on this subject are *Old Mother Earth*, by Kirtley F. Mather, *The Earth and Its Rhythms*, by Charles Schuchert and Clara M. Le Vene, and *Autobiography of Earth*, by John H. Bradley.

2. One of the most exciting travel books ever written is John W. Powell's story of his pioneer exploration of the Grand Canyon: *First through the Grand Canyon*.

3. Inasmuch as the dry grassland regions of the world are also for the most part plateaus and plains, the books which we recommended in Chapter VI contain material that also bears on the subject matter of this chapter. In Unit VI, where the human geography of nations is treated, books are recommended which deal specifically with the flatland areas where national power is concentrated.

Unit IV
Man and the Natural Resources

THE FOREST RESOURCES

Importance of natural resources. Here and there in our mental travels round the globe we have caught glimpses of the wealth which is known as the natural resources. With this wealth, freely and lavishly given by nature, man has built his earthly estate. On the moon there is no such wealth. There are no forests and grasslands, no wild animals and fish, no metals, soils, and fuels—and no men and civilization.

Without the natural resources of the earth, neither men nor the accomplishments of their hands and heads could possibly exist. In this unit we shall study these treasures in some detail. We shall be careful to distinguish such "natural" resources as wild grasses and wild animals from such "cultivated" resources as wheat and beef. We shall constantly be reminded that the natural resources are problems as well as blessings, for the following reasons:

1. They are unequally distributed over the surface of the earth. As a result, they lead to quarrels between men in different regions and to the terrible scourge of war.

2. They are consumable and in some instances irreplaceable. As a result, they force men repeatedly to change their adjustments to the earth, often at the cost of considerable pain and misery.

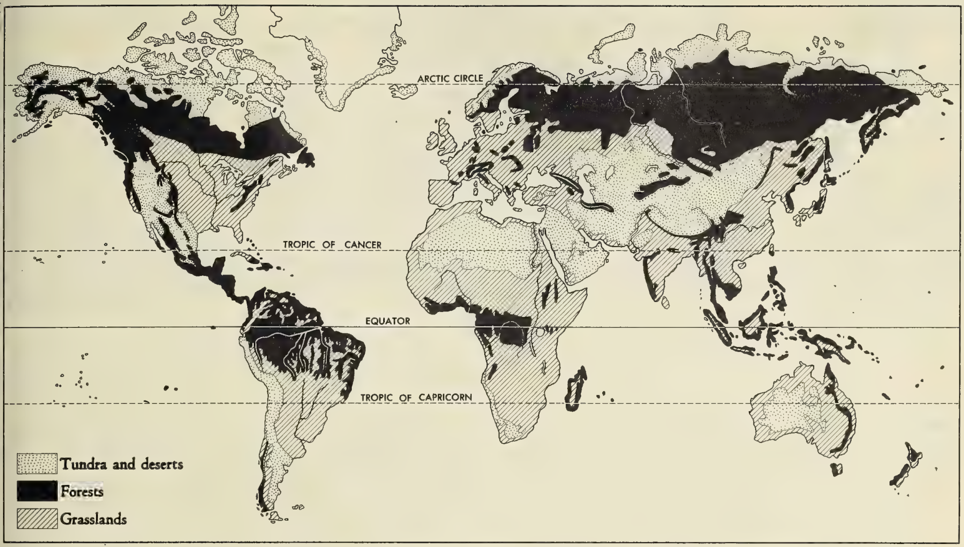
As geographers it is our business to know the value and distribution of the various natural resources. It is our business to know the difference between their proper and improper use. Both as geographers and citizens of the world it is our business to know how the unequal distribution of natural resources has led in the past to quarrels between men of different nations. Above all, it is our business to seek for ways of making such quarrels impossible in the future.

Distribution of the plant resources. In Unit II of this book we saw that different types of vegetation reflect different types of climate. We saw that in a great variety of ways plant life constitutes an important link in the relationship between climate and man. In this chapter we shall look at plant life from a different point of view. We shall study the native vegetation of the earth as a geographic factor in its own right, as an essential ingredient in the lives of men and women. We shall consider it as a natural resource which people both use and abuse.

Looking at the earth's cover of native vegetation from the point of view of its usefulness, we see that it can be divided into three classes: (1) tundra and desert vegetation, (2) forests, and (3) grasslands. The distribution of these three great types of vegetation on the earth is shown on the map on page 193. Tundra and desert vegetation, as you have already learned in Unit II, is of little use to man, and will not concern us in this unit. Forests and grasslands, on the other hand, are of great use to man in many places and in many ways. We shall devote a large part of this chapter to the study of the use—and the abuse—of these types of vegetation.

What is a forest? We have already seen that not all forests are alike. Forests, in fact, are so strikingly different from one another that it is reasonable to ask, "What, exactly, is a forest?" About all that can be said in answer to this question is that *a forest is an association of plants in which trees are the most prominent element.* Many forests contain other woody plants besides trees: bushes, shrubs, and (in the tropics) vines. Many forests contain plants which are not woody: grasses, mosses, and several other forms of vegetable life. But in all forests, trees are the conspicuous element; all other plants are mere trimmings.

How many trees must band together before they constitute a forest? Is the ten-acre woodlot behind the cornfield a forest? Is the



The native vegetation of the earth can be divided into three great classes.

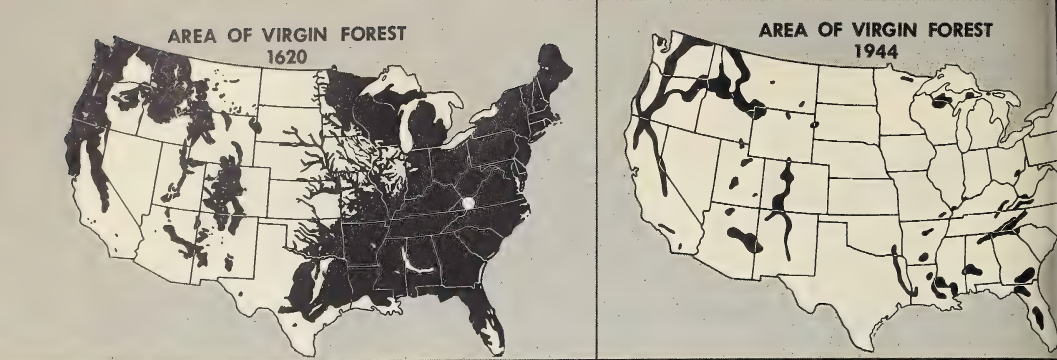
peppering of dwarfed trees on a desert mountaintop a forest? The answer in both cases is yes. The word "forest," as popularly used, implies a vastness of large trees. To botanists and geographers it merely means that trees of any sort are more conspicuous than other vegetation in a natural association of plants on an area of any size.

Why is a forest? Why are some lands covered chiefly with grasses and others chiefly with trees? Perhaps you remember that we touched on the answer to this question in Unit II when we studied the belts where grasslands and forest lands meet. We saw that in such belts grasses and trees compete for moisture, with grasses winning on the drier edges of the belts and trees on the wetter edges.

Trees, in other words, need more moisture than grasses do. Taking moisture from soil and air and giving it back again is an important part of the activity of all plants. Trees, being the largest plants, need the largest amounts of moisture. Forests, being chiefly an association of trees, need moist climates. In high latitudes and high altitudes, temperature and wind are more important than moisture in determining where forests shall grow. Everywhere else it is chiefly the distribution of moisture that determines the distribution of forests.

Men against the forests. Men, like forests, have a decided preference for the rainier climates of the earth. Accordingly, men and forests have been closely associated through much of human history. In the beginning all men were probably hunters. They probably lived chiefly in the forests because food, shelter, and protection were more easily obtained in wooded than in open country.

Today a few men are still living primitive forest lives. We caught glimpses of some of these men in the taiga forests of high latitude lands and in the rain forests of the tropics. We found them living on a level but little above that of the forest beasts. Isolated from one another by the wilderness between their clearings, untouched by influences from other lands and peoples, forever busy with the job of merely keeping



U.S. Forest Service

This is what men have done in the course of three centuries to the native forests of the United States.

alive, these people live in the forests as in a prison. They have neither the means nor the time to become civilized.

Very early in human history it would seem that aridity and cold destroyed many of the forests of the middle and high latitudes, forcing many men to live in open country. As early as the Stone Age, human beings left records of their lives in such country. Later the climate moderated and trees returned to many regions. In the meantime, however, men had discovered the possibilities of agriculture, and the advantages of treeless lands for agricultural pursuits. Since then men have rather generally turned against the forests.

History is full of the records of men who either lived on the open plains or made forested lands into open plains by cutting down the trees. Wherever population has pressed hard upon the land, trees have given way to men. In more than one wooded locality, little isolated clearings have been enlarged and joined until they swallowed the forests. Most of the heavy forests of northern China, southern Japan, Western Europe, and eastern United States have been whittled down toward the vanishing point. Even such lush tropical forests as those of Java and Ceylon have bowed to the will of man.

The saw in the United States. The story of the forests in the United States follows a plot which had been worked out before in other parts of the world. It is chiefly the story of the saw. When the Puritans came to Massachusetts in 1620, virgin forests covered nearly half of what is now the United States. Nearly all the land east of the Mississippi River was blanketed by trees. The Englishmen who came to live in these forests knew the advantages of a cheap and abundant supply of wood because they had suffered from the lack of those advantages. Most of the forests of their European homeland had been cut down before they were born.

Very soon the early colonists in the American forests had sawmills buzzing all the way from Massachusetts to Virginia. They sent lumber to treeless Western Europe, where people were willing to pay extravagant prices for it. They built hundreds of wooden ships, thousands of wooden houses, hundreds of thousands of wooden barrels and other utensils. They hacked down trees to make roads and cultivated fields, and to remove the cover where hostile Indians might lurk. They did in America what their ancestors had done in Europe: they killed the goose that laid the golden eggs.

They, and their children after them, sawed their way steadily westward. Across the Allegheny Mountains they made farm lands out of the fertile forest soils of the Middle West. Later their followers jumped over the grasslands and began to butcher the forests of the Rockies. Today the last virgin forests of the United States are fighting a losing battle with the saw in Washington, Oregon, and California. In three hundred years the residents of that country significantly changed the face of their land, as the maps on page 194 will show. In a brief three centuries they destroyed more than 85 per cent of their virgin forests.

Are the forests doomed? There is an old saying that "you can't eat your cake and have it too." Forests must make way for farms if men are to eat. They must be turned into a variety of commodities which modern civilization needs. Even in this age of metals and plastics, wood is still widely used as fuel. Houses and furniture are still largely made of it. Paper is made of it. PT boats are made of it. Telephone poles, fence posts, and railway ties are made of it. And it is used in other structures and articles which are too numerous to mention. How can we get all this wood without destroying trees?

The answer, of course, is that we can't. But *we can destroy the trees without also destroying the forests.* Let us see how this can be done—and why it must be done.

What France learned. France, like the eastern United States, was once completely covered with forests of mixed broad-leaved and evergreen trees. The people of France, like the people of the United States, treated their forests as if they were inexhaustible—and by doing so quickly exhausted them. The chief difference between these two national blunders was a difference in time. When Americans were just beginning to destroy their forests, Frenchmen had already begun to suffer for having destroyed theirs. They had already begun to work on the problem of bringing their forests back. Their three centuries of experience along this line makes a valuable textbook for Americans, who must now at last come to grips with the same problem.

Much human misery comes from the habit of taking a short-range view of things. Throughout history men have tended to exploit the natural resources for immediate personal gain, caring little for the rights of other men or the needs of the future. Forests, for example, are worth much more to a nation as a whole than the products which can be made of their wood are worth to the individual members of a nation. When France began to suffer for the destruction of her forests it was not chiefly because her people no longer had wood to use and to sell to their neighbors. It was because *the rain and the rivers, no longer held in check by the absorbent roots of trees, began to run riot over the land.* Floods and erosion began to tear the country to pieces, to rob the farms of precious topsoil, and to threaten the welfare of the entire nation. In the next chapter we shall see just how this sequence of unhappy events takes place.

France met this problem by realizing the geographic chain which connected the destruction of forests in the Alps and in the Pyrenees Mountains with the failure of farms on the plains at their feet. The French government, accordingly, planted

This great Douglas fir in a Washington forest has been able to resist every enemy but man.

trees along the mountain streams where short-sighted people had cut them down. It drained large areas of swampland on the coastal plain along the Bay of Biscay, and planted trees there. In time, it both checked the ravages of erosion and reforested nearly 20 per cent of all the land. Before the Second World War France was actually selling to Great Britain timber which had been carefully cut without damage to the forests that produced it.

Forest conservation in the United States. Estimates show that in recent years the United States has been destroying its forests about four times as fast as they grow. Just one Sunday edition of a metropolitan newspaper requires the destruction of several acres of small spruce trees. Ten billion board feet of lumber represents the demand on our more valuable timber preserves for just one year prior to the Second World War. What the toll of the war will be nobody can yet tell. But it is all too clear that during both peace and war the drain on the dwindling forests of the United States is more than the forests can stand.

Not all the blame for the rapid shrinkage of our forest resources can be placed on the lumberman. Democracy gives him the right to supply legitimate demands for wood by legitimate methods. Intelligent lumbering has already gone far toward correcting the scandalously wasteful methods of the past, in the following ways:

1. By cutting only mature trees, with as little damage as possible to the young trees nearby. These young trees must grow up to replace the trees which have been removed if the forest is to go on producing.

2. By cleaning up the "slash" of worthless branches, bark, and sawdust. Such combustible waste, if left strewn on the ground, invites fire into the woods after the lumberman has left.

3. By reducing waste in the logging and milling of timber. Three fifths of every marketable tree is too much to throw away, but that has been the average of logging and milling waste in the past.

Intelligent lumbering is only one part of forest conservation. The chief enemies of forests are fire and disease. Fire has felled many more trees than has the saw. The gypsy moth, the Dutch elm disease, the white pine blister rust, and a host of other

Fire is forest enemy number one.

U.S. Forest Service Photo

Soil Conservation Service

This is what fire, the saw, and neglect have done to one fine American forest.

tree diseases are hard-working and able assistants of fire. Such enemies of forests cannot be successfully fought by private individuals alone. They are primarily problems of national administration, and the national government of the United States is dealing with them effectively.

The United States Forest Service not only fights forest fires after they have been kindled; it also fights the carelessness of campers and smokers, which is responsible for about 90 per cent of all such fires. Together with other government agencies and certain private institutions, it carries on endless war against tree-killing pests. These organizations also plant millions of young trees on deforested areas. All told, they are doing much to save and restore our forests, but they are fighting against heavy odds. They need the coöperation of all the people if they are to succeed.

The political geography of forests. Forests have affected the political history of nations in a variety of ways. All through the Middle Ages the forests of Europe provided refuge for defeated armies, and for individuals who for one reason or another found it wise to withdraw from society. More than once such armies and individuals have later emerged from their forest hideouts to play important parts in the affairs of their day. As recently as the Second World War, the forests of Europe have played a political role in history. The activities of Russian and Balkan guerrillas were made possible in many instances by the protection afforded by trees.

Though forests, unlike fertile grasslands and rich mineral deposits, cannot be listed as one of the direct causes of war, they have indirectly influenced the rise and fall of nations. Both ancient Greece and ancient Rome made the mistake of destroying their forests. Both suffered the misfortune of having swamps, mosquitoes, and malaria take the place of the forests in many areas. Both fell, at least partly, because of malaria. There are many other instances of this kind in the history of nations, some of which we shall mention in Unit VI of this book.

Soil Conservation Service

This grassland is healthy because it has not been overgrazed.

THE GRASSLAND RESOURCES

What is a grassland? Just as forests are associations of plants in which trees are the most prominent element, grasslands are associations of plants in which grasses are the most prominent element. Like the trees of the forests, the grasses of the grasslands are associated with other types of plants. In Unit II we studied the three chief varieties of grasslands: the steppes, the prairies, and the savannas. We saw that the grasses of the steppes are spotted with bushes where the steppes give way to the deserts. We saw that the grasses of the prairies are spotted with trees where the prairies give way to the humid middle latitude forests. We saw that the tropical savannas have a liberal scattering of trees throughout their range. But in all these types of grasslands the grasses are the conspicuous element; all other plants are mere trimmings.

Why is a grassland? Just as moisture determines the types and distribution of forests, it also determines the types and distribution of grasslands. We learned in Unit II that grasslands reflect climates which are neither extremely dry nor extremely wet; that they are nature's means of bridging the gaps between the arid deserts and the humid forests. We learned that on the desert side, where the climate is semiarid, short grasses predominate; that on the forest side, where the climate is subhumid, tall grasses predominate.

The grasslands of humid regions, which go by the name of meadows, are the only native grasslands that occur in truly wet climates. Meadows, however, are small, scattered, and of slight importance among grasslands as a whole. As far as their role in human geography is concerned, they belong with the man-made pastures.

Though most grasses thrive under climates in which most trees would die of thirst, grasses are not so tough as this fact might make them appear to be. Grasses live in the skin of the soil; unlike trees, they cannot tap the deeper layers of soil for the moisture that gathers there. Trees, by virtue of their great root systems, can live through a bad drought during their growing season; grasses, with their shallow roots, must have *some* moisture at this season if they are to survive. We have already seen how fickle is the rainfall over most of the grasslands of the earth; how precarious is the life of grass—and the lives of men who depend on grass. Can anything be done to reduce these hazards?

The need for grassland conservation. The regulation of climate is not man's business, but the regulation of his own life with reference to climate is. In Chapter VI we learned something of the damage which men have inflicted on both themselves and the grasslands by failing to adjust themselves to the climate of these regions. In 1892 the United States government established the first national forest in an attempt to safeguard the dwindling forest resources of the nation. Not until decades later did it do much to save the dwindling grassland resources of the nation. Fortunately, the government is now fully aware that it is just as necessary to save our grasslands as our forests—and for many of the same reasons.

In Chapter VI we learned that hoofs and plows are the greatest enemies of grasslands. We learned that overgrazing and overplowing lead to the destruction of grasslands, just as overcutting and fire lead to the destruction of forests. We learned that floods, dust storms, and misery are the inevitable result of these abuses. Such calamities, like an epidemic of influenza, begin as small and local problems which enlarge and spread into plagues of national and even continental extent.

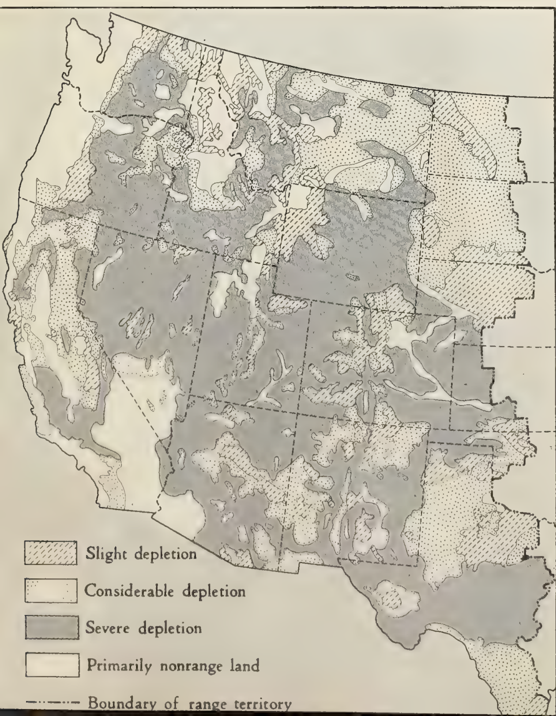
On pages 108–110 we discussed the program which the United States Department of Agriculture has proposed for severely limiting farming and grazing on the Great Plains. If you will read those pages again, you will see that the program deals chiefly with methods whereby individual farmers and stockmen of that region may hope to solve their personal problems of how to make a living on the land. Conservation of grasslands as a whole demands a broader program and one designed for the people of the nation as a whole. For the conservation of

This grassland is sick because it has been severely overgrazed.

Soil Conservation Service

The map at the top shows the original extent of native grasslands in North America.

The map at the bottom shows what abuse and neglect did to the semiarid range lands of the West.



grasslands, like the conservation of forests, has become a pressing national necessity in the United States. Let us see how the national government is dealing with this necessity.

Grassland conservation in the United States. The upper map on this page will give you an idea of the vast extent of native grasslands in North America. In the United States alone such lands account for some 850,000,000 acres, about the same amount of territory as was originally occupied by forests. With the march of civilization and the increase in population, the tall-grass prairies were doomed. The ground they occupied was far too valuable for agricultural purposes to be allowed to remain in grass. There is no reason why this ground should be returned to grass. The need for grassland conservation applies almost exclusively to the semiarid grasslands, where agriculture and grazing may be boomerangs that endanger not only the people who employ them but also the welfare of the entire nation.

The lower map on this page tells better than words can do the serious condition of the semiarid grasslands of the United States when the Federal government decided to do something about it. It is obvious from this map that the problem of grassland conservation is really two problems: (1) the problem of saving the grasslands which have not yet been seriously depleted, and (2) the problem of restoring those which have. All authorities agree that the first step toward the solution of both these problems is restriction of agriculture and grazing. Ranchers have rather generally learned through sad experience that intensive dry farming on semiarid grasslands does not pay, but some of them have yet to learn that intensive grazing on such lands does not pay either.

By recent estimates our Western range lands still support about 35 per cent more livestock than is good for them. The Federal government has estimated that the 17.3 million head now grazing there should be re-


Soil Conservation Service

This fine stand of grass in Texas was grown on land which a few years before was being rapidly destroyed by the wind.

duced to 10.8 million head. It believes that as grass increases with this restricted use, the herds may gradually be allowed to increase.

Obviously, this end could be more easily achieved if the government owned the grasslands. But about half of all the semiarid grasslands in the United States are still privately owned—and this is the half that contains most of the seriously depleted areas. It is clear that there should be national grasslands, just as there are national forests, with a Federal Grassland Service to match the Federal Forest Service.

Lacking such means for promoting the conservation of grasslands, the Federal government must depend on appeals to the good sense and the good will of individual men to get them to use the still usable grasslands without abuse. Unfortunately, there are people who prefer to make all the money possible as quickly as possible, with no thought of either their neighbors or the future. But as the immediate gains from the grasslands continue to shrink in terms of money and to expand in terms of misery, intelligent ranchers are rapidly coming to realize that the blind exploitation of these natural resources must stop. There is an increasing willingness on their part to cooperate with such scientific agencies of the government as the Soil Conservation Service and the Division of Range Research when they are convinced that these agencies have a practical and impartial approach to the problems.

The Federal government has been particularly convincing in several instances where it has tackled the problem of restoring seriously depleted grasslands. Most of you have probably never been to Dalhart, Texas, but some of you may have seen the movie *The Plow That Broke the Plains.* That movie showed what happens to a semiarid grassland when its grass is destroyed. The scabby lands from which the wind had stripped the soil, the sand dunes from which not even a sheep could scrape a decent meal, the appalling desolation of the landscape

Photo by B. C. McLean

Sorghum provides both an excellent cover for depleted range land and excellent fodder for livestock.

as a whole, made a picture that shocked the American public.

The government was shocked enough to do something about it. It leased the region from its private owners and searched for possible ways of bringing the land back to health. Its first and chief problem was to lock the ground against the wind. It discovered that nature had provided some two hundred varieties of locks that might be used, locks that ranged in size from the small hard-bitten grama and buffalo grasses of the drier plateaus to the giant bull grass of the sloughs. It found that in addition to these native grasses such imported and cultivated types of cover vegetation as broom and Kaffir corn, Johnson and Sudan grass, and a variety of sorghums might grow on the wounded land.

To make a long story short, in *just one year* the government succeeded in restoring a cover of vegetation to most of the denuded areas round Dalhart. It also actually succeeded in producing a good crop of forage from some of these areas! And what it did at Dalhart it has done, and is continuing to do, elsewhere. Such achievements give substance to the hope that in time the grasslands of the United States will reach a condition of maximum use with a minimum of abuse.

Political geography of grasslands. Grasslands, like forests, play a mighty role in both the national and the international affairs of millions of people. As we have seen, grasslands may become a serious national problem. The Second World War has proved that they may also become a serious international problem. If land-hungry Germans had not long looked longingly at the fertile grasslands of the Ukraine, Germany might never have invaded Russia. Because grasslands are valuable sources of food and are unequally divided among the nations of the world, they have more than once determined the moves on the international checkerboard. We shall discuss these moves at greater length in Unit VI.

THE WILDLIFE RESOURCES

The importance of wildlife. To the primitive Eskimo on the shores of the polar sea, wildlife is the most important thing in the world. The existence of seals, fish, and other wild animals makes possible his own existence. Most men, however, no longer depend on wildlife for food, clothing, and shelter. Their domesticated plants and animals and their manufactured articles supply most of their needs, and could supply all if wildlife should suddenly vanish from the earth. What good, then, are wild animals in a civilized world?

Your author immediately thinks of one good because he is enjoying it even as he writes. Outside his window this winter morning the woods look cold and dead. But in the yard the chickadees are flitting in and out of the feeding box on the pear tree. From time to time the bluejays come, talking, quarreling, and looking far finer


© Charles J. Belden

The herds of elk in the Rocky Mountains are a valuable source of food and sport.

than they really are. Now and then, when things quiet down, a hairy woodpecker sidles into the box and pecks shyly at the suet. A gray squirrel on a nearby stump wonders if he could get a cheekful of sunflower seeds without attracting the dog.

These creatures are of little practical use to your author. Though they doubtless eat some weed seeds in his garden, they much prefer the seeds which he buys for them in the pet shop. They often distract him from his work. But they bring warmth and life to the cold and lonely landscape. They bring beauty and cheer. Without them and their kind in other places, the earth would be an uglier and sadder planet.

Wild animals, however, do more than enliven and beautify the landscape. Wildlife—especially birds, mammals, and fish—is still a valuable source of sport, food, and fur in many regions. But as in the case of forests and grasslands, the practical value of wildlife does not lie wholly in the direct and immediate uses which can be made of it. Like forests and grasslands, wild animals are strands in a complicated web of relationships. When these strands are broken the entire web is weakened.

If all bees, for example, should suddenly disappear from the fields, many food plants that cannot reproduce without help from the bees would also disappear. If all birds should disappear from the gardens and orchards, many other food plants would go into the stomachs of insects rather than of men. If all mountain lions should disappear from the forests, deer and elk would multiply beyond the capacity of the forests to support them, with many dying of starvation and many invading and destroying the crops of neighboring farms. If all the fish should disappear from the streams, the water would grow foul with the decay of materials which are normally eaten by fish, and the streams would become a deadly menace to the men along their banks. If wildlife in general should disappear, the balance of the living world would be so severely upset that man himself might disappear.

In one way or another, men have repeatedly interfered with this balance only

Soil Conservation Service

Advancing civilization drove the bison from the wide grasslands of North America to the fenced pastures of government ranges.

to learn that in most cases it decidedly does not pay to do so. In dealing with wildlife, as in dealing with forests and grasslands, the objective of all nations should be use without abuse. But how can this objective be reached when men are ever increasing in number and ever taking over more of the surface of the lands? Where is there room for wild animals in the modern world?

The conservation of land animals. Part of the answer to this question, at least for nations that have mountainous regions with sparse populations, lies in the establishment of national forests. Land set aside for the preservation of trees should at the same time be set aside for the preservation of the wild animals that live among the trees. Such a policy has been widely followed in the United States and Canada. Many of the national forests and parks of these nations are also wildlife preserves, where native wild animals are given care and protection. Such large animals as mountain sheep, mountain goats, grizzly bears, and elk owe their existence in the twentieth century to this care and protection. In return they perform useful functions in the economy of forest life, and they supply men with a considerable amount of sport and food.

The native animals of the grasslands are less fortunate because with the press of population these lands are needed for domesticated animals. It was inevitable that the bison should give way to the steer on the Great Plains. The antelope, on the other hand, can live in country which would discourage even a sheep. By enlightened state and Federal government supervision this animal has become an important source of sport and food on the arid and semiarid steppes of Wyoming. In North Dakota too, the preservation of extensive marshlands by government agencies is responsible for the existence of untold numbers of wildfowl, which must have such places for breeding grounds. As refuges for wild birds and fur-bearing animals these marshes yield vastly greater dividends than if they had been drained and put to private commercial uses.

The conservation of fresh-water wildlife. Wherever we turn, whatever region or type of environment we examine, we find that the coming of man has meant the going of wildlife. Records left by early colonists in North America tell of a land that swarmed with game and fish. In a brief three centuries, the passenger pigeons that once darkened the sun in their flight are now represented by a few stuffed specimens in museums. The magnificent trumpeter swan is held from extinction by the thinnest of threads.

The sturgeon was once king of fishes in the vast meshwork of streams that constitutes the Mississippi and Missouri river systems. Like the bison that once roamed the lands which these rivers drain, the sturgeon has been reduced by man to the status of a relic. The shad that once thickened the waters of Atlantic coastal rivers have all but disappeared. The salmon which were once so plentiful in Pacific coastal rivers that men pitchforked them onto the fields for fertilizer are only a remnant of what they once were.

Fortunately, the shortsightedness which led to such needless slaughter of wildlife has pretty generally been cured. People pretty generally realize that it is neither necessary nor wise to kill off *all* fish and game, even in districts which are thickly settled and intensively developed. The wildlife resources of such districts, especially the resources of lakes and streams, actually become more and more important as more and more people look to them for rest and recreation. Thanks to the Bureau of Fisheries, the Biological Survey, various state fish and game commissions, and sportsmen's organizations, the destructive exploitation of fresh-water wildlife by trapping and fishing has now rather generally been stopped.

One great menace, however, remains: the menace of pollution. Protective fish and game laws and reconstructive restocking programs are of little use on waters that are poisonous to wildlife. Manufacturing has come to nearly every large stream in the United States—and pollution has come with it. The vile waste from numberless factories and the sewage from an estimated 40 million people are being dumped *without any treatment whatsoever* into the lakes, streams, and coastal waters of the United States. Any living creature that touches these waters runs the risk of disease and death, whether fish, ducks, oysters, or men.

The control of pollution is a problem of political geography. Several badly polluted American rivers cross state lines in thickly settled industrial regions. It is of no use to have just one organization, or one city, or even one state in favor of cleaning up such a river. The job can be done only through the coöperation of all who come in contact with the river. Such a job is difficult to do, but Europe has proved that it can be done. Even in her most highly industrialized areas, Europe's rivers are rather generally clean and their wildlife healthy because the people as a whole want it so.

Wildlife resources of the sea. By far the most immediately valuable of all wildlife resources are the edible fishes and other useful creatures of the sea. Commercial fishing in the oceans of the world ranks as one of the major activities of man. Though this activity goes on in many places, it is most highly developed in four large regions, as you can see by the map on page 206.

The fishing region of first importance includes the waters round the islands of Japan and the coast of eastern Siberia. Japan takes about one fourth of the world's yearly catch of fish. Fish is the chief source of animal food for the Japanese people and one of the chief sources of fertilizer for their fields. Before the Second World War the Japanese also sold considerable quantities of fish, shrimps, and deep-sea crabs to foreign nations.

Bordering the Japanese and Russian fishing region on the east are the less important but still valuable fishing grounds of northwestern United States, Canada, and Alaska.

Commercial fishing takes place chiefly in these four great regions.

This region produces nearly all the world's canned salmon. A third great fishing region takes in the Atlantic coastal waters of the United States, Canada, and Newfoundland, where the world's greatest oyster and cod fisheries are located. The fourth great fishing region lies off the coast of northwestern Europe. In peacetime this region leads all other regions in the exportation of sea food, with total yearly shipments of a million tons of herring, cod, and mackerel being not unusual.

The national conservation of fisheries. Though the sea is wide and its edible citizens seemingly as numberless as the sands of the shore, they are still open to abuse by men. All countries that face the sea must sooner or later also face the problem of conserving the wildlife resources of the sea. This problem, like the problem of conserving the wildlife resources of the land, calls for national regulations.

Many "fisheries" have nothing to do with fish. They are devoted to the exploitation of such mollusks as clams and oysters, and such crustaceans as lobsters, shrimps, and crabs. These may be called the *shallow-water fisheries* because most edible mollusks and crustaceans live either in shallow coastal waters or on the tidal flats. Great care must be used in regulating these "fishing grounds" because they are easily accessible and can be exploited by almost anybody without investment in expensive equipment. All progressive nations with shallow-water fisheries have regulated the use of them by law. Some governments have also taken effective measures against the pollution of oyster beds and similar near-shore fishing grounds, and have established hatcheries and instituted extensive restocking programs.

The *deep-sea fisheries* would seem at first thought to be rich enough and far enough away from the haunts of men to be practically inexhaustible. This, alas, is not true. Commercial fishermen have definitely reduced the world supply of haddock, cod, and other deep-sea fishes by seining them with small-meshed nets which kill the unmarketable little fish while capturing the large ones. Boats with modern refrigeration have trailed schools of such very large fish as tuna until every individual was taken, leaving none to reproduce and restore the school. The effect of such practices is felt by everybody who buys a deep-sea fish in the market. The remedy is laws with teeth which are sharp enough to catch and to hold the individuals who damage for personal gain a natural resource that belongs to the people as a whole.

Oddly enough, man has inflicted grave injuries on the wildlife of the sea without leaving the shore. Salmon are among the most valuable food fishes in the world. By a strange quirk of nature these creatures come up from the sea into fresh-water rivers to lay their eggs. By building dams and other barriers across coastal rivers men have closed many of the finest salmon rivers to the salmon. By doing so they have materially reduced the supply of one of the world's best foods. The remedy for this evil is obviously the removal of its cause. By building such "fish ladders" round dams as are shown below, we can help salmon to get to their spawning grounds in the rivers and to keep their kind on earth.

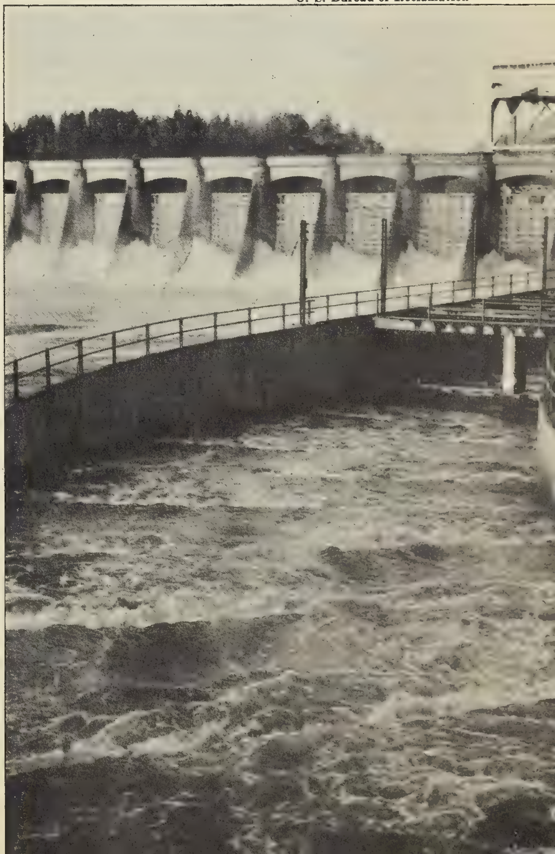
The international conservation of fisheries. The oceans touch many lands and the boats of many nations go forth to seek their treasures. International disputes have more than once arisen over the division of the spoils. But in one notable instance an international agreement was made which not only greatly reduced the number and seriousness of disputes but also saved an extremely valuable animal species from extinction.

The fur seals that roam the northern Pacific as far west as Japan and as far south as California are not fish, but as a natural resource they may be classed with the deep-sea fishes. Their large size and beautiful soft but durable fur make them one of the most valuable of the fur-bearing animals. Their strange habit of returning every year to the Pribilof Islands off the coast of Alaska to breed makes them one of the most easily abused animals. In the latter half of the nineteenth century hundreds of thousands of these animals were slaughtered in the waters round their breeding grounds by the citizens of four nations. By 1910 the fur seal was nearing extinction.

In 1911 a treaty was drawn up by Russia, Japan, Great Britain, and the United States in an attempt to stave off this disaster. The Pribilof Islands were made a fur seal reservation under the control of the United States, but with each of the four interested nations to share in the harvest of fur. This harvest was restricted to young male seals that were not needed for breeding purposes. The agreement worked so well that the fur seal population of the Pribilof Islands today is almost ten times as large as it was when the treaty was signed.

Fish ladders at Bonneville Dam enable salmon to swim up the Columbia River to lay their eggs.

U. S. Bureau of Reclamation



The walrus and the whale have not been so fortunate. Men of many nations have driven the walrus of the Arctic to the brink of extinction. By doing so they have practically eliminated a valuable source of ivory and oil, and have made the hard life of the native arctic peoples harder. The whale has also been greatly reduced in arctic waters and is now being rapidly removed from the antarctic waters. Unless international agreements are soon drawn up to save these two greatest of all marine creatures, they will surely vanish from the earth. Man will be forever poorer for his folly, because a species once exterminated is gone forever.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. We need not worry very much about our natural resources because most of them are either inexhaustible or the supply can be easily replenished.

2. It is fortunate for men that the natural resources are so evenly distributed over the earth.

3. It has been said that plants are the ultimate source of food for men. This is not true, because men also eat meat.

4. A forest is a large number of trees.

5. The more progressive peoples of the earth have tended to stay away from forest regions because they are gloomy and inhospitable.

6. Men have cut down most of the forests of Europe and the United States for the sole purpose of using the wood for construction and other related purposes.

7. Since all wooden articles will someday be replaced with plastics, we need not worry about the destruction of the forests.

8. A grassland may be described as an area entirely covered with grass.

9. Grass is a hardy plant that will tolerate almost any kind of abuse.

10. Grass supplies an unlimited amount of food for an unlimited number of grazing animals.

11. The chief value of wild animals is the pleasure they give people who hunt, study, or watch them.

12. The game commissions of many states stock streams and lakes with fish entirely for the benefit of fishermen.

13. One way to conserve wild game is to kill as many lions, bobcats, wolves, and similar animals as possible.

14. Conservation is not a problem in sea fisheries. The ocean is such a big place that supplies of edible fish are inexhaustible.

15. Conservation of plant and animal resources consists chiefly in using less of these resources.

QUESTIONS FOR DISCUSSION

1. How would you conduct a program of conservation for the country round your home?

2. Are there forests in your neighborhood? If so, what kinds of trees grow there? What other kinds of plants grow in these forests?

3. If you owned a large tract of lumber forest, how could you go about developing it without destroying the forest and still make a profit from it?

4. Do diseases attack the trees in your neighborhood? If so, what is being done to check or cure the diseases?

5. What do you think is a reasonable plan for grassland conservation in the United States? How do you think such a plan could be made to work?

6. What would you say are the chief reasons why the great commercial ocean fisheries are located where they are?

THINGS TO DO

1. One of the most backward of all peoples are the Pygmies, who live in the tropical rain forests of Africa and elsewhere. Find out as much as you can about these people from an encyclopedia or some other source. Write a report on them, stressing the effect of the forest environment on their activities and their cultural development.

2. Find out from a lumber dealer in your community what types of lumber are most commonly used in your community and where they come from.

3. The Taylor Grazing Act of 1934 was an important step in grassland conservation. Look up the provisions of this act and find out if possible what effects they are having on the grasslands of the United States.

4. Look up and report in class on the ways in which the United States and Canada are co-operating to conserve such wild migratory birds as ducks and geese.

5. Find out what happens to the sewage of your community. If it is dumped into a lake or river, find out if it is treated before it is put into the water. If your community has factories, find out what the industrial waste products are and where they go. Write a report on your findings and suggest any improvements you believe to be necessary for public health and wildlife conservation.

6. Select a small plot of ground with a variety of plants growing on it: trees, bushes, and grass. This can be a farm field, a city park, or your own yard. Make a list of all the different plants which you can find in this small area. Observe your plot of ground at different times of the day, and under different weather conditions. Make a list of all the different animals which you have discovered using or living on this plot of ground. Try to find out how the animals make use of the plants which are growing there and also how the animals may be useful to the plants. Write a report on your findings under the title "A Study of the Relationships of Living Creatures in My Community."

BOOKS TO READ

1. Many books have been written about forests and their conservation. Publications of the Forest Service, United States Department of Agriculture, are rich in forest lore. If you assume that all government publications are "dry," try reading *Forest Outings*, which was written by thirty foresters and is published by the Forest Service. If forests mean nothing to you now, they probably will mean a great deal to you after you have read this extremely interesting and well-illustrated book.

2. Among many good books that deal wholly or partly with trees and their conservation, *Men and Trees*, by JOSEPH GAER (with exceptionally fine illustrations), *Our Promised Land*, by RICHARD NEUBERGER (on the great virgin forest lands of the Northwest), and *The Maine Woods*, by HENRY DAVID THOREAU (a classic on forest life and travel), are outstanding.

3. In Chapter VI several general books on the grasslands of the world were recommended. To this list should be added *Behold Our Land*, by RUSSELL LORD, and *Rich Land, Poor Land*, by STUART CHASE. And just as the Forest Service of the United States Department of Agriculture has published many bulletins of general interest on the forests, the Soil Conservation Service of that department has published many comparable bulletins on grasslands. Every American citizen should be familiar with these sources of good reading and sound instruction.

4. Good books on wildlife and its conservation are legion. The first requirement for the conservation of wildlife is that people have an understanding and love of wild creatures. In America the books of JOHN J. AUDUBON, HENRY DAVID THOREAU, JOHN BURROUGHS, JOHN MUIR, and ERNEST T. SETON have done much to interest people in their wild animal neighbors. In England the books of W. H. HUDSON and HENRY WILLIAMSON are outstanding in this field. Special favorites of your author are *Walden*, by THOREAU, and *Tarka the Otter*, by WILLIAMSON. If you read only one book of this type, however, read *The Compleat Angler*, by IZAAK WALTON, which has an undying charm for fishermen and nonfishermen alike.

5. Many books on conservation in general (some of which are recommended in the next chapter) deal with wildlife and its conservation in a more systematic and scholarly way.

THE ORIGIN OF SOIL

Importance of soil. Man would not have become civilized with the help of the living resources alone. Without such mineral resources as stone, metal, and fuel, all the great cultures of men from the Stone Age to the Air Age would have been impossible. Without soil, which is a combination of living and mineral resources, men could never have even come into existence.

In Unit III we saw how men are influenced by the shape of the land surface on which they live. They are even more profoundly influenced by the soils that cover these surfaces. Repeatedly in this book we have been reminded that men in their own way are as dependent on soil as trees are. It is time that we look at this important geographic relationship in detail.

The production of mantle-rock. Soil, like every other element in the physical environment, is a product of great forces operating through long periods of time. All the mechanical and chemical forces which are forever gnawing at the surface of the lands work toward the production of loose rock. Though the individual pieces of this material may be as big as houses, the forces that produce them tend also with time to reduce them to smaller and smaller particles. Much more rocky waste of this sort is produced on the lands than rain, rivers, glaciers, and wind can remove to the sea. It lies like a cloak, or mantle, on the bare body of the earth, and is known as the *mantle-rock.*

In some places the mantle-rock lies on top of the parent rock from which it was derived. In most places the particles of the mantle-rock have been brought in from distant regions. In some places the mantle-rock is only a few inches thick; in other places it has accumulated to depths of hundreds of feet. Nearly everywhere it is made

Notice the small pick in this photograph. It marks the place where the consolidated bedrock below gives way above to the loose materials of the mantle-rock.

Photograph by Lang, U.S. Geological Survey

This diagram shows how leaching, eluviation, and the accumulation of humus work toward the production of soil.

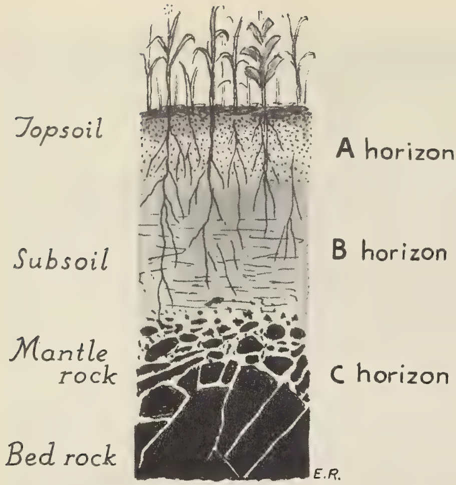
up of a complicated mixture of different mineral materials. The mineral materials in the upper portions of the mantle-rock are the chief ingredients of soil.

The production of soil. In most regions the production of soil from mantle-rock is the result of three processes:

1. Rain sinking into the pores between the particles of mantle-rock dissolves certain mineral materials and carries them away by a process which is known as *leaching*. Some of these materials may be deposited later in lower portions of the mantle-rock; some find their way to the underground water, to the rivers, and eventually to the sea. Mineral materials that water cannot dissolve are left behind. Leaching goes on most vigorously in warm rainy climates and in the surface portions of the mantle-rock. It tends with time to turn the surface portions of the mantle-rock into soils which are made up largely of insoluble materials. Soils which are of value for raising crops, however, are not completely leached because plants require certain of the soluble materials for growth.

2. Seeping water also carries the finer particles of insoluble mineral materials out of the upper portions of the mantle-rock by a process which is known as *eluviation* ("washing away"). These particles may be deposited later in the lower portions of the mantle-rock, or they may be carried away to the sea. Eluviation, like leaching, takes place most vigorously in warm rainy climates. Extreme eluviation tends to make surface soils coarser and less suitable for agriculture than soils which are only slightly affected by this process.

3. The growth of vegetation adds organic materials to the upper portions of the mantle-rock. The dead leaves, twigs, roots, and other litter which develop as byproducts of the lives of plants and animals slowly decompose under the attack of moisture and bacteria. Such partially decomposed organic material is known as humus. The *accumulation of humus* is the third important soil-making process. It takes place most effectively in cool climates where there are relatively few bacteria and insects to destroy the humus before it can accumulate.



All maturely developed soils exhibit these easily recognized horizons.

Soil Conservation Service

This is a photograph of an actual soil profile. Can you pick out the A, B, and C horizons?

The soil profile. These three processes turn the portions of the mantle-rock which they affect into the mixture of mineral and organic materials that is known as soil. Because the soil-making processes work on very different materials under very different conditions they produce a great variety of soils. The mineral materials in the original mantle-rock, the vegetation, the relative amounts of leaching and eluviation, the relationship between humus production and humus destruction, all help to determine the nature of any given soil.

All maturely developed soils, however, are alike in one regard: they are all divided into three rather easily recognized layers, or *horizons*, which students of soil call the A, B, and C horizons. A vertical cross section of these horizons is known as the soil profile. Soil profiles vary greatly from place to place, but they all have certain common characteristics.

As you can see in the diagram at the left, the A horizon, or *topsoil*, is the uppermost zone of the soil. It is the zone of greatest leaching and eluviation, processes which coarsen the texture of soil and reduce its fertility. It is also the zone of greatest accumulation of humus, a process which increases the fertility of soil. The value of any given topsoil for agricultural purposes is greatly affected by the degree in which the accumulation of humus makes up the losses which leaching and eluviation bring about.

The B horizon, or *subsoil*, is generally somewhat finer in texture than the A horizon because some of the leached and eluviated materials from the A horizon are deposited there. Lime, iron oxides, and alumina are deposited in the B horizon, and in many cases this enriches the soil for agricultural purposes. But if too much deposition takes place, tough layers of "hardpan," "gumbo," or "iron crust" develop in the B horizon and greatly reduce its value. Underneath the B horizon is the C horizon, which consists of the mantle-rock that has not been altered by the soil-making processes.

Needles and twigs that cover the ground in regions of cone-bearing forests make the soil highly acid.

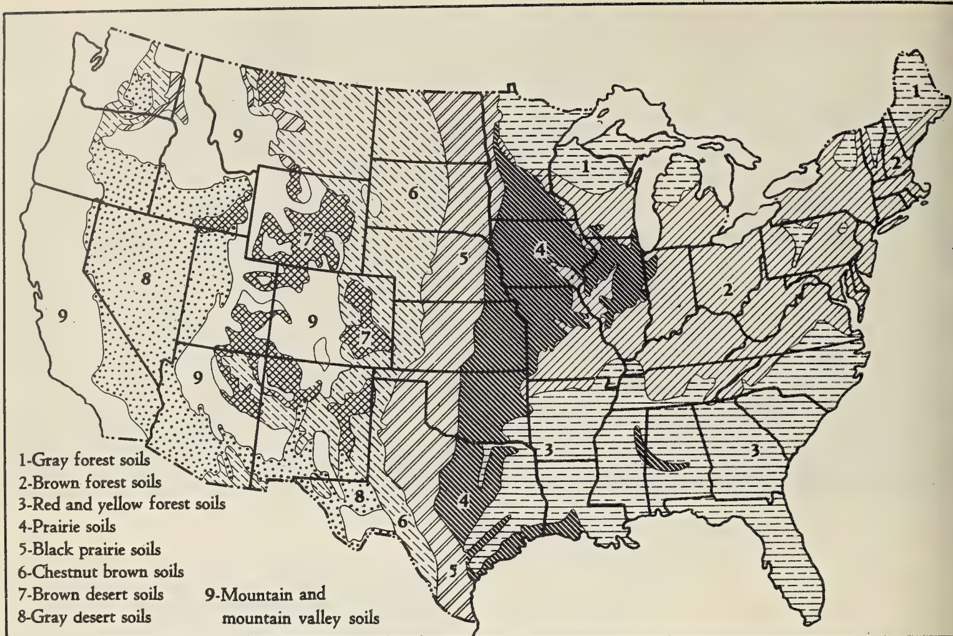
THE TYPES OF SOIL

Climate, vegetation, and soil. It should be obvious from what we have said above that climate plays an important part in the production of soil. Climate, in fact, is almost as clearly reflected in the soil as it is in the plants that grow in the soil. Because of this fact we can recognize widely different types of soil, just as we can recognize widely different types of vegetation. The major types of vegetation and soil are related not only to climate but also to one another. Most of the earth's soils, like most of the earth's vegetation, can be broadly distinguished as forest, grassland, and desert types.

Forest soils. Forest soils, like the forests themselves, reflect the humid conditions under which they exist. Iron and aluminum are among the most abundant mineral materials in the mantle-rock of all lands. In wet climates these two elements readily combine with oxygen to form what chemists call oxides. Such oxides are acid in nature, insoluble in water, and abundant in forest soils. Alkaline mineral materials, such as soda, potash, and magnesia, are soluble in water and therefore tend to get leached out of forest soils. Because most cultivated food plants need alkaline minerals for nourishment, they do not thrive in most forest soils.

Three chief types of forest soils can be recognized. The first type is found mainly in the high latitude belts of cone-bearing forests, where winters are long and cold and summers short and wet. Under such conditions the activity of bacteria and earthworms in the topsoil is reduced to a minimum. The litter of needles and other waste from the trees does not get very well mixed with the mineral materials of the A horizon of the soil. Most of the humus in these high latitude forests lies like a mat on top of the soil.

Slowly decaying, this cover of humus becomes highly acid, and so does the water that seeps through it. This acid water leaches the soluble minerals out of the topsoil (chiefly the brown oxide of iron), leaving it ashy gray in color. Deposition of iron oxides lower down produces a brownish



This map shows the distribution of the chief types of soil in the United States.

subsoil. Such soils are called *podsols* ("ashy soils") or simply *gray forest soils.* They are the chief soils of the great belts of evergreen forests in North America and Eurasia, and they rank among the least fertile soils or earth.

The soils of tropical and subtropical forests are very different from the podsols of the high latitudes. Under year-round warm moist conditions the humus of the forest floor is rapidly decayed and leached away. Soluble minerals in the soil are also carried away, and insoluble iron oxides are widely developed in both the A and the B horizon. This produces soils which are red or yellow in color and which are known as the *red and yellow forest soils.* (The colors are due to the red and yellow oxides of iron.) These soils are severely leached and therefore poor in the soluble mineral materials which cultivated plants must have. When cultivated, they must therefore be heavily and repeatedly fertilized. So treated, however, they may become very fertile.

Midway in both character and location between the gray forest soils and the red and yellow forest soils are the *brown forest soils* of middle latitude forests. The humus that develops from the broad-leaved trees of these forests is less acid than that which develops from the needles of high latitude cone-bearing forests. It is less rapidly destroyed by bacteria than the humus of subtropical and tropical forests. The result is soils of a brownish color with a fair amount of humus; these soils, though leached and eluviated, are still fairly rich in mineral foods. (The humus plus the brown oxide of iron gives this soil its color.) Brown forest soils are intensively cultivated in many regions; with proper care they can take their place among the better soils of the earth. The distribution of the chief types of forest soils in the United States is shown on the map above.

Grassland soils. Grassland soils, like forest soils, vary with the nature of the climate and the vegetation. Some of the most valuable soils on earth occur along the wet margins of the tall-grass grasslands, and are known as *prairie soils.* These soils are very dark, even in the B horizon, because the thick grass provides an abundance of humus which accumulates because the action of bacteria in the rather dry soils of subhumid climates is relatively slight. The subhumid climate also acts as a check on leaching and eluviation, processes which greatly reduce the fertility of soils in wetter climates. It also checks the tendency toward an accumulation of insoluble minerals in layers which interfere with plowing and with the even distribution of moisture.

Near the dry margins of the prairies, the true prairie soils give way to soils of even darker color which are known as the *black prairie soils.* These soils have been leached very little and the minerals that have been removed from the A horizon are generally deposited at fairly deep levels in the B horizon. This makes for extremely fertile soils, which, however, are less valuable than the true prairie soils because of the small amount of rainfall in the regions where they are developed.

On the steppes proper the black prairie soils give way to the *chestnut brown soils,* the lighter color of which results from the smaller amounts of humus which the shorter grasses produce. These soils, like all soils of arid and semiarid climates, are rich in lime and other soluble alkaline minerals; they are correspondingly poor in the acid oxides of iron and aluminum. As such, they are just the reverse of forest soils.

In many regions, lime dissolved from the A horizon of the chestnut brown soils is deposited in layers of hardpan near the top of the B horizon. This happens because under a semiarid climate the rain that penetrates the soil evaporates before it sinks very deep into the ground, thus quickly giving up the lime which it has leached from the topsoil.

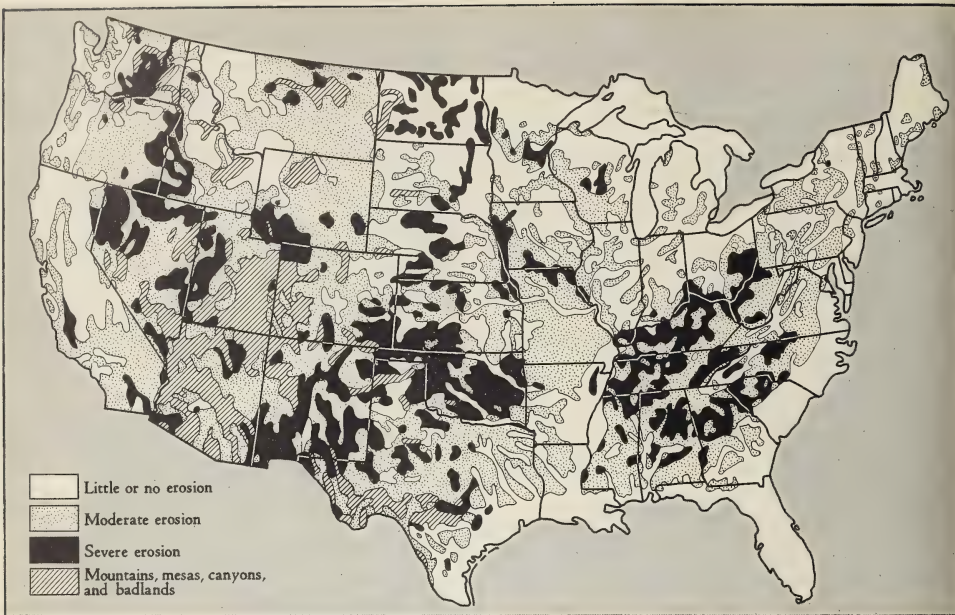
Atchison, Topeka, and Santa Fe Railway

The rocks in the foreground are pieces of petrified trees which grew when this part of Arizona was much more humid than it now is. Today the gray desert soils of this district support very little vegetation of any kind.

The presence of hardpan plus the low annual rainfall makes dry farming on these soils anything but an easy and profitable business. See the map on page 214 for the distribution of the chief types of grassland soils in the United States.

Desert soils. The soils of the wetter desert regions resemble those of the drier steppes. They are brown in color and they generally contain a layer of lime hardpan near the surface. Such *brown desert soils* are fertile in spite of their low amount of humus because they are only slightly leached. Where irrigated they produce rich crops.

The *gray desert soils* of the drier deserts, on the other hand, are the poorest of all soils. Hard crusts of alkaline materials, harmful to plants, are likely to be present in these soils very close to the surface. Where this is the case no amount of water can make the desert bloom. (See the map for the distribution of desert soils in the United States on page 214.)



This map shows how seriously wind, water, and abuse have injured the soils of the United States.

THE CONSERVATION OF SOILS

The fertility of soils. The types of soils described above produce—either directly or indirectly—about 85 per cent of all the raw materials used by man. The proper care of the soil is obviously one of the most important of all human problems. Each type of soil presents its own peculiar problems. All soils, however, are alike in one way in that they are all open to serious harm from cultivation and erosion.

Most farmers have learned that the minerals which cultivation takes from the soil must be returned through crop rotation and the use of fertilizers if the soil is to go on producing. Most farmers are just beginning to learn that *the body of the soil, as well as its fertility, can be lost.* They are just beginning to realize that soils which it took nature thousands of years to produce can be lost to erosion in a few years; that lost soils cannot be replaced in time to do the farmers or their children or their children's children any good. Men generally are just beginning to realize that they can no longer take the soil for granted; that such an attitude toward this invaluable resource in the past has brought agricultural lands all over the earth to the verge of disaster.

The map above will show you what men and erosion have done to the soils of the United States during the few brief decades of their agricultural history. Earlier in this book we have had glimpses of the influence of erosion on men. In the chapter before this we had glimpses of the influence of men on erosion. Let us try to discover all that the map means in terms of human mistakes and suffering, and to decide what human ingenuity and good sense can do about it.

The disharmony of earth and man. Everywhere beneath the activities of men are the activities of the earth. The central problem of human geography is to keep

Pictures, Inc.

Forces which are beyond human control cause such earthquake damage as is shown in this picture. Far greater damage is caused by other earth forces which men turn upon themselves.

these two types of activities in harmony. The forces that build the physical environment ordinarily work at a very slow pace. As long as the physical environment changes slowly, man can conveniently adjust the cultural environment to it. But if anything greatly speeds up the changes in the physical environment, chaos may fall upon the cultural environment and disaster upon men.

In 79 A.D. Vesuvius had been quiet for so long a time that the people who lived in the vicinity did not even know that the mountain was a volcano. Then suddenly Vesuvius burst into activity and buried the city of Pompeii under millions of tons of volcanic debris. On August 31, 1886, the people of Charleston, South Carolina, were having what seemed to be just another sultry summer night. Suddenly a roaring filled the earth and sky, waves began to churn the ground, and Charleston collapsed into rubble and dust. Such disasters, fortunately rare, result from a quickening of the rate of change in the physical environment. They are, in the words of an insurance policy, "acts of God," for which men cannot be held responsible.

Less dramatic but even worse disasters result from the acts of men. Everywhere on earth rain, running water, wind, and other physical forces are working to tear down the highlands and to build up the lowlands. Normally these forces of erosion and deposition work slowly because the earth's natural cover of vegetation acts as a shield against them. Normally they are not a menace to man.

When man destroys large portions of the protective shield of vegetation in building his cultural environment, he greatly speeds up the work of the physical forces. He turns erosion and deposition into enemies. He makes the physical environment change with a speed which all his great powers of

Soil Conservation Service

Soil Conservation Service

rapid adaptation cannot match. He creates, in short, a condition which is disastrous to himself: a physical environment which is out of harmony with the cultural environment.

The human geography of erosion. The chain of disaster that develops from the speeding up of changes in the physical environment is not everywhere linked up in the same way. Generally, however, it begins in the highlands with the destruction of forests. Most streams rise in hilly or mountainous country, which is normally covered with trees. When such country is cut or burned clean of its trees, it is powerless to fight off the attacks of rain and running water.

With no roots to absorb some of the rain, to check its downward flow, and to hold the soil in place, the land quickly becomes furrowed with gullies and stripped of soil. The main arteries of drainage become swollen and muddy with each downpour; their channels grow steadily deeper and wider at an abnormal rate of speed. These processes forge the first great link in the chain of disaster, *the link of destructive stream erosion.* (See photographs 1 and 2 at the left.)

Where streams of this sort converge upon the lowlands, particularly such lowlands as have been robbed of their natural vegetation, they form rivers that are a terrible menace to the people who live along their banks. Unable to contain the water that rushes into them, these rivers periodically overflow their banks and flood the settlements which have grown up there. Millions of human lives and billions of dollars have already been paid for the folly which has helped to make these rivers behave as they do. Their behavior forges the second great link in the chain of disaster, *the link of the destructive flood.* (See photograph 3 on this page.)

On plains and plateaus with arid or semiarid climates, deforestation, overgrazing, and overplowing produce their most disastrous effects. They open the land not only to the ravages of running water but also, as we saw in the last chapter, to the onslaughts of wind. Most of the grasslands of the world have suffered more from wind than from water erosion. Once sores are opened on these lands, the wind very rapidly enlarges them. In places great areas may be stripped of soil as thoroughly as if they had been swept by a broom. In other places, farms, roads, and fields may be buried under barren sand and dust. This third great link, which wind contributes to the chain of disaster, may be called *the link of the destructive dust storm.* (See photograph 1 on this page.)

The fourth and final link in the chain of disaster is *the link of poverty and forced migration.* Photograph 2 shows the abandoned home of a once prosperous farmer in the South. Water erosion gutted his farm and destroyed its fertility and with it his ability to make a living there. Photograph 3 shows a family of homeless people whose farm was suffocated by a dust storm and abandoned. These people and thousands like them are victims of ignorance of geography in action. They would not have suffered poverty and forced migration if everybody had realized the importance of the facts which we have just discussed.

Can the soil be saved? Every link in this chain of disaster is made possible by man's abuse of the soil. The only way to break the chain—wherever it has developed and however its links are arranged—is to do away with this abuse. We saw in the last chapter that the restoration and preservation of trees round the headwaters of streams, and of grasses on the windswept steppes, is absolutely essential in the fight against erosion. But though absolutely essential, the conservation of forests and grasslands is only part of the remedy for soil abuse.

Population is increasing nearly everywhere in the world, and with it the need for food, shelter, and clothing. The soil must produce most of these necessities, and many of the luxuries which people also de-

Soil Conservation Service

Soil Conservation Service

Photo by E. W. Jenkins

These onions were planted in straight rows which ran up and down the slopes of the land. One heavy rainstorm washed them completely out of the ground.

Contour planting helped to insure this splendid crop. By curving round the slopes in horizontal lines, the planted rows and furrows acted as little dams to check the flow of rain water.

Photo by James N. Meyer

mand. Clearly there is a limit to the amount of soil that can be withdrawn from human use. Equally clearly, the soil which is put to use must be raised to the highest possible level of productivity. Since many of the most essential uses of the soil involve the destruction of its cover of native vegetation, how can disastrous erosion be avoided? Are there any effective ways of preventing the erosion of farm lands? If rapid erosion and its resulting disasters are to be stopped in a country as a whole, they obviously must be stopped on the farm lands, as well as on the forest lands and grasslands.

Conservation of farm lands. There is no possible way of bringing back to the farm lands the soil which erosion has already carried to the sea. Fortunately, there are ways of slowing down erosion on these lands so that the soil will not be removed more rapidly than the processes of rock weathering can replace it. The chief methods of achieving this goal are as follows:

Soil Conservation Service

Alternating strips of corn, grain, and alfalfa guard this hilly farm against erosion.

1. *Contour planting.* Sloping land should never be planted in straight lines which go up and down hill and which block out the all too familiar pattern of oblong fields. (See the upper photograph on page 220.) Sloping land should be plowed in curved lines that follow contours. Contours are horizontal lines on the surface of a slope; a field that has been plowed and planted along such lines is shown in the lower photograph on page 220.

By such so-called contour planting, each furrow and planted row in a sloping field acts as a little dam to check the speed of the water that runs over the field after every rain. So checked, much of this water soaks into the ground; much soil that would otherwise be carried away remains in place. Ordinary "up and down" plowing and planting on sloping land has just the opposite effect. It turns many of the furrows into gutters that speed up the flow of water and make easy the removal of soil.

2. *Disk plowing.* Ordinary plowing turns over the soil, burying the stubble of plants and laying the soil open to the greedy fingers of water and wind. By so-called disk plowing the soil is broken by revolving metal disks; stubble is worked into the soil without destroying its effectiveness as a shield against erosion. Disk plowing should be practiced wherever it is practicable, and especially in regions where wind erosion is a menace.

3. *Cover cropping and strip cropping.* Cover crops are close-growing crops such as cereals and hay. Rye and certain other hardy cover crops can be used in many regions to anchor the soil of farm lands in winter, thus guarding the soil against erosion during periods of rain and thaw. Where sloping land is sown to such open-growing crops as corn and potatoes, strips of close-growing crops should be alternated with strips of the open-growing crops. (See the photograph above.) By this so-called strip cropping, the matted roots of the close-growing crops are made to act as dams and sponges to check the runoff

Soil Conservation Service Photo by Lowary

The terrace on the right of this strip of barley carries off rain water which might otherwise erode the plowed field below

of water and soil from the unguarded strips of the open-growing crops.

4. *Terraces and check dams.* Terraces built a few feet in height along the contour lines of sloping fields can be profitably used in many places with contour planting and strip cropping. Such terraces as are shown in the photograph on this page do much to retard the runoff of water and the loss of soil. Where gullies have begun to gnaw into a field, a check dam made of logs, saplings, stones, or wire netting will often check erosion and enable the land in time to heal its wounds.

By such methods as these, combined with the methods of forest and grassland conservation which we have already discussed, men can conquer the demon of erosion. They can reduce and perhaps even eliminate the more highly destructive varieties of dust storms, floods, and famines. Above all, they can save what is left of the eight or ten inches of topsoil in which their civilization and their very lives are rooted.

CORRECT THESE STATEMENTS

The following statements are partially or wholly false. Correct them and explain or discuss your corrections.

1. Soil is produced from mantle-rock wholly through the processes of leaching and eluviation.

2. All soils are useful for the same purposes because they all have the same profile.

3. Climate is the only important factor which affects the development of soil.

4. All forest soils are highly acid and not very productive.

5. Black prairie soils are very productive because of the accumulation of humus and extensive leaching.

6. The brown soils of steppes and middle latitude forests and the red and yellow soils of warm humid climates owe their color to the presence of humus.

7. Desert soils are of little value because of the absence of humus and the presence of alkaline crusts in the A horizon.

8. Soils occur everywhere, and since they are unlimited in quantity they require little care.

9. The erosion and deposition of rock materials are natural processes which men cannot affect.

10. Plowing straight up and down the slopes of hilly land makes furrows which carry off rain water before it can erode the soil.

11. Soil erosion, once started, is almost impossible to check.

QUESTIONS FOR DISCUSSION

1. What would you say are the chief causes of the differing colors of soil, and how is the color of a soil related to its fertility?

2. Do you know of any place in your neighborhood where soil erosion has occurred? Have you ever examined this place carefully? If so, what do you think are the causes of the erosion? What, in your opinion, are the remedies for it? Is anything being done in your community to retard or prevent soil erosion?

3. Many agricultural experts believe that some areas in the United States have soil which is too poor to be profitably farmed. What do you think should be done with these areas and with the people who are trying to make a living on farms in these areas?

THINGS TO DO

1. Perhaps there is an excavation for a house, for a pipeline, or for some other purpose in your neighborhood. If there is, examine the soil profile shown in this excavation. See if you can recognize the A, B, and C horizons. How thick is the A horizon and what color is it? Make a sketch of the soil profile, and if you have a camera photograph it. If there are several excavations in your neighborhood, compare the soil profiles of as many as you have time to visit.

2. The next time a heavy rain occurs in your community watch the process of soil erosion. Choose a slope where the ground has little or no grass or other plants growing on it. Observe how the rills and rivulets wash away the unprotected earth and leave little gully-like scars on the bare ground. Also, watch a slope which is covered with vegetation and see the effect of rainwash on a slope which is protected with plants. Write a summary of your observations.

3. Severe dust storms occurred in the Great Plains region in 1934. See how much information you can obtain from newspapers and news magazines of that year. Write a report on these dust storms, discussing the following topics: (1) areas affected by the dust storms; (2) description of a typical dust storm; (3) effect of the storms on local agriculture and land value; (4) effect on human beings and livestock: (5) causes of the storms; (6) how to prevent future dust storms.

If you write to the United States Department of Agriculture you can get further information on dust storms. Perhaps you know someone who has seen a dust storm of this kind and can give you valuable information.

4. Millions of dollars have been spent to check floods along the valley of the lower Mississippi River. Look up and make a report on (1) how this money has been spent; (2) how flood control measures on the lower Mississippi are related to conservation measures farther north; (3) how soil erosion by the Mississippi has affected the farm lands of the regions which this river and its tributaries drain.

BOOKS TO READ

1. The farmer has many problems, all intimately related to the soil. You will find no better statement of these problems than in the first hundred pages of *Farmers in a Changing World*, the 1940 Yearbook of Agriculture published by the United States Department of Agriculture.

2. We have seen in this unit that the conservation of all living resources is tied up with the conservation of soil. A few books that will give you a broad picture of the general problem of conservation have been already recommended. Other readable books of this type are *America Begins Again*, by KATHERINE GLOVER, and *Pandora's Box*, by MARIAN BAER. A reliable and not too difficult reference book on all phases of conservation is *Conservation in the United States*, by AXEL F. GUSTAFSON and other members of the faculty of Cornell University.

3. The causes and results of soil erosion have nowhere been better set forth in words than in *Deserts on the March*, by PAUL B. SEARS. They have nowhere been better set forth in pictures than in the United States documentary films *The Plow That Broke the Plains* and *The River*. *The River*, by PARE LORENZ (the man who made the film of that name), is an excellent book with many illustrations, based on the script of the film.

XIII · THE MINERAL RESOURCES

MINERAL RESOURCES OTHER THAN METALS, FUELS, AND WATER

The importance of mineral materials. The crude mineral materials that make up nearly all the planet on which we live enter our lives in many ways. We have already seen how important some of these materials are to us through their contribution to the bodies of plants and animals and to the soils. Mineral materials are also important to us in many more direct ways. Such terms as "Stone Age," "Bronze Age," "Iron Age," "Coal Age," and "Oil Age" testify to the direct importance of the mineral resources in human life. They also suggest that human history shows a progressive development which corresponds with the discovery and development of different types of mineral resources. This is not strictly true because these mineral "ages" are really "stages" of culture rather than periods of time.

The history of the use of mineral resources has not been the same for all men. Even today, for example, the Australian bushmen know little about the uses of metal; they have lived in a "Stone Age" of culture from the beginning of their history. The primitive natives of inner New Guinea, on the other hand, jumped from the "Stone Age" to the "Oil Age," without passing through any other mineral "ages," when the Second World War moved on wings into their jungle retreats.

It is true, on the other hand, that the history of mankind *in general* tells a story of the progressive development of different types of mineral resources from the more abundant and simpler to the rarer and more complex. The common rocks of the earth's crust were certainly the first mineral materials to be widely used by human beings as a whole. Then came the use of such common metals as copper, bronze, and iron. Still later came the use of the mineral fuels and a host of relatively rare and complicated mineral materials of many types.

As mankind in general progressed through these different mineral "ages," men did not abandon the use of one type of mineral resources when they began to develop another type. If you think of the "Stone Age" as being far in the past, just look at the photograph of modern New York on page 225. Nearly everything you see in that photograph is stone, or such stony materials as glass, brick, and concrete. Modern men use every kind of stone that the ancients used, and a great many kinds that the ancients did not use. Modern men, in short, are still in the "Stone Age"—and in every other mineral "age" that has ever been described. Mineral resources are the framework of the modern world.

The building stones. The mineral resources of the world, exclusive of soils, are of four main types: (1) mineral materials other than metals, fuels, and water, (2) metals, (3) fuels, (4) water. On all the lands of the earth the materials of the first type are much the most abundant and the most evenly distributed of all the mineral resources. Some fifty different mineral materials other than metals, fuels, and water are widely used by modern man, some of them in their natural state and some as ingredients in manufactured articles.

Since the very dawn of human history, men have used the common rocks of the earth's crust to build dwellings and other structures. Nearly everywhere you go today you can see such rocks as granite, marble, limestone, slate, and sandstone woven into the fabric of the cultural environment. Man is a master builder, and stone is the most durable of building materials. Structures made of lumber are open to attack by fire, moisture, and boring insects. Structures made of metal are open to attack by rust and other chemical forces of destruction. Structures made of stone, though not everlasting, will stand for centuries after other types of structures have crumbled away.

Natural building stone is so expensive to move that most of it finds its way into the cultural environment very close to the localities where it is quarried from the physical environment. Certain local building stones, however, are especially distinguished for beauty or durability, or for the ease with which they can be cut and trimmed for use. Such building stones have a wide distribution. The granites of northern New England, for example, have found their way into many a tombstone, monument, and building far from home. The slates and marbles of this same region have also traveled far, and so have the beautiful marbles of Italy and the adaptable limestones of Indiana.

Many stony building materials in common use are manufactured products, but they are made chiefly of sand, clay, and lime. Sand is widely used in making glass, mortar, concrete, and molds for iron foundries. Clay is universally used in bricks, cement, sewer pipes, tiles, and pottery. Hoover Dam, on the Colorado River, and Grand Coulee Dam, on the Columbia River, are two of the greatest monuments that were ever erected to the engineering genius of men. Together they will increase the available water power of the United States by 25 per cent, and will irrigate land surfaces the total area of which will be much larger than the area of Texas. These great dams are also monuments to the importance of common mineral materials in the modern world. They are made very largely of lime, clay, sand, and crushed stone.

Chemical uses of mineral materials. Many mineral materials other than metals, fuels, and water are valuable to man because of their chemical qualities. *Limestone* is perhaps the most widely used of all the mineral resources. It supplies cut stone for

By Ewing Galloway, N.Y.

The skyscrapers of New York testify that the Stone Age of human culture has not passed.

buildings, crushed stone for roads, and lime for mortar, cement, and concrete. It also has many chemical uses: as "flux" to remove iron from its ores; as a cure for "sour" (acid) soils; as a necessary chemical in tanning hides, refining sugar, and manufacturing glass.

Salt is another mineral material of many uses; its value to man only begins with its ability to make his food taste good. Salt is one of the most effective and least harmful preservatives for food, and is widely used as a preservative for fish and meat. It is also a necessary chemical in the manufacture of soda and other products. Fortunately, it is one of the most evenly distributed of the

Texas Gulf Sulfur Company

In Texas, sulfur in underground deposits is melted by steam and forced to the surface through pipes. There it hardens into such chemically pure sulfur as is shown in this photograph.

indispensable minerals. Practically every great industrial area on earth has access to a cheap and abundant supply of salt.

Sulfur is another mineral resource on which modern civilization leans heavily. Enormous quantities of sulfuric acid are made from sulfur and used in an enormous variety of industries. The rubber and paper industries could not exist without sulfur; matches, gunpowder, fireworks, insecticides, and many drugs consume many tons of it every year. Italy, Spain, Japan, and Chile, all have rich deposits of this mineral, but Louisiana and Texas produce about four fifths of the world's supply.

Perhaps the most important use of the mineral materials other than metals, fuels, and water is as sources of nitrogen, phosphorus, and potassium. These chemical elements combine with other elements to form the soluble nitrates, phosphates, and potash which are so necessary to the lives of plants. A ton of wheat takes 47 pounds of nitrate, 18 pounds of phosphate, and 12 pounds of potash out of the soil. There are various ways of putting these absolutely essential mineral materials back into the soil of croplands; one of the best ways is that of treating the soil with mineral fertilizers.

The desolate Atacama Desert of Chile contains the only extensive deposits of natural *nitrates* on earth. The Chilean government and nitrate producers long enjoyed nearly complete control of the distribution of this valuable mineral resource. Scientists in other countries, however, broke the monopoly by inventing a process for extracting nitrogen from the air. Today any country that has abundant fuel or water power, which this process requires, can get all the nitrogen it needs for fertilizer (and unfortunately for bombs too) without access to deposits of natural nitrate. Nitrates can also be made from ammonia and sulfuric acid, a method that yields about half the nitrates used in the United States.

The world is much better supplied with natural *phosphates* than with natural nitrates. Phosphate deposits in Florida, Tennessee, Kentucky, and North Africa produce most of the phosphate rock that is used for fertilizer today. There are other rich deposits in the United States and elsewhere that have scarcely been touched. The great *potash* deposits of the world, on the other hand, are concentrated in Germany. With the two world wars, however, many smaller deposits in many other countries have been developed.

The minor nonmetallic minerals. There are many minor nonmetallic mineral resources which the modern world finds extremely useful. There is *asbestos*, for example, the importance of which has grown as the need for brake lining has increased, and which is also in great demand for fireproofing and insulating purposes. There are *gems* (especially diamonds), which are used in jewelry and in many more practical devices; *gypsum*, which is used in plasterboard and stucco; *mica*, which is used for a variety of electrical purposes. There are *barite*, which goes into paint, *borax*, which goes into cleaning powders, and a host of other mineral materials too numerous to mention.

THE METAL RESOURCES

The discovery of metals. The use of metals is so widespread and varied in the modern world that it would be hard to imagine a world in which metals did not exist. Yet up to relatively recent times that is the kind of world in which all men lived. Metals, of course, did not suddenly spring into being; like all other mineral resources, they are the result of processes which needed eons of time to reach completion. The metals that men are using today were all in existence long before the first man was born, but men were not aware of this fact during most of their own existence. Though there are many things that archeologists and historians do not know about the history of man, there is one thing about which they all agree: *During most of his existence man has lived in a stone age of culture.*

Jets of water are used for breaking up this soft surface deposit of phosphates in Florida.

American Agricultural Chemical Co.

Smelting, which unlocks the harder metals from their ores, was probably discovered by some primitive man who noticed that certain dull stones gave off shining substances when heated.

Why, when metal is obviously superior to stone for so many purposes, did men wait so long before putting the metals to use? The answer is simple enough. Stone and nearly all the stony materials that we have just discussed can be used in their natural state. In nearly all cases their possible uses are either immediately apparent to the eye or comparatively easy to discover. Nearly all metals in their natural state, on the other hand, are both disguised and imprisoned in the earth.

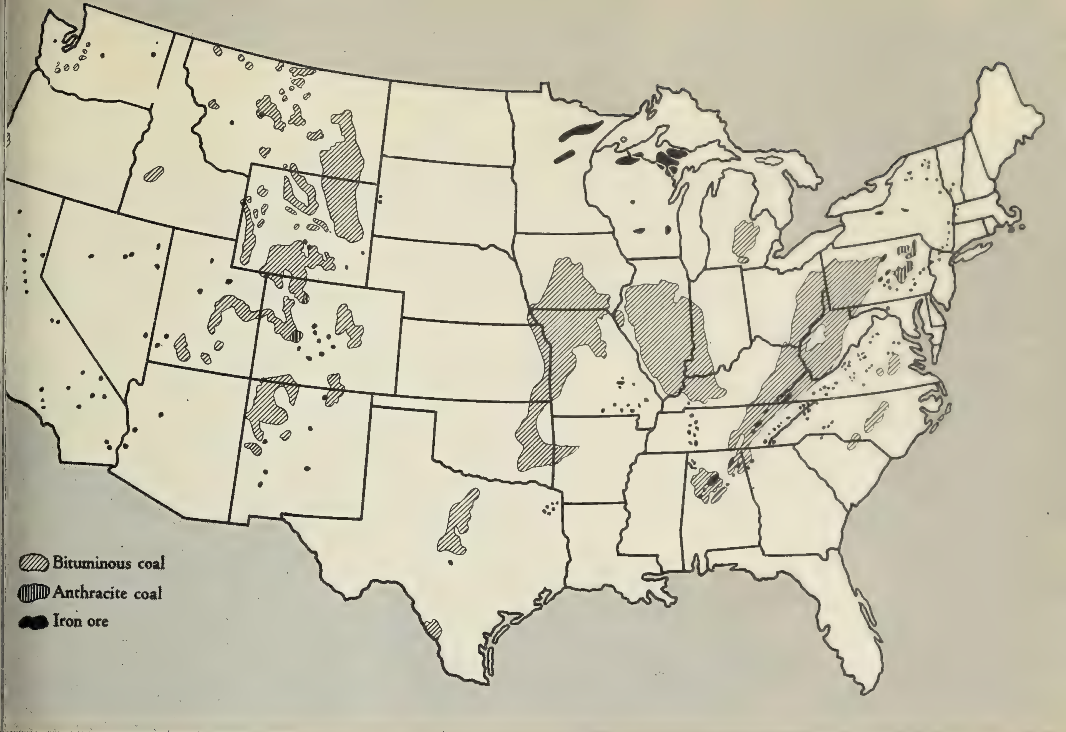
Few metals, as they occur in the rocks of the earth's crust, are the hard, heavy, shiny materials which the word "metal" suggests. Most metals are bound to other mineral materials in what chemists call compounds, and most of these compounds do not in any way resemble metals. People all over the world during most of human history used stone for weapons and utensils simply because they could break neither the disguises that conceal most metals nor the locks that imprison them.

There are a few metals that occur in a "free," or "native," state, which means that in their natural state they are not chemically combined with other mineral materials. In such a state they have the glitter which distinguishes pure metals from other mineral materials and which makes them easy to see. Gold, silver, and copper are metals that occur "free" in many regions. It is doubtless because of this fact that these metals were the first to be used by man. Unfortunately, all these metals are soft and therefore unsuitable for use in the weapons on which the lives of primitive men depended. Men did not really develop a true metal culture until they discovered the art of unlocking the harder metals from their compounds.

This discovery was probably made—as so many of the greatest discoveries have been made—by accident. Perhaps round some primitive campfire some unnamed genius noticed that certain stones gave off shiny substances when heated. From that point on, the natural curiosity and inventiveness of men doubtless led to the knowledge of how to extract metals from the rocks by the use of fire. Once smelting (as this process is called) had become common knowledge, the place of metals in human life was assured.

Iron in the modern world. One of the first metals—possibly the very first metal—to be freed from its compounds was iron. Hard, abundant, and widely distributed over the surface of the earth, iron rapidly became important in the world of men. Since its discovery some few thousands of years ago, iron has steadily increased in usefulness. Today it is by far the most valuable of all the metals, serving more vital purposes in our machine civilization than all other metals combined.

Perhaps you have noticed how many rocks and soils are red, brown, or tan in color. These colors reveal the presence of iron compounds, which are much the most common pigments in nature. In most places, however, these compounds are spread too thinly to be valuable as sources of metallic iron. Iron mining is profitable in most



In the United States, rich deposits of iron ore are conveniently close to rich deposits of coal. Both are conveniently close to great industrial centers.

places only where the iron compounds are so concentrated that the rocks in which they occur contain 50 per cent or more of metallic iron. Such rocks are known as iron *ores*. No deposit of mineral materials can be called an ore unless the valuable materials can be extracted from the worthless materials at a profit.

The value of the ores of all metals is partly determined by factors other than the percentage of metal which the ores contain. Many deposits of metal-bearing rocks are hard to mine. Many lie far from the places where they can be cheaply smelted and their metals easily distributed. Many contain impurities which are difficult to remove but which must be removed if the metal is to be of any value. These factors not only help to determine the value of any given body of ore; in many cases they determine whether or not a metal-bearing deposit is worth mining.

Iron ores must not only contain a high percentage of iron but must also be near to cheap sources of the fuel and limestone which are necessary for smelting them. One reason for the industrial supremacy of the United States in the modern world is that it has large, rich deposits of iron-bearing rocks which can be cheaply smelted because they are near to large, rich deposits of coal and limestone. The map on this page shows the location of the iron and coal deposits.

For many years the deposit of iron ore in the famous Mesabi Range of Minnesota has been the most productive deposit of its kind on earth because it has everything a good deposit of iron ore should have. It is rich in iron and extremely large. It lies near the surface of the earth and is soft enough to be mined with steam or electric shovels. The ore can be cheaply transported by boat to ports on the Great Lakes where much of it

By Ewing Galloway, N.Y

These ore trains in the outskirts of Duluth came from the rich iron ranges of Minnesota. The ore will be shipped from Duluth to other Great Lake ports in Illinois, Indiana, Ohio, and New York

is smelted and manufactured into iron and steel. Some of the ore goes by train from the lake ports to other iron and steel centers to the south and east.

The political geography of iron ore. Iron is more important to modern man than any other metal. The industrial security and expansion of nations everywhere depend on their ability to get plenty of iron ore and plenty of coking coal to smelt it. The uneven distribution of iron ore and coal in the crust of the earth does not everywhere favor the industrial ambitions of nations. This leads to endless economic and political friction between the "have" and the "have not" nations. In more than one instance it has helped to breed war.

The United States is fortunate in having within its own borders all the raw materials which are necessary for its great iron industries. It is doubly fortunate in being far removed from less well-endowed nations that might covet this wealth to the point o aggression. The Soviet Union, like the United States, possesses vast deposits o iron ore and coal, which are more than ade quate for its needs. Some of the richest o these deposits, however, are open to aggres sion from the west. Germany's invasion o Russia during the Second World War wa partly the result of her desire to possess th great iron deposits of Krivoi Rog in th Ukraine and the nearby coal fields of th Donets Basin.

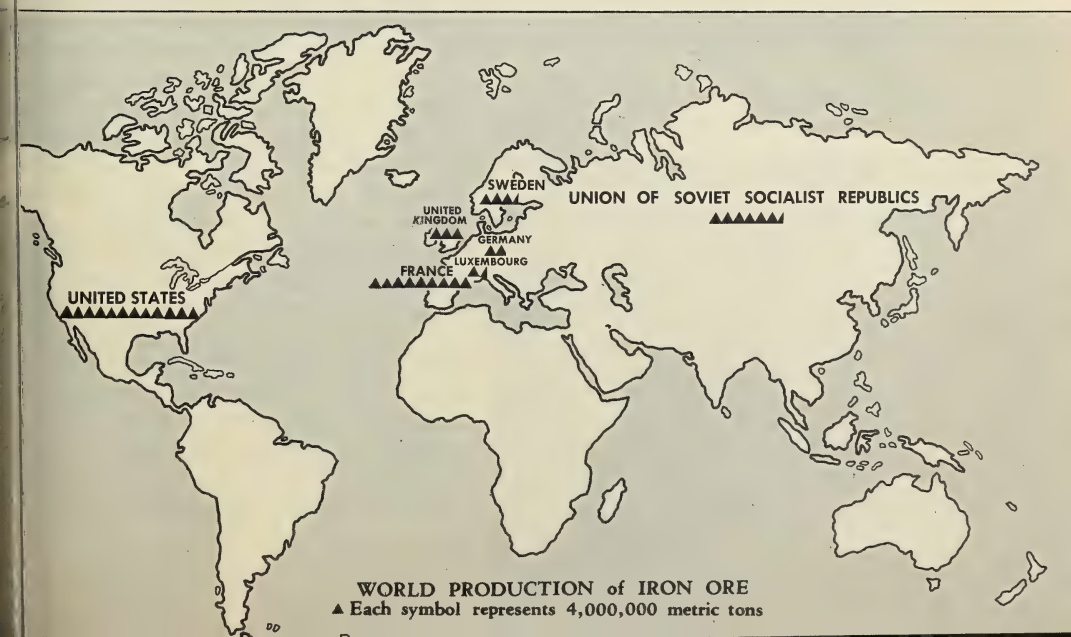
The United States and Russia are two o the three greatest iron-using regions o earth. The third is Western and Centra Europe. Many of the political storms of thi region have revolved round iron and coa Some of the nations of this region are ric in these resources and some are poor; som have enough coal to smelt the iron whic their industries require, but not enough iro ore; some have enough iron ore, but no nough coal. *Not one nation of Western and Central Europe has all the iron ore and all the coal it needs.*

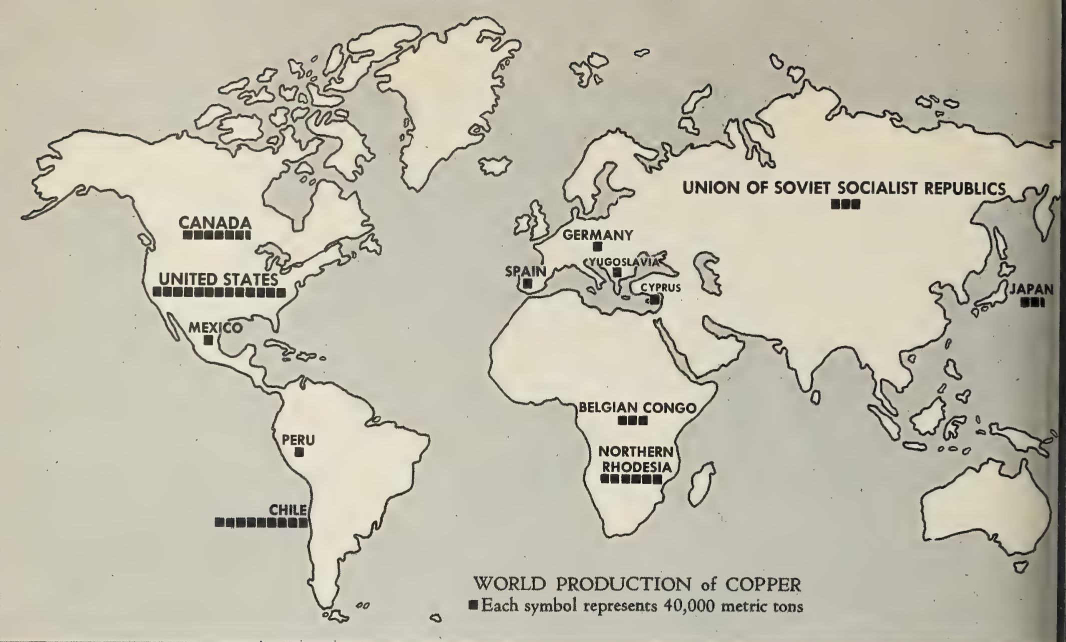
Before the Second World War, Great Britain, with plenty of coal but only about half the iron ore it needed, imported iron ore from Sweden, Spain, and Newfoundland. Sweden, with almost no coal, exported its extremely high-grade iron ore chiefly to Great Britain and Germany. Germany and Belgium, rich in coal but poor in iron ore, sold coal to France and other countries, and bought ore. France, with the most valuable iron deposits of the entire region but short of coal, sold ore to Germany, Belgium, and other countries, and bought coal. Though an international syndicate of steel companies was successfully reducing the friction that developed out of this international trading, Germany decided in 1939 to simplify matters further by seizing control of all the coal and iron ore of the entire region.

Iron ore and coal have also helped to breed international friction and war in the Orient. Japan developed into a great industrial nation with hardly any iron deposits or coal fields of its own. The rich coal fields of China were one of the reasons for Japan's invasion of that nation in the early 1930's. The iron deposits of China, though small, were doubtless not overlooked by Japan, whose own deposits were even smaller. It is obvious from all this that one of the most desperate needs of the modern world is economic and political agreements between industrial nations that will make up for the inequalities in the distribution of iron and coal. Unless such agreements are made—and made to work—wars will continue to be waged.

Other important metals. Copper, like iron, is one of the oldest metals known to man. It is second in importance only to iron in the world today. Copper did not really come into its own until the electrical industries began to expand, toward the close of the nineteenth century. Copper is a good conductor of electricity and it can easily be drawn into wire. The United States is the richest of all nations in copper, as the map on page 232 will show. (The production maps in this chapter are based on conditions just prior to the Second World War.)

The United States, France, and the Soviet Union lead the world in the production of iron ore.





The United States produces much more copper than any other country on earth.

Unlike iron and copper, *aluminum* has just begun to play an important part in modern life. Though the commonest of all metals, it is so well hidden and so securely locked in its dull earthy ores that none of it was even seen until 1825. Not until 1886 was a method perfected for producing large quantities of metallic aluminum at a profit.

Airplane propellers of aluminum alloys are light, strong, and resistant to chemical decay.

Life Magazine

This method requires such tremendou resources of power that only countries wit much cheap water power can generate th electricity which is necessary to extract thi metal from its ores. Here, again, the Unite States is blessed. Even before the Secon World War aluminum stood fifth in im portance among the metals which this na tion produced. With the war, the produc tion of aluminum was increased to amoun which at this writing are still steadily in creasing. Whatever the production of th future may prove to be, it will certainly b enough to put aluminum very close to th top of the list of important metals.

The great value of aluminum in war de rives from its lightness. This property plu its strength when alloyed with other meta —to say nothing of its freedom from chem cal decay—makes it the ideal metal for ai planes. But aluminum is also ideal for au tomobiles, trains, and a great variety o utensils. It is still more expensive than stee but ways of reducing its cost—and thereb extending its use—will doubtless be foun

Courtesy of Canadian Pacific Railway

This mine at Juneau, Alaska, has produced a great many millions of dollars' worth of gold.

Next in importance to iron, copper, and aluminum—the Big Three among the metals—come *lead* and *zinc*. Though very different in properties, these two metals are twins that are generally found together in the rocks. Both have been prized by men for many centuries because of their varied usefulness. Today lead is used chiefly in storage batteries, paints, and pipes; zinc is used chiefly in dry batteries, paint, and as a coating to keep iron objects from rusting. Here, once more, the United States leads the world—in both production and consumption.

Among the minor metals of importance in industry *tin* is the most abundant. The ancients used a great deal of bronze, an alloy of tin and copper. Today tin is used chiefly for coating "tin" cans (which are made mostly of iron). It is also used in the manufacture of bearings, and of "tin" foil (an alloy of tin and lead), and in a variety of other products. The United States, which is so rich in so many metals, has practically no deposits of tin. Before the Second World War it used about half the world supply of this metal, which it bought from British Malaya and the Netherlands Indies. With the Japanese conquest of southeastern Asia it had to get its tin from Bolivia and Nigeria, the only other regions on earth with large reserves of tin ore.

Some metals are valued chiefly because they are rare. *Platinum*, which is mined chiefly in Russia and South America, is such a metal. Though platinum is no more beautiful than silver, it is more highly prized for mounting precious stones simply because it is rarer and therefore more expensive. *Gold* is similarly prized for its rarity but also for its great beauty. It has been used chiefly in jewelry and objects of art, and until recently in coins. *Silver*, though much more abundant than platinum and gold, ranks as a "precious" metal and partakes of many of the luxury uses of such metals. All these "precious" metals have certain industrial uses too, but these are of little importance.

The alloys. The art of mixing metals to form alloys is one of the most ancient of human skills. Thousands of years ago men discovered that if tin and copper are melted together, the resulting metal (bronze) is harder—and therefore more suitable for weapons, tools, and works of art—than either of the metals in a pure condition. Ever since that day men have been experimenting with alloys. The need for new alloys, with special properties for special purposes, is repeatedly felt as industry expands. Metallurgists have met this need by variously combining a comparatively small number of metals into a great number of alloys, just as the makers of our language have used the same few letters to create a great many words. The number of useful alloys is increasing every year.

Iron is the heart of all steel, but nearly all steel contains metal other than iron. *Manganese*, for example, is added to iron to make a type of steel that expands and contracts very little when heated and cooled. *Nickel* has become practically indispensable to the iron and steel industries because it adds the toughness and elasticity to steel which so much modern machinery must possess. *Chromium* when added to steel helps to prevent rusting; such steel is used in "stainless" steel cutlery and in many modern streamlined trains. *Vanadium*, *tungsten*, and *molybdenum* are alloyed with steel to make it hard and tough. All told, there are some 500 varieties of steel in use today and nearly all are alloys of iron and other metals.

This mine near Sudbury, Ontario, produces nickel ore. The Canadian nickel deposits, richest on earth, were discovered by accident when a railroad cut was being excavated.

Courtesy of Canadian National Railways

Steel alloys make up only part of the alloys that have become important in modern civilization. The geographic significance of these metallic mixtures lies in the fact that they raise to great importance a variety of metals that are relatively rare. None of the metals that are mixed with iron to make the various alloys of steel are very abundant; yet some of them have become as essential to industry as iron itself. In peacetime such relatively rare metals are therefore of extreme economic importance; in wartime they take on extreme strategic importance. At all times their rarity and uneven distribution greatly complicate the political and economic relationships of nations.

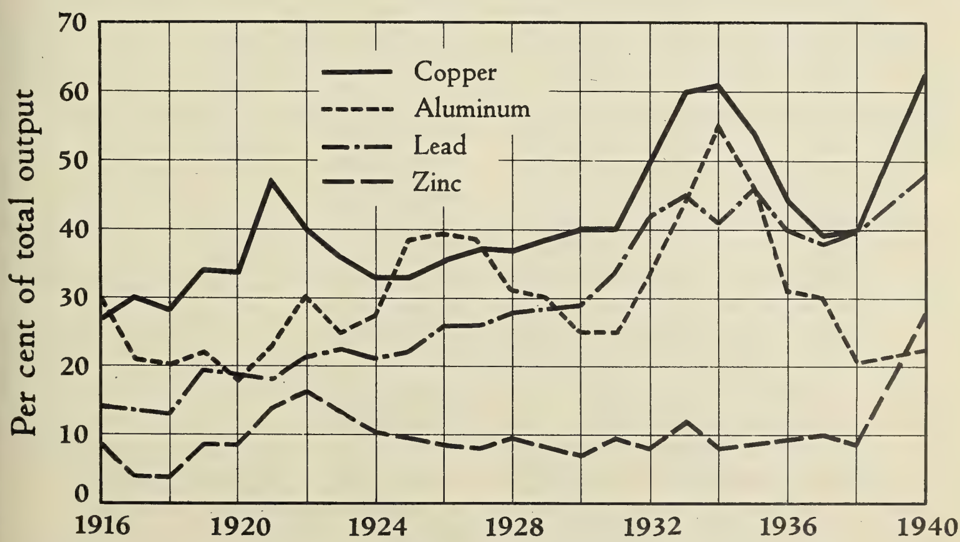
The future of metals. Even the commonest metals are relatively rare ingredients in the mineral make-up of the earth. And metals are not like crops that can be replanted from year to year; once harvested, they are gone—for all practical purposes—forever. The civilized world is already suffering from a shortage of certain metals. What can man do to postpone the day when all metals will have been consumed? Fortunately, there are several things he can do.

He can search for new supplies of metals in the remoter corners of the earth. He can develop methods for using many extensive deposits of low-grade ores which have not generally invited exploitation while high-grade ores have been abundant. In the United States the discovery of new ore bodies steadily declined from 1880 to the outbreak of the Second World War. The war greatly increased the demand for all metals in all the participating countries, and led to the discovery and development of many ore deposits that had previously been overlooked. It also stimulated the search for more economical methods of extracting metals from their ores. It thus increased the metal reserves of the world, but not nearly enough to offset the waste of metals which is part of the price that man must pay for mechanical warfare.

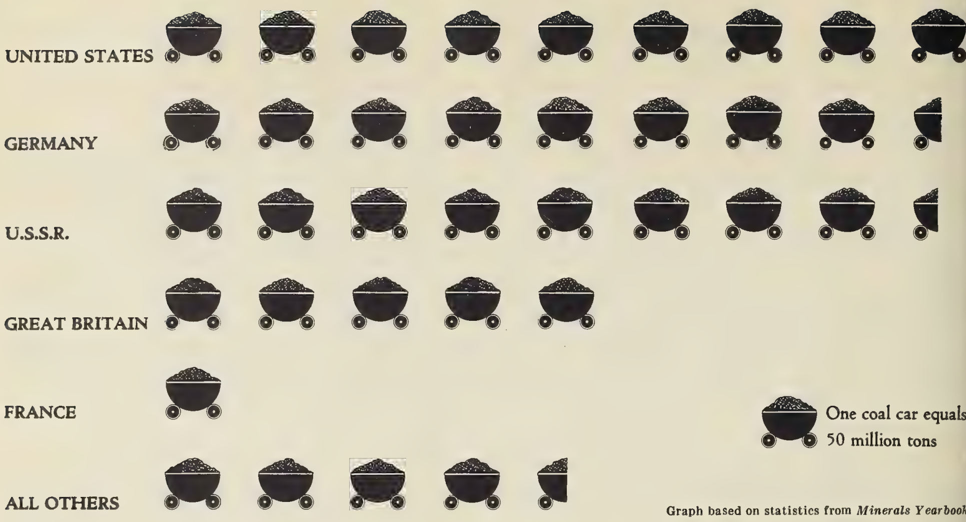
The great new development of plastics, and of nonmetallic lacquers and enamels, will doubtless continue to reduce the demand for metals in many ways. The use of scrap metal has already lessened the drain on the world's metallic ore reserves. Before the Second World War greatly stepped up the demand for steel, about one third of the steel produced in the United States was made from metal that had been used before. Considerable percentages of the production of other important metals were also derived from scrap, as the graph on this page will show.

Wasteful mining methods have destroyed untold quantities of the world's richest metal reserves, especially in the United States. All metal ores are associated with worthless rock, which must be weeded out at the mine. Careless mining has weeded out much of the ore along with the rock. It has also destroyed great blocks of rich ore in many mines through cave-ins caused by bad engineering and improper timbering of shafts.

Fortunately, such abuses are steadily growing rarer. Nearly everywhere both mining and smelting methods are steadily improving. In one way or another the world reserves of metals can be made to last a long time. An aid to this end is the sobering realization, every year becoming more widespread, that *every ton of metal that is wasted or used is a ton subtracted from a definitely limited supply.*



This graph shows how much of the total United States production of four important metals was derived from scrap during the years before the outbreak of the Second World War.



This graph shows the yearly production of coal during 1938–1940. During 1941–1945, the average annual production of coal in the United States increased to 635,714,000 tons.

THE FUEL RESOURCES

The importance of mineral fuels. The mineral resources that we have studied so far go into the building of the modern world. Let us now turn to the mineral resources that run the world. Action is the essence of human geography, and action requires energy. The energy that ran the ancient world came chiefly from muscle and wood. The energy that runs the modern world comes chiefly from coal and petroleum.

Most of the energy that turns the machinery of our Machine Age is in the form of heat which comes from the burning of coal and petroleum. Coal warms innumerable buildings and keeps innumerable factories, smelters, power plants, and railroads in operation. Petroleum moves millions of airplanes, automobiles, ships, and trains, heats many buildings, and runs many industries. The gases which are associated with both coal and petroleum are widely used for heating, cooling, and cooking. These heat-yielding mineral materials are called mineral fuels. Without them civilization, as we know it today, obviously could not exist.

Men were slow in recognizing the value of metals, but they were even slower in recognizing the value of mineral fuels. The ancients rather generally knew that coal would burn, but they preferred wood for fuel. The early Egyptians embalmed their dead with petroleum and the early Romans burned it in their lamps. But a realization of the tremendous possibilities of these minerals as sources of energy did not begin to dawn on men until well into the nineteenth century. Not until the steam engine and the gasoline engine were invented did coal and petroleum begin to play really important parts in human affairs. Today these mineral fuels are the very foundations of modern life.

The origin of coal. Coal deposits are more easy to discover and to exploit than petroleum deposits because they lie for the most part closer to the surface of the ground. Coal, as a result, came into widespread use some decades before petroleum did. But for many long ages the coal seams of the earth lay in their rocky beds, undisturbed by men.

Coal is a product of sun, vegetation, swampy land, and time. It originated at several different periods of the geological past when climates were mild and great swamps lay upon the lands. The lush plants that grew in these swamps covered the bottoms with decaying vegetation when they died. This dead vegetation was slowly built up into layers that were separated from one another by layers of sand and mud which from time to time the rivers and the sea washed in.

As time went on, bacteria continuously worked on the decaying plants, drawing out more and more of the oxygen and leaving behind larger and larger percentages of the carbon, of which vegetable matter is chiefly composed. Compressed by the growing weight of the sediments above, and in some cases squeezed by movements in the earth below, the layers of vegetable material lost more and more of their gaseous ingredients with time. Today these layers are made chiefly of carbon and are known as coal. The sand and mud that were laid down with the vegetable materials are now compressed and cemented into layers of rock.

The varieties and distribution of coal. Carbon is the substance that gives coal its color and makes it burn. It is the bottled energy of sunshine that fell upon the earth many millions of years ago. All coal can be divided into three great varieties on the basis of its carbon content.

1. *Lignite*, or brown coal, has the lowest carbon and the highest water content of all coals. It is the least valuable of coals for these reasons and also because it crumbles and shrinks when exposed to the air. Much of the world's lignite is in North America and nearly all is still unused.

2. *Bituminous*, or soft, coal contains much more carbon than lignite does and is therefore darker in color. It also contains a considerable amount of gas. Being soft, it is dirty to handle, and it is likely to give off a dirty smoke when burned. It is much the most abundant and widely distributed of all the varieties of coal. Most of the coal that modern industries use is bituminous. Certain types of bituminous coal are used in the manufacture of coke, which is used in smelting iron ore. All continents except South America and Africa are well supplied with this kind of coal; the United States, the Soviet Union, and China are the three best supplied nations.

3. *Anthracite*, or hard coal, is the highest of all types of coal in carbon and the lowest in gas. It is the cleanest, hottest, and most valuable of all the types. It is also the rarest. In no country does anthracite make up a large percentage of the coal reserves. Even the United States, richest of all nations in coal, has relatively little anthracite, as the map on page 229 will show.

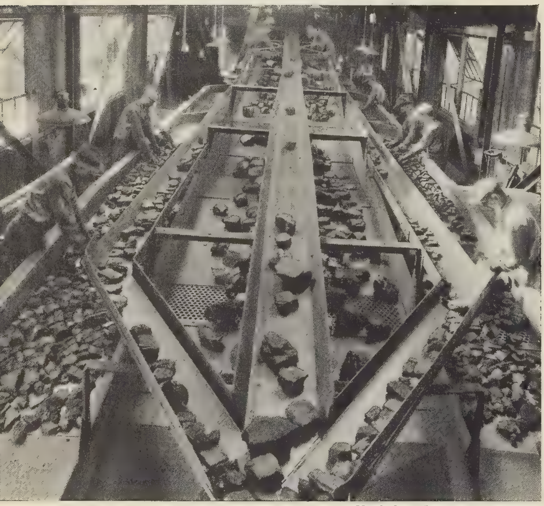
How coal is mined. Valuable coal seams vary from a few inches to several feet in thickness. In a few places the seams are so close to the surface that they can be mined in open pits with steam or electric shovels. Such *strip mining*, as this method is called, is the cheapest, safest, and least common way of extracting coal from the earth.

Most coal seams are too deeply buried under layers of worthless rock to make this type of mining practicable. In most regions the coal must be reached by vertical shafts which connect with horizontal tunnels, or "drifts," at various levels. This so-called *shaft and drift mining* honeycombs the earth to a pattern which resembles the hallways on the different floors of a hotel. Opening off the tunnels are hotel-like "rooms," where the coal is mined. In an up-to-date coal mine the coal is removed from the seams by electric cutting machines and carried to the surface of the earth in electric cars. There it is separated from the chunks of worthless rock with which it is mixed, sorted into various sizes, dumped into coal cars, and sent to a waiting world. (See the photographs on page 238.)

Coal mining, even with modern equipment, is a dangerous business. The gases associated with coal are both poisonous and

Bureau of Mines

Electric drills loosen the coal in the seams.



Norfolk and Western Railway

The coal is sorted on picking tables.

Coal tipples load the coal into railroad cars.

James Sawders

explosive; the rocks in which coal is embedded are treacherously shifty. Many coal mining towns are drab and depressing; many coal miners are unhealthy and unhappy. The social problems of coal mining have many causes, but they are all rooted in the geographic fact that this occupation is a dirty and dangerous way of life. Much has already been done to improve the physical and economic conditions under which coal miners work and live. Much more must be done if the coal mining industry is not to be threatened continually with shutdowns, which in turn threaten the welfare of whole nations.

Coal and industrial progress. Only countries with the ability either to produce or to buy large quantities of coal have been able to achieve industrial importance in the modern world. We have already seen how vital is the relationship between coal and iron ore; how this relationship leads to international friction because coal and iron ore seldom occur together in nature. Not only for the smelting of iron ore but for all its other important uses, coal must generally be moved from the places where it is mined to the places where it is consumed. In the case of the industrial cities of South America it must be moved thousands of miles. Coal is, in fact, the greatest traveler on earth, far exceeding in miles and tonnage any other type of freight.

The countries that have had the greatest industrial development are those that contain centers of dense population not too far from regions with rich deposits of coal. Much of the industrial and commercial success of Great Britain has been due to this fact. Great Britain has been doubly blessed because it has not only been able to run its own industries with its own coal but also been able to sell coal to less favored nations. With rich mines not far from good harbors, it has been able to ship coal cheaply to nations that needed it in any part of the world—and to bring back food and other raw materials that it needed itself. In one way or another, the United States, Germany, and all the other great industrial nations owe their industrial success largely to the fact that they contain centers of dense population which are close to rich deposits of coal.

The countries that have had the least industrial development rather generally possess little coal of their own and lie far from practicable sources of supply. Nearly all tropical countries are poor in coal, which is one of the reasons why few of them have made much industrial progress. China and Russia, on the other hand, possess some of the richest coal reserves on earth. For a variety of reasons, cultural rather than geographic, industrialization lagged in these countries up to relatively recent times. But it leaped ahead with great strides in Russia after the First World War, and it will doubtless do the same in China after the Second World War.

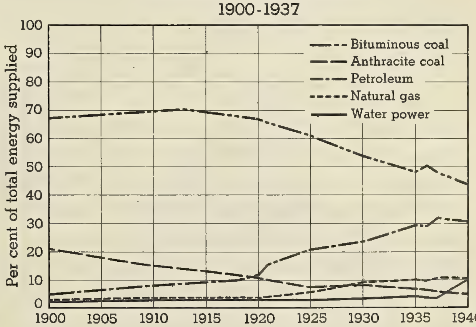
The rise of petroleum. Coal had already been established as the leading source of energy in the industrial world when Colonel E. L. Drake (the gentleman in the high hat in the photograph at the right) drilled the world's first oil well. Here and there "rock oil" was known to seep out of the ground in Pennsylvania. In 1859 a group of men conceived the idea that this oil might compete with the oil that was distilled from coal as a fuel for lamps. They hired Drake to drill a well near Titusville, Pennsylvania, in an attempt to develop a commercial supply of rock oil. After months of discouraging labor with the clumsiest kind of equipment, Drake struck oil at a depth of 69 feet below the surface of the ground.

People laughed at Drake while he was drilling his well, but they stopped laughing when the oil began to flow. It suddenly dawned on them that rock oil could be used as a source of power, as well as of light. With that realization came the beginning of the Oil Age. Wells were feverishly drilled in many places; rock oil, which came to be known as petroleum, rocketed to a place of

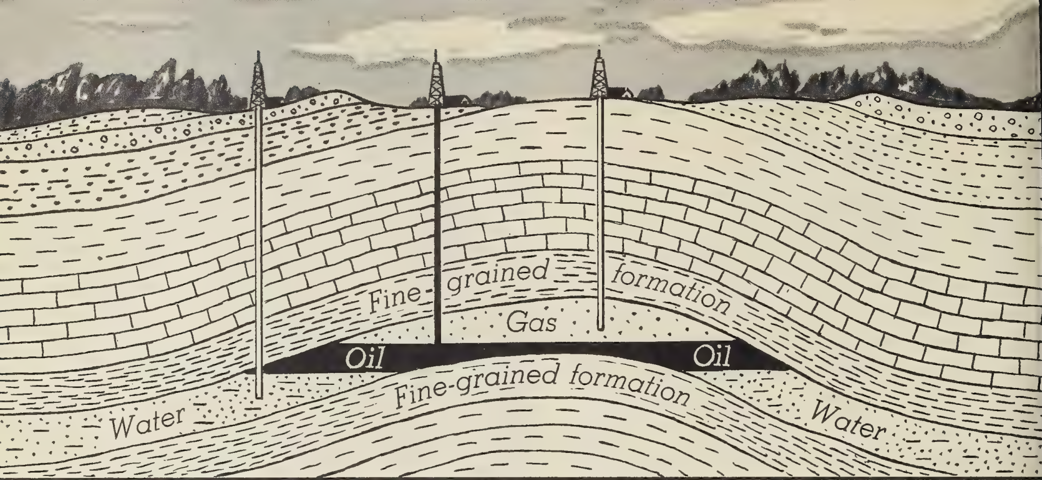
The Oil Age began when this crude drilling rig at Titusville, Pennsylvania, struck oil.

tremendous importance in human life. Today over one thousand products of petroleum are in everyday use. As a source of energy to turn the wheels and to heat the buildings of our machine civilization, petroleum challenges the supremacy of coal. (See the chart below, which shows the relative importance of the various energy-producing minerals.)

DISTRIBUTION OF ENERGY
1900-1937



Origin and recovery of petroleum. Geologists believe that petroleum, like coal, is the product of the decay of living creatures. Whereas coal is derived chiefly from the remains of ancient plants that were buried under sand and mud in swamps, petroleum



The gas and oil shown in this diagram were pushed by water through the pores of a coarse-grained layer of rock which was sealed above and below by fine-grained layers. The light oil and gas were trapped by the arch of the "structure." Notice how the position of the wells on the "structure" determines whether they strike water, oil, or gas.

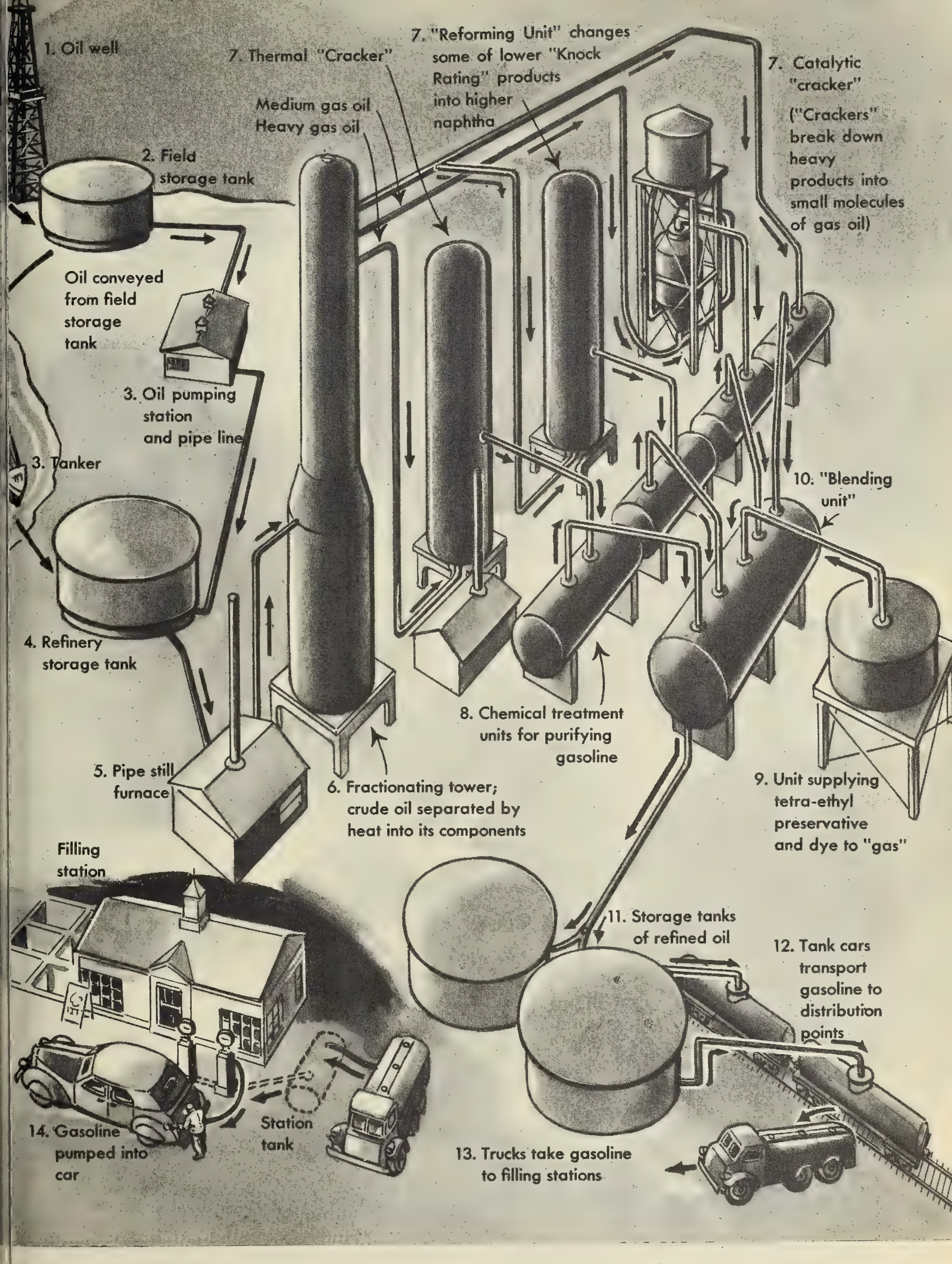
is derived from the remains of both plants and animals that were buried under the sediments of shallow seas. Bacteria and pressure, working on the dead bodies of these ancient creatures, gave rise to complex oily compounds of hydrogen and carbon which became imprisoned in scattered drops through the layers of sediments.

With time the sediments were squeezed and cemented into rock, and elevated into land. The little drops of oil were gathered together in the coarser formations and pushed along by the water that moves through the pores of rocks. The oil kept moving until such a "structure" as is shown in the diagram above stopped it.

Geologists can discover the structures that trap oil in pools (some of which are over two miles deep) by studying the arrangement of the rocks that appear on the surface of the ground. The physicist has instruments that can tell whether the condition of the rocks beneath the surface is favorable to the trapping of oil. Modern drilling methods can recover much of the petroleum and the natural gas with which it is generally associated. Modern refineries efficiently break down the "crude" petroleum into gasoline, kerosene, lubricating oil, fuel oil, asphalt, and several minor products. Pipelines economically carry the crude oil to the refineries; tank cars, trucks, tank ships, and barges carry the finished products to every corner of the globe.

The distribution of petroleum. Though pools of petroleum are known to be numerous and widely distributed on all the continents except Africa and Australia, relatively few regions produce nearly all the petroleum that is used today. North America in general is the richest reservoir of oil on earth. Oil wells are strewn all the way from Yukon Territory to southern Mexico, but the United States is much the most productive part of this vast belt. As you can see by the map on page 242, over 60 per cent of the world's supply of petroleum comes from the United States.

The second greatest oil-producing belt lies in western Asia. It extends along the backbone of the Ural Mountains to the Caspian Sea and the Persian Gulf, with the Soviet Union and Iran claiming the lion's share. Third in world importance is the petroleum belt of South America. Here most of the production comes from Colombia and



This is what happens to oil in its journey from the well to the filling station.

Venezuela, but the oil-bearing formations extend down both sides of the Andes through Ecuador, Peru, and into Argentina.

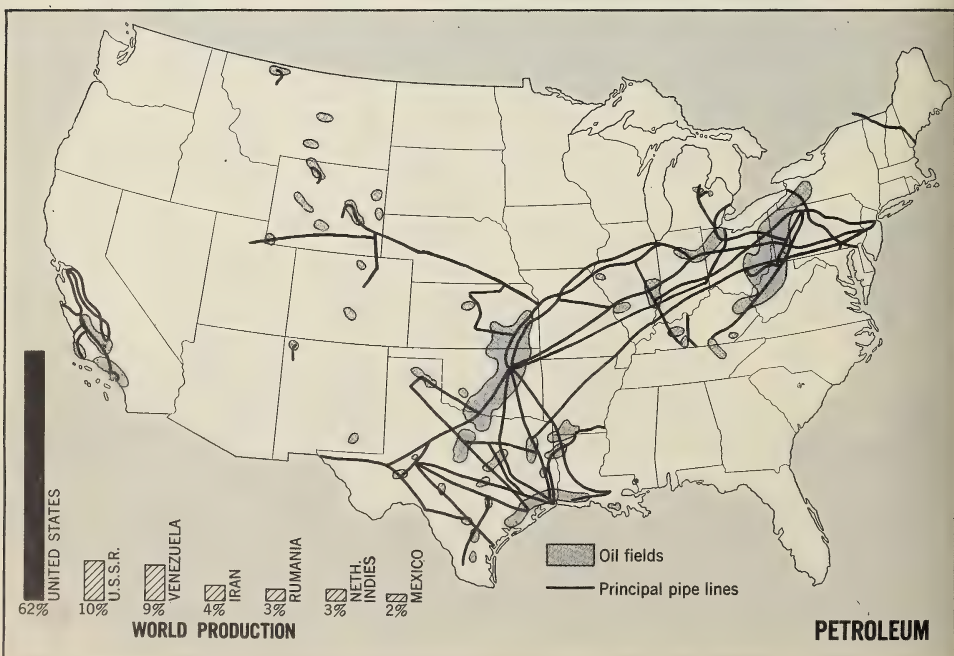
The only other oil-producing region of world importance today is southeastern Asia, chiefly India, Burma, and the Netherlands Indies. Though this region stands fourth in production today, its reserves are great. It may well stand first tomorrow. Northwestern Europe, which consumes a large percentage of the world supply of petroleum, must get nearly all of it from other regions.

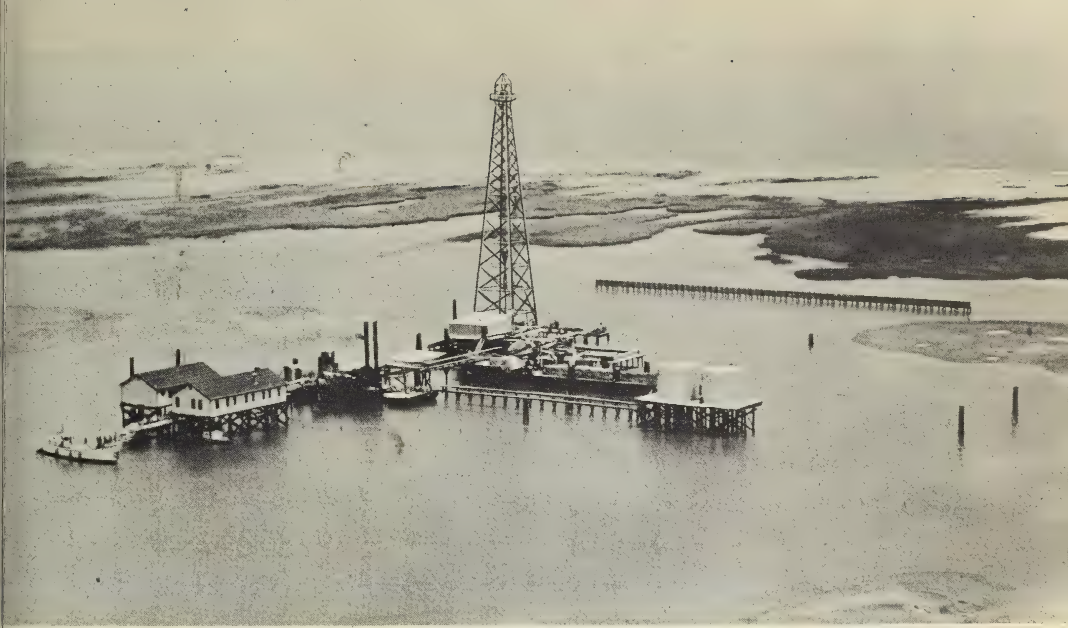
Petroleum in the modern world. Though petroleum today is challenging coal as a source of power, it competes with coal directly only in a few instances. The automobiles, airplanes, and most other machines that use gasoline, lubricating oil, and grease could not possibly use coal. Petroleum does compete with coal as a fuel for heating buildings and driving ships, and in most cases petroleum wins. Fuel oil is so much more convenient and economical than coal as a steamship fuel that even the British navy, an offspring of coal, has largely shifted to oil.

Aside from its uses as a fuel and a lubricant, petroleum is used widely in building roads, paving streets, roofing buildings, and in many other ways. The natural gas that occurs with—and is really a by-product of—petroleum is useful for lighting and heating. It is cheap, clean, and extremely high in heating power. Such cities as Los Angeles, California, Amarillo, Texas, and Edmonton, Alberta, which lie close to producing gas fields, use virtually no other types of fuel.

All told, the products of petroleum are the most widely and variously useful of all the mineral resources. They enter into many phases of national and international

This map tells the story of the location and production of petroleum in the United States at the start of the Second World War





Gulf Oil Corporation

Oil wells like the one above are beginning to tap some of the ten billion gallons of oil estimated by experts to exist under the ocean floor off the coast of Texas and Louisiana.

life. The Second World War was in no small measure waged with—and for—petroleum.

Conservation of the mineral fuels. Aside from water power (which we shall discuss later in this chapter), coal and petroleum are practically the sole sources of artificial heat, light, and power in the modern world. Though the reserves of these materials are great, the drain on them is tremendous. Like metals, the mineral fuels will someday be exhausted. What can men do to put off this evil day? What can they do to meet it when it comes?

Coal and petroleum, unlike metals, leave no scrap that can be used again. They bestow their blessings of heat and power but once. Like metals, coal and petroleum have been recklessly wasted through careless methods of production and uneconomical use. It has been estimated that even today about one ton of coal is wasted for every three tons mined. Nobody can even estimate the amount of oil that has been lost in "gusher" and burning wells. Obviously, the conservation of these mineral fuels must deal chiefly with the reduction of waste. Fortunately, the problem of waste is now being attacked on many fronts, and with considerable success.

Though the likeliest regions of the earth have already been pretty thoroughly prospected for coal and petroleum, new deposits are occasionally discovered. Such discoveries, however, are bound to become less and less frequent as time goes on. A better hope for extending the life of the world's mineral fuel reserves lies in the development of methods for using the now unused fuels of inferior quality. There are vast deposits of lignite in North America which are both low in heating power and far from the great industrial centers. Someday these low-grade coals will be burned at the mines and their energy carried in the form of electricity to the places where it can be used; or they may be converted to oil for use as liquid fuel.

In several regions there are large deposits of rocks that smell of petroleum when they are broken open with a hammer. Some of these so-called "oil shales" can be made to yield as much as a barrel of oil to the ton. So long as plenty of "pool oil" is available, men will not pay the much greater price for oil that is extracted from oil shales. Someday, however, the oil shales will be the only remaining source of petroleum. It has been estimated that the great deposits of oil shales in North America could supply the liquid fuel needs of that continent for a century and a half.

With care and ingenuity the coal reserves of the world might be made to last perhaps another few thousand years, the oil reserves perhaps another few hundred years. In that time more or less satisfactory substitutes will doubtless be found. There will probably be an increased use of such nonmineral fuels as alcohol, which can be made from plants. Ways will doubtless be found for extending the use of water power, the development of which has lagged wherever coal and petroleum have been plentiful and cheap. Perhaps ways will also be found for making the sunshine, the winds, and the tides take over some of the jobs that coal and petroleum perform today. Men may be trusted to find ways of getting their hard jobs done with relative ease, even though they may never again have such cheap and energetic workers as coal and petroleum.

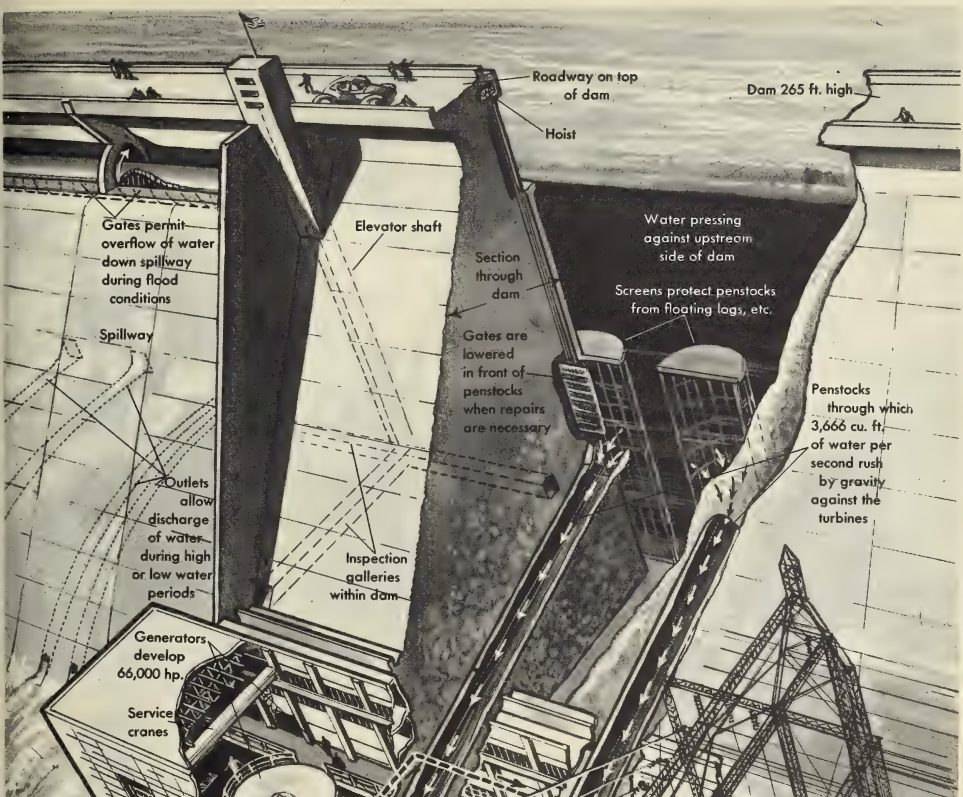
THE WATER RESOURCES

Water as a source of power. Throughout this book we have seen what an important role water plays in the drama of human life. Water as rain, snow, and flood; water for irrigation and drinking; water as a medium of transportation; water in other ways too numerous to mention is a vital element of human geography. Water as a source of power, however, is definitely overshadowed by coal and petroleum, but it will doubtless become vastly more important in the future.

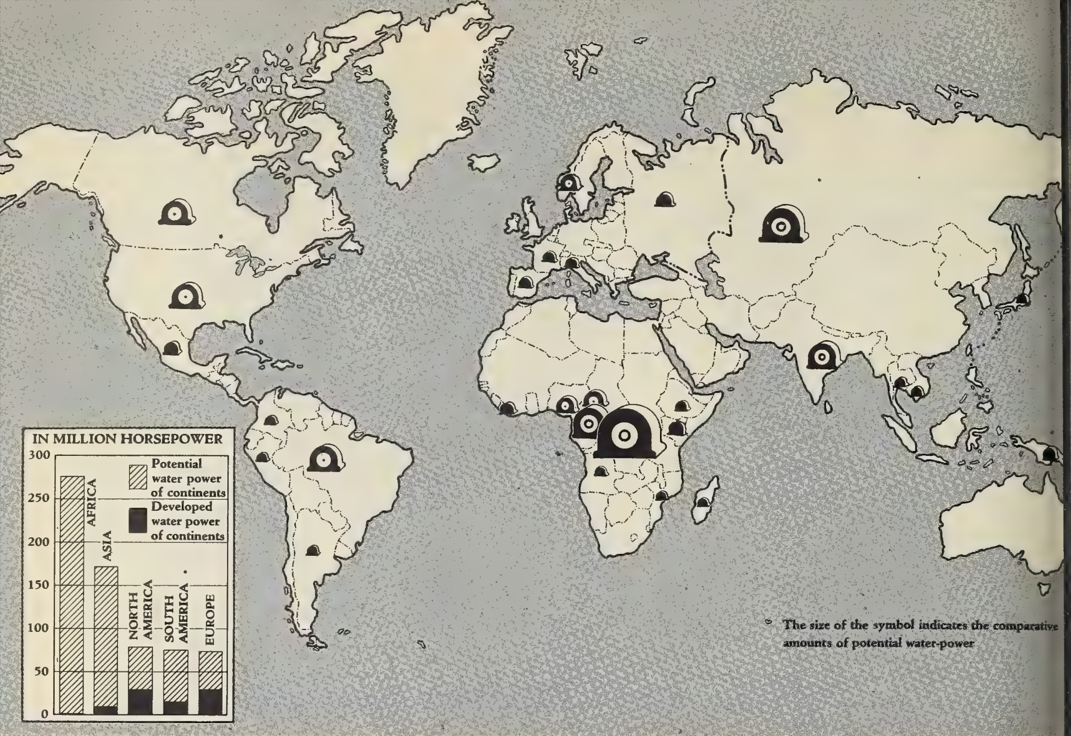
Long before coal and petroleum were used as sources of power, men had placed water wheels in streams to generate the power to perform a variety of simple tasks. Though water power has been used continuously for many centuries, it was not significantly exploited in any country before 1910. Though many great water power projects have since been developed in many lands, the development of water power continues to lag in the world as a whole because the mineral fuels are far more convenient and for most purposes much cheaper. Certain industries, however, require such large amounts of power that it has paid them to install the extremely expensive equipment which is necessary before water power can be developed on a large scale. Once harnessed, water is a fairly cheap—and practically inexhaustible—source of energy.

How water is harnessed. To harness the energy of running water, a dam is generally built at a narrow place on a river of steady but vigorous flow, and a power plant is built below the dam. The water that piles up behind the dam is drawn into the plant through tunnels or pipes as it is needed. There it is made to turn great turbines, which are old-fashioned water wheels in modern form. The turbines turn generators, which change the energy of the running water into the energy of electricity. The illustration on page 245 shows how such a so-called hydroelectric plant works.

Hydroelectric plants have already been built at Niagara Falls in New York and in Ontario, Grand Coulee Dam in Washington, Norris Dam in Tennessee, and many other places in the United States and Canada. Even before the New World had undertaken large-scale water power developments, France and Italy had done so. These developments should not be undervalued; we shall be reminded of their importance from time to time as we go on in this book. Nevertheless, many of the world's best sites for hydroelectric plants are still unused. The mountain streams of Scandinavia and the Alps in Europe, the wet southern slopes of the Himalayas in Asia, the western moun-



This diagram explains how the great hydroelectric plant at Norris Dam works.



This map shows the location and amount of the water power resources of the world.
The graph at the left shows how much of this wealth has already been put to use.

tains of North and South America, and particularly the streams that fall off the central plateau of Africa contain many millions of horsepower which today is going to waste. The estimated water power resources of the world and their present state of development are shown on the map on this page.

If these resources were fully developed, they could supply the modern world with much of the energy it needs. In the past the development of water power has been held up not only by competition with the mineral fuels but by inability to transmit energy very far from the places where it was produced. Industries that used water power were bound to the streams that generated the power. Many of the best streams for this purpose were located too far from the great centers of population to be practical locations for manufacture.

Today, however, it is possible to carry hydroelectric energy over wires as far as 300 or 400 miles without prohibitive loss. This range will doubtless be increased as the science of energy transmission grows. As the range increases, the use of water power will doubtless increase because one of the greatest obstacles in the way of its use will disappear. "White coal" may well become as important tomorrow as black coal is today.

Other uses for surface water. Many regions with well-watered mountains also contain arid or semiarid flatlands. In such regions men can kill two birds with one stone. They can run the water of the mountain streams through turbines to generate power and then spread the water over the flatlands below to grow crops. In one way or another, and in many parts of the world, hydroelectric and irrigation projects are combined. The chief irrigation projects of western United States, as shown on the map on page 87, are also almost without exception the chief water power projects as well.

In many cases such projects yield benefits in addition to irrigation and power. The large lakes that have formed behind Grand Coulee and Hoover dams, for example, hold back flood waters which once did much damage along the lower reaches of the Columbia and Colorado rivers. The Bonneville Dam, on the lower Columbia River, was designed not only to develop hydroelectric power but to regulate the water level of the river so that seagoing ships could move inland as far as 176 miles above the mouth of the river. The reservoirs behind these and many smaller but similar dams are lakes that provide refuge for wildlife and rest for men.

Water for cities. The almost unbelievable quantities of water which large modern cities require are taken very largely from the surface waters of the land. New York City uses more than a billion gallons of water every day—about 140 gallons for every citizen. Chicago uses water at nearly twice this rate. Smaller cities use less water than larger cities, but few cities of 100,000 or more inhabitants use less than 100 gallons per person per day. Most of this water goes into the running of factories and mills. Less than 20 gallons per person per day is needed for such domestic purposes as drinking, cooking, bathing, and washing clothes.

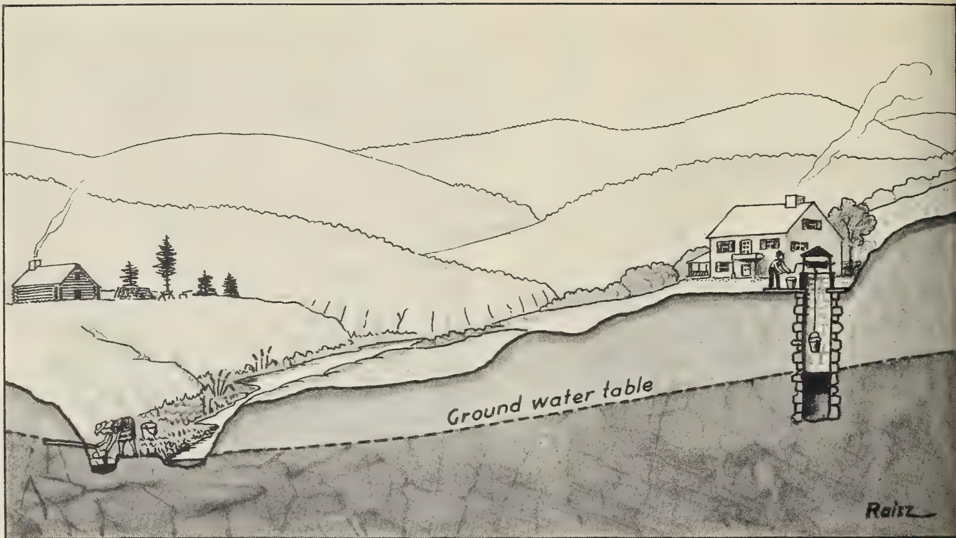
About 75 per cent of the larger cities in the United States obtain their water from lakes and streams. Chicago, Cleveland, Buffalo, and other large cities are fortunate in being able to draw unlimited quantities of soft fresh water from the Great Lakes. Many other cities, such as Minneapolis on the Mississippi, have rivers to draw upon. Water taken from such surface sources is likely to be muddy and polluted by sewage and industrial waste. It must be treated in one way or another to remove the sediment and to kill the harmful bacteria.

Many cities have no adequate source of water near at hand. They must bring in their water from other localities, in some cases at great expense. Much of the water used in New York City comes from the Catskill Mountains, a hundred miles away. Cities in dry climates have the most difficult water supply problems. The large and rapidly growing city of Los Angeles would disappear if it were forced to depend on its local water supply. Modern Los Angeles is able to exist in its semiarid setting only through a vast and complicated system of dams, reservoirs, aqueducts, siphons, and pumping stations. These great engineering achievements make it possible to bring great quantities of water into dry Los Angeles every day from the Sierra Nevada and the Colorado River, some 250 miles away.

The underground water supply. Not all the water resources of the earth lie upon its surface. Beneath the surface of the land in nearly all localities the rocks contain water which men can tap through springs or wells.


Spence Air Photos

Besides supplying vast quantities of water for irrigation, electric power, and recreation, Hoover Dam helps to control floods and erosion along the lower reaches of the turbulent Colorado.



This diagram explains the relationship between the water table and the surface of the ground.

More than half the people of the United States live in small cities, towns, villages, and on farms which draw their water from this hidden source of supply.

The underground, or ground, water is simply rain that has soaked through the soil and into the fissures and pores of the rocks beneath the soil. All types of rocks have pores in which water can collect; in some types of rocks the pores are large and numerous enough to permit the water to move slowly from place to place like ink in a blotter. Below a certain level the rocks in nearly all localities are saturated with water. The top of this saturated zone is called the *water table*.

In humid country the water table generally stands within 50 feet of the surface of the ground, and can be easily reached by shallow wells. Under desert lands the water table may be as far as 3500 feet below the surface, too deep in most cases to make wells practicable. Ordinarily, the water table is closer to the surface under valleys than under hills, as the diagram on this page shows. The water table may fluctuate considerably with seasonal variations in rainfall; during periods of drought it may sink so low that wells go dry.

Many home water supplies in rural districts come from springs; that is, from underground water which leaks out at the surface, as shown in the diagram. Most springs are small in size and uncertain in flow. Some springs in Florida, Oregon, and elsewhere, on the other hand, are so large and steady that they could supply the water needs of great cities. Wells, however, are much the most common means of tapping the underground reservoirs. A well should be dug or drilled into a highly porous water-bearing formation to a depth considerably below the water table. Wells that reach only moderately porous formations, or that do not penetrate the formations deeply, are likely to go dry.

Underground water contains greater quantities of dissolved mineral materials than surface water does. When used in large quantities by cities and towns, it may have to be treated to remove the calcium and magnesium which make it "hard."

Though underground water is less likely than surface water to be polluted, the fact that it is sealed in the ground is no guarantee against contamination.

Well water may be rendered unfit to drink and typhoid fever and other dread diseases may be spread by water which has seeped into wells after having been polluted by barnyards, outdoor toilets, and cesspools. To avoid this danger wells should always be located on the highest ground possible. They should be tested frequently for disease-producing germs.

Conservation of water. Unlike the other mineral resources which we have studied in this chapter, water is not destroyed with use. The water you send down the drain does not disappear. It may sink into the ground, be cleansed of its impurities, and flow from another faucet another day. Or it may flow with a river to the sea, there to add its bit to the maintenance of the highways of the ships. Or it may evaporate into the air and later condense into rain that will fall on some thirsty field in some other part of the world.

Though the water resources of the earth cannot be destroyed, they can nevertheless be abused so that a condition is created which resembles destruction. Polluted water, the curse of civilization, is obviously as bad as no water at all. Nor is abundant water in one locality of any use to another locality in which the water resources have been recklessly squandered. Extravagant use of the public water supply has more than once seriously threatened a community by depleting the local reservoirs of surface and underground water.

Regional abuse of the water resources goes hand in hand with regional abuse of forests, grasslands, wildlife, and soil. Forests and grasslands are nature's means of leading rain water into the ground. When forests are felled and grasslands plowed, the water table sinks and wells go dry. At the same time the swollen and muddy surface streams become not only useless but harmful to men. We have already indicated how such a disastrous state of affairs can be avoided. The conservation of precious water resources is not least among the blessings that come from intelligent and unselfish use of the land.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. Civilization has passed beyond the Stone Age and only a small percentage of the things now used are made of stone.

2. Most of the nitrates used in the United States and other countries come from the extensive deposits in Chile.

3. Metals came into widespread use late in the history of man because early man failed to discover their existence.

4. Iron is mined at all of the few places on earth where it is known to occur.

5. The metals used in making steel alloys are used in such small quantities that they are of little importance.

6. Iron is a more useful mineral resource than copper because there is more iron than copper.

7. We need not worry too much about our supply of metals, because other materials can serve all the purposes that metals serve.

8. It is not necessary to conserve our supply of petroleum, because when it is exhausted other fuels, and other sources of petroleum, such as "oil shale," will be developed.

9. Industrial nations have always developed where large deposits of coal existed.

10. Water power is the most important source of industrial energy.

11. The water table is everywhere about 50 feet below the surface of the ground.

12. Underground water is not so pure as surface water and should be avoided wherever possible.

13. Water is an inexhaustible resource which occurs everywhere.

QUESTIONS FOR DISCUSSION

1. What are the chief advantages of knowing how to use iron instead of being restricted to stone or stone and bronze? In how many ways do you use iron in your daily life?

2. Why are most modern industries so dependent upon coal?

3. Under what conditions should you be willing to invest your life's earnings in a water power project? Should you like to invest your money in a water power plant in Africa?

4. Italy and Switzerland have developed a much larger percentage of their available water power than the United States. What do you suppose is the reason for this?

THINGS TO DO

1. Look round your school and make a list of the objects which are made of minerals. List the uses of each object and wherever possible tell what mineral or minerals have gone into its manufacture.

2. Make a survey of the buildings in your town or neighborhood to determine the local use of building materials other than wood. Write a report on where these materials come from and why they are used.

3. If there is a quarry or mine in your region, arrange to have your class visit it. Find out what mineral or rock is quarried or mined, how it is taken out of the ground, how much of it is produced, what its uses are, and where it is sold. Make complete notes on your trip and write a report on your findings.

4. During the Second World War the United States mined chromium, tungsten, and antimony from ore deposits which ordinarily could not be mined at a profit. Read up on these metals and write a report on why they are so important in time of war.

5. Try to discover all the different uses of the mineral fuels in your community. Find out what fuel is most widely used, what it is used for, how much is used, where it comes from, and how it is transported. Perhaps you can persuade a coal and oil dealer in your community to give you some of this information.

6. Estimate the storage capacity for fuel in your community as a whole and try to estimate how many days, weeks, or months this amount will serve the needs of the people. Make similar estimates for your home and your school. Find out why you use a certain kind of fuel, how much you use, and how long your supply in storage will last.

7. Find out how much water is used in one week by your school and determine the amount that is required per person to keep your school running.

BOOKS TO READ

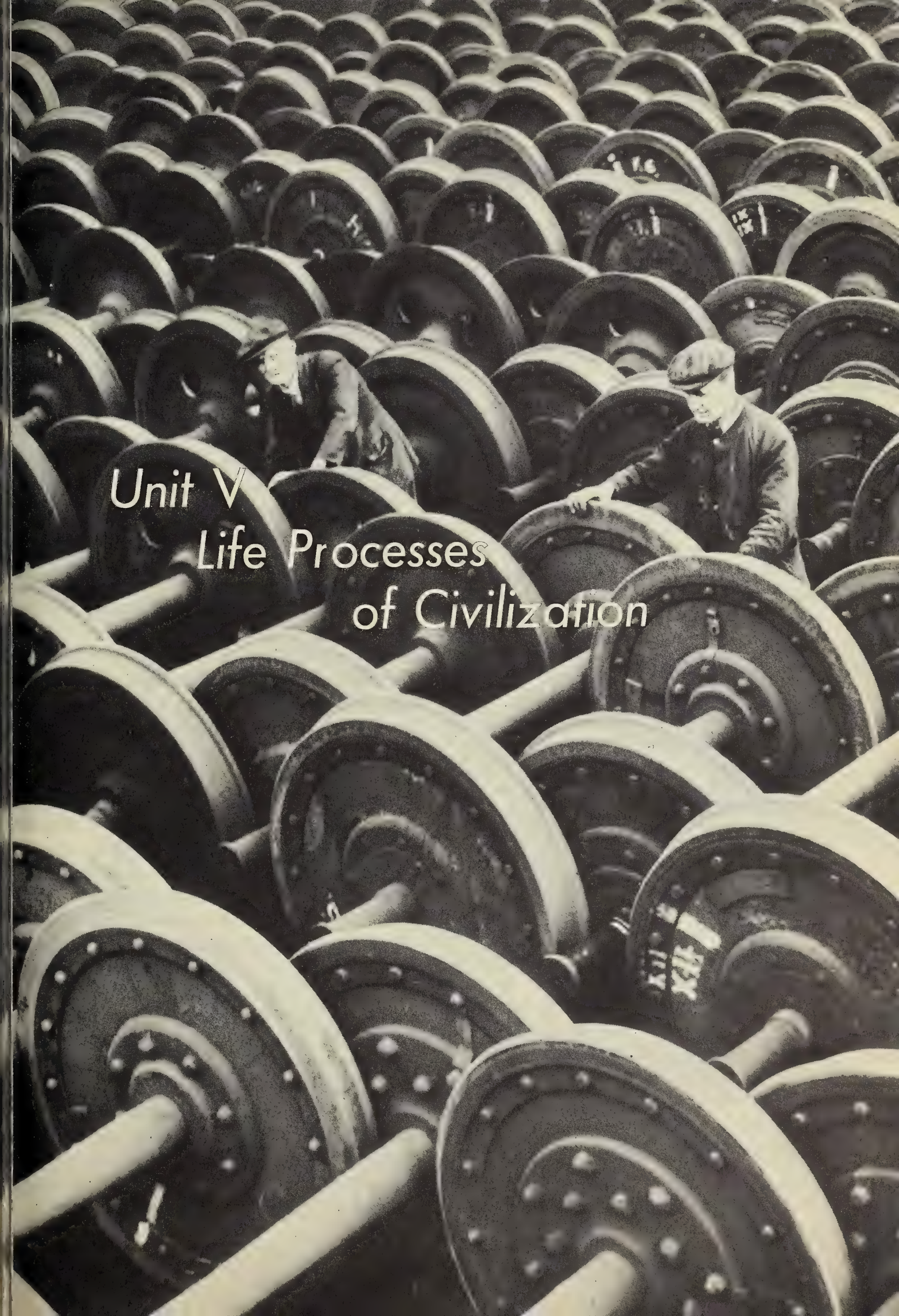
1. If you are interested in the mineral materials of the earth, you will probably want to learn the names of the common rocks and minerals of your neighborhood. A book that will help you to do this is *Field Book of Common Rocks and Minerals*, by FREDERIC B. LOOMIS.

2. Most books on building stones and other earthy minerals are rather technical. Very interesting chapters, however, on some of these less glamorous mineral materials can be found in *All about Treasures of the Earth*, by FREDERICK A. TALBOT, and *America's Treasure*, by WILLIAM M. REED. Both these books also contain very entertaining chapters on metals and mineral fuels.

3. *The Story of Iron and Steel*, by DONALD WILHELM, tells the history of the development of the metals which are of most importance to modern civilization. *The Book of Metals*, by DONALD WILHELM, deals readably with the metals in general. *The Metals*, by ARCHIE F. COLLINS, deals chiefly with the metallic alloys. A fascinating adventure story which will give you a picture of the problems of a modern prospector is *In Search of Soviet Gold*, by JOHN D. LITTLEPAGE and DEMAREE BESS.

4. If you want to know more about coal and petroleum, look up *A Guide to the Study of Non-metallic Mineral Products*, by WILLIAM S. BAYLEY. Easier reading on these mineral fuels will be found in the books listed above under 2. A good readable book on the water resources is *The Story of Water Supply*, by HOPE HOLWAY. The story of how one great river was made to serve the purposes of men is vividly told in *The Colorado Conquest*, by DAVID O. WOODBURY.

5. *Our Mineral Civilization*, by THOMAS T. READ, gives a picture of the progress which has been made in the use of the mineral resources during the past century.



Unit V
Life Processes of Civilization

XIV · MANUFACTURE AND TRADE

THE ELEMENTS OF MANUFACTURE

What is civilization? If you look up the definition of "civilization" in a dictionary, you will find something like this: "A condition of organization, enlightenment, and progress in human society." If you have just been reading the newspaper you might be inclined to doubt the "enlightenment" and "progress" of society today. But you cannot doubt the "organization." If civilization is anything at all, it is a great many human beings who are living in ways that tie them on the one hand to the earth and on the other hand to one another.

The importance of manufacture. The two billion people who live on the earth perform so many different activities that it would be hopeless to try to list them. All these people, however, do one thing in common: they all use the raw materials of the earth in order to live. Few people use many of the raw materials in their natural form. Even such people as the primitive Eskimos change the form of the seal and other arctic animals in fashioning the weapons, utensils, clothing, and houses which make their lives possible. *The processes whereby the form of raw materials is changed to make them useful to men are known broadly as manufacture.* They are fundamental processes in all human cultures from the simplest to the most complex.

Manufacture brings different human activities into relationship with one another. The agricultural activities of raising wheat, for example, are of no use by themselves. The wheat must be ground into flour, baked into bread, and distributed to the hungry before it can fulfill the purpose for which it was raised. The chain of geographic relationships which stretches from the planting of the wheat to the eating of the bread involves three types of processes:

1. The processes of *primary production*, which supply the raw materials.

2. The processes of *secondary production*, or *manufacture*, which render the raw materials fit for use.

3. The processes of *distribution*, which get the finished products to the people who use them.

Manufacture holds the chain together by linking the processes of primary production with the processes of distribution.

In the earlier units of this book we have seen how the primary industries of production—hunting, fishing, herding, agriculture, lumbering, and mining—are carried on in the different parts of the earth. We have seen how they vary from place to place with variations in climate, land forms, and natural resources. All these primary productive industries, however, are alike in one regard: they must all be linked up with the industries of manufacture and distribution before they can yield their ultimate benefits to men.

Not even in a primitive society can a man without help from other men produce and prepare for use all the things he needs. In civilized society the relationship of the primary production, manufacture, and distribution of commodities is so vast and complicated that every person is related in countless ways to countless other people. An endless and endlessly varied stream of commodities flows like blood through every part of the body of civilized society. Manufacture acts as the lungs of this society, building and purifying the blood into a condition of greatest usefulness.

Mechanical energy and manufacture. Just as a lung must have blood and air in order to operate, a manufacturing plant must have raw materials and energy. In the earlier units of this book we have seen that raw materials are produced in practically every corner of the globe. We have seen that the mineral fuels, chief sources of energy in the modern world, are also widely

Fairchild Aerial Surveys, Inc.

its superb location with reference to raw materials, markets, and transportation facilities has helped to make Detroit the greatest center of automobile manufacture on earth.

though much less evenly distributed. Modern manufacturing industries, on the other hand, are neither widely nor evenly distributed. The map on pages 254–255 will show that the great manufacturing centers of the world today are concentrated in a relatively few small areas. Why have these areas become the great centers of manufacture?

We shall devote much of this chapter to trying to answer that question. First of all we should recall what we have already observed: that social and historical influences with very little basis in geography may play large parts in the location of manufacturing industries. The fact that Detroit is favorably located with reference to many raw materials, markets, and transportation facilities is a geographic reason for its being the world's greatest center of the automobile industry. The fact that Detroit is the home town of Henry Ford, and the place where he found it easiest to play his important role in the development of the automobile industry, is a nongeographic reason for the concentration of this industry in that city. Many other manufacturing industries are similarly influenced by forces that lie outside the field of geography.

The world distribution of manufacturing industries has two decidedly different aspects, only one of which is shown on the map on pages 254–255. Wherever manufacture is carried on without the help of power-driven machinery, it is likely to be small in output, limited in influence, and widely scattered in distribution. It is likely to produce commodities from raw materials which are near at hand for markets which also are near at hand. This is the general condition of manufacture in the so-called "backward" countries, where many essential articles are still made by hand. It was the general condition of manufacture everywhere before the invention of the steam engine and other power-driven machines toward the end of the eighteenth century.

Once manufacture was freed from the drudgery of hand labor in the so-called "progressive" countries, it quickly began to assume the concentrated aspect pictured

Hunting and fishing
Herding
Intensive farming
Sparse farming with stock raising

THE W

Manufacturing

Mining

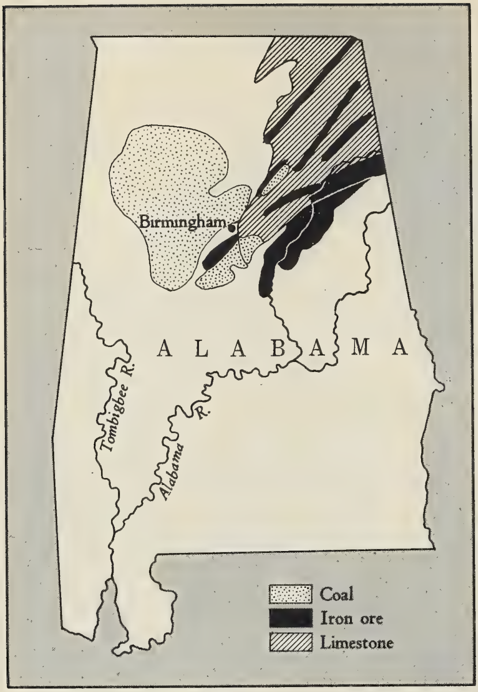
Oil production

Lumbering

Little or no activity

WORK

Armadillo Projection



This map shows why Birmingham, Alabama, is an ideal location for the steel industry.

on the map on pages 254–255. One factory with mechanical energy can do the work of many factories with nothing but muscle energy, and this makes for fewer and larger factories. Though raw materials are obviously of first importance in all types of manufacture, the location of raw materials no longer determines the location of many types of factories. In many cases mechanical energy working through the mediums of railroads, trucks, and steamboats can bring in raw materials and fuels to areas which offer particularly favorable conditions for the operation of factories.

The raw materials of manufacture. The manufacture of clothing in the United States illustrates how modern transportation can free a manufacturing industry from the need of being near the place where its raw materials are produced. The clothing industry is concentrated in New York and a few other large cities of the East and Middle West. None of these cities is very near any of the regions that produce the cotton and wool from which most clothing is made. All, however, are labor, trading, and transportation centers. The clothing industry has found it profitable to concentrate where such advantages are greatest rather than where raw materials are most plentiful. With plenty of labor, easy access to jobbers and retailers, and fast, cheap transportation in all directions, the clothing industry can afford to bring in its raw materials from anywhere in the world.

Certain types of manufacturing industries, on the other hand, must be closer to the source of their raw materials. Industries that use heavy or bulky raw materials which are expensive to move profit greatly by being close to the source of supply. One reason why Birmingham, Alabama, has become a great center for the steel industry is that coal, iron ore, and limestone occur together in that region. Few steel centers are so favorably located as Birmingham, but all are located near—or have cheap water routes to—regions that supply the heavy and bulky materials which the steel industry uses in great quantities.

Meat on the hoof not only is bulky but also contains much waste. The farther a packing plant is located from the range where the animals are raised, the more it must spend to transport this waste. The meat-packing industry of the United States, accordingly, found it profitable to locate for the most part in Chicago, Kansas City, and other large cities of the Middle West. These localities are about midway between the range lands which supply the raw materials and the markets which consume most of the finished products. They are in the region that produces the corn that fattens the animals after they have been shipped from the range. They are also great railroad centers through which the finished products can be efficiently distributed.

Power and fuel for manufacture. Much that we have just said about raw materials is also true of the power that turns the wheels and the fuels that heat the blast furnaces of modern manufacture. It is generally true that industries which consume large quantities of power and fuel find it profitable to be close to a source of supply. Industries that consume small quantities of power and fuel can operate profitably much farther from a source of supply.

When modern manufacture was in its early stage of development, cheap and rapid transportation facilities did not exist. Factories were chained to places that produced power and fuel. In Western Europe many early factories and smelters were located near forests that could supply the wood for the charcoal which was widely used as fuel; later they moved to the vicinity of the coal fields, where, for the most part, we find them today. The first textile mills of New England had no way of getting coal; so they located on streams where water power could be developed. More than one manufacturing city in eastern Pennsylvania is indebted to neighboring coal fields for its growth and prosperity.

Most of the machinery in factories today is driven either directly by steam which in turn is derived from the burning of coal or indirectly by electricity which is made with the help of steam which is derived from coal. Many industries, such as the iron and steel industries, use great quantities of heat energy, as well as great quantities of mechanical energy. Nothing can compare with the mineral fuels, and particularly with coal, as cheap and convenient sources of these two types of energy. It is nevertheless true that the location of many factories, mills, and foundries near coal fields is today more a matter of habit than of need. Cheap transportation of the energy-producing minerals—and of energy itself in the form of electricity—has freed a great many types of manufacturing industries from the need of locating near the sources of power and fuel.

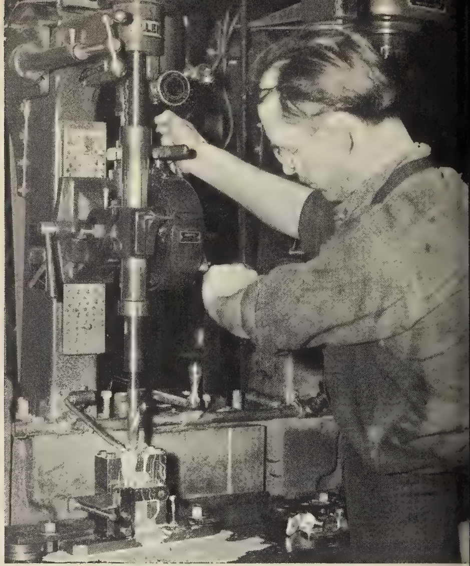
Manufacturing industries can be divided into two general types on the basis of the raw materials and fuels which they require.

This meat-packing plant derives many advantages from being located in the Corn Belt, midway between the range lands of the West and the markets of the East.

Aero-Graphic Corp. Photo

Kaufmann-Fabry Photo from James Sawders

In modern manufacture there is a lessening demand for unskilled workmen.



James Sawders

The complicated machinery of modern manufacture can be operated only by skilled workmen.

Industries that specialize in products that require raw materials of comparatively light weight and comparatively small amounts of power and fuel are known as *light industries*. They stand in contrast to the *heavy industries* which produce such commodities as iron, steel, and heavy machinery.

For reasons which we have discussed above, some localities specialize in light industries and others in heavy industries. In the past the industrial development of certain countries, such as Argentina, has been held back because they lacked domestic supplies of the iron and coal which are necessary for the heavy industries, and because foreign supplies of these materials were too far away to be profitably imported. Such countries have had to depend chiefly on the primary production of their forests, farms, mines, and waters, and on manufacture of the light variety.

Labor for manufacture. Though men have been extensively replaced by machines in the modern industrial world, human labor still plays an important part in manufacture. People who work in manufacturing plants can be roughly classified as skilled and unskilled workers. Unskilled workers need little natural ability or training. With the progress of invention they have become less and less important to the manufacturing industries in general. They have little influence today on the location of these industries.

Even the industries that still employ large numbers of unskilled workers do not find it necessary to locate where this type of labor is plentiful. As a general rule, it is easy to bring unskilled workmen into any area where they may be required. Such workmen are accustomed to moving from job to job and from community to community. Though these drifting workers solve one of the geographic problems of modern industry, they create social problems of a serious nature. Without community ties and responsibilities, ignorant and easily moved by emotional appeals, they have frequently been the victims of unscrupulous employers, labor leaders, and politicians.

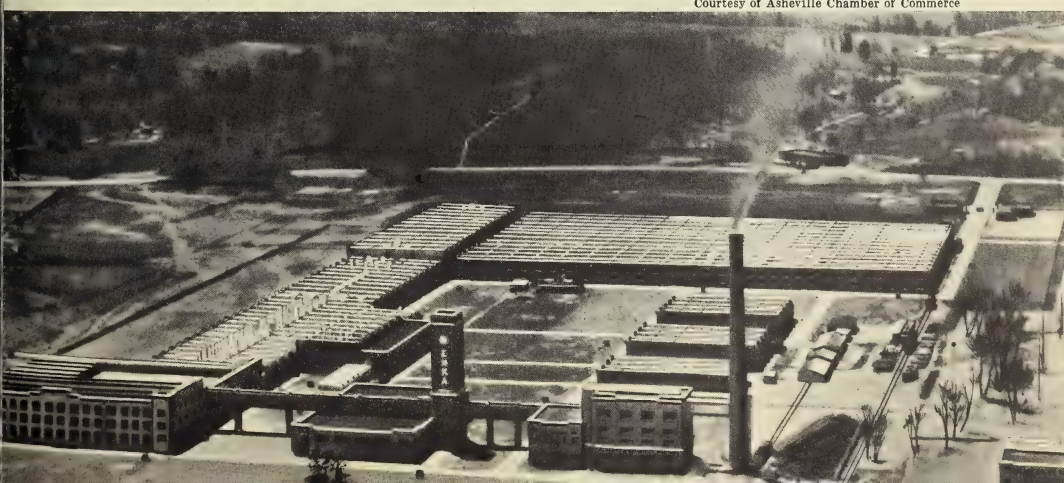
As machinery became more and more complicated with time, the work of operating and caring for it came to require more and more skill. Not only that, but many of the more intricate operations of modern industry cannot be done by machines. They demand the nimble fingers and trained minds of men and women. The skilled workmen who perform these operations are vital parts of many modern manufacturing plants. Such workers are not nearly so easy to move as their unskilled associates. They tend to build strong ties with the communities in which they live. People of this sort, to be sure, can be persuaded to change their place of residence. In many cases, however, persuasion is so difficult and expensive that industries have preferred to locate in areas where there is a plentiful supply of the particular variety of skilled labor which is required.

Markets and transportation. With raw materials, power, and labor, manufacture assembles its endless array of commodities. Through markets and the facilities of transportation the commodities are distributed to the men and women who use them. Though modern transportation makes it possible to send goods from any given place to any other given place on earth, it is not always practicable to do so. The general rule that applies to raw materials, power, and fuel applies also to the products of manufacture. The heavier and bulkier the products, the more profitable it is for the plants that produce them to be close to the markets that distribute them and the people who consume them. We shall consider this vital element of manufacture at greater length when we discuss the processes of transportation in the following chapter.

Other elements of manufacture. Many things influence the nature, location, and success of manufacturing activities. Some of these influences are of minor importance, but they occasionally rise to major importance locally. Occasionally a manufacturing plant is unable to operate profitably, even though it is well located with reference to all its essential needs. Many textile mills in New England, for example, went out of business when similar mills with much cheaper labor sprang up in the South. More than one smelter has had to shut down or move to some other locality because the people in the neighborhood, objecting to the poisonous fumes that go with smelting, passed laws which made continued operation impracticable. Not a few manufacturing projects of every type have suffered for lack of enough wealth (capital) to run them effectively. Local tax rates, land values, policies of labor unions, cost of living, freight rates, and many similar social and economic factors frequently have a decisive influence on the destiny of a manufacturing plant.

Textile mills like this one in the South, where labor is cheap, drove many New England mills out of business.

Courtesy of Asheville Chamber of Commerce



THE LOCATION OF MANUFACTURE

Cities as centers of manufacture. Most modern manufacturing plants are concentrated in cities for reasons which should be obvious from what we have already said. Both the people who make and the people who use most manufactured articles are concentrated in cities. Cities are also the points on which the major routes of transportation converge. They are the great commercial centers where the complicated business transactions which are associated with manufacture can best be carried on.

It is easy to understand why in many cases manufacturing industries either have established themselves in cities or have caused cities to grow up around them. It is less easy to understand why in other cases the exact opposite is true. In recent years there has been an increasing tendency for manufacturing industries to move from larger to smaller cities, and in some cases into the country. For a variety of reasons this decentralizing tendency will probably continue in the future.

Advantages of decentralization. Nobody can fairly deny that the modern city has many excellent qualities. Its fine schools, playgrounds, parks, libraries, museums, theaters, markets, business opportunities, and many other advantages and conveniences cannot be matched by smaller towns and villages. Along with these excellent qualities, however, the modern city has many bad qualities which are either less pronounced or entirely absent in smaller centers of population.

Not all cities perform the same function. Some, like Washington and Ottawa, are devoted chiefly to administrative and political activities. Some, like Atlantic City, are chiefly centers of recreation and health. Most cities, however, function chiefly as centers of manufacture, commerce, and transportation. As these activities have grown in importance and complexity, the cities that house them have grown larger and more confused.

Such cities are almost invariably noisy and dirty. Large numbers of their people are improperly housed, clothed, and nourished. The larger the cities grow, the more crowded they become. Taxes, graft. racketeering, and the cost of living increase, while peace and security decrease. Both individuals and industries become more and more like too many goldfish in a bowl, gasping for the oxygen which their lives require but which their environment cannot supply.

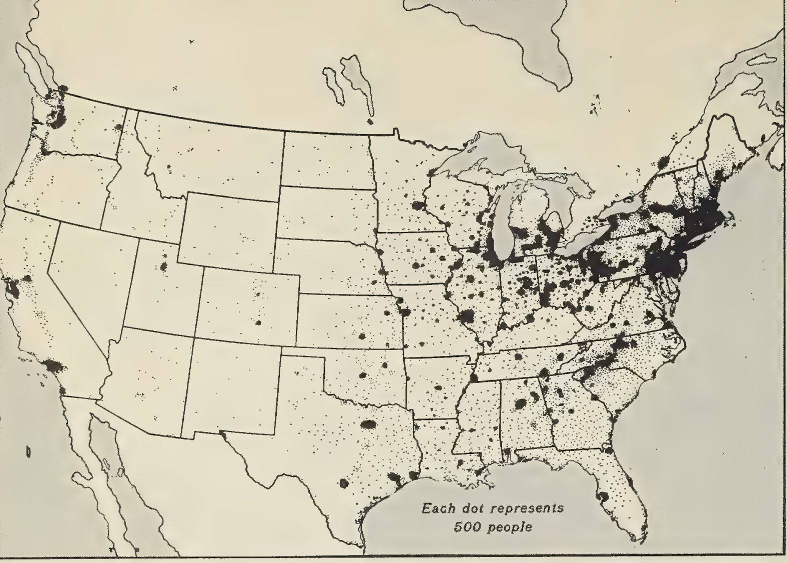
The manufacturing industries must take much of the blame for this condition. It is they, together with the commercial industries with which they are closely related, that cause most of the congestion and confusion of the modern city. It is therefore fitting that the manufacturing industries should have demonstrated one of the best ways of reducing these evils. By moving into less heavily populated areas, several manufacturing industries have already begun to reduce city congestion and at the same time have benefited themselves. Not all industries that move out of cities do so for the same reasons or reap the same benefits. There are two benefits, however, which they all share.

1. They gain room to expand and relatively cheap and low-taxed land on which to do so.

2. They increase their efficiency by creating more healthful, more economical, and more pleasant conditions for their workers.

The movement toward decentralization. Some manufacturing industries have profited by breaking up their large centralized, congested, and vastly complicated plants into smaller plants. Each of these smaller plants has its own particular operation to perform and is located where geographic conditions are most favorable to that operation. Before the Second World War the highly centralized automobile industry in the United States had definitely moved toward this kind of decentralization. Engines were made in one place, bodies in

This is how one automobile plant had begun to decentralize before the outbreak of the Second World War. Though crowded in the sketch, the branch factories are actually widely separated.



Most of the manufacturing activities of North America are concentrated in northeastern United States and southeastern Canada.

another place, and certain parts at still other places; assembly plants were widely scattered from coast to coast. This movement toward decentralization, to be sure, did not take the manufacture of automobiles out of the city. But it spread the industry through many cities and reduced congestion in the few large Michigan cities where it had originally been concentrated.

Some manufacturing industries have found it profitable to cut themselves loose from the great urban centers of population. Among these are the plants that have located near newly developed sources of hydroelectric power. There are good reasons for believing that rural factories near airports may someday come to have all the advantages of city factories today—with none of the disadvantages.

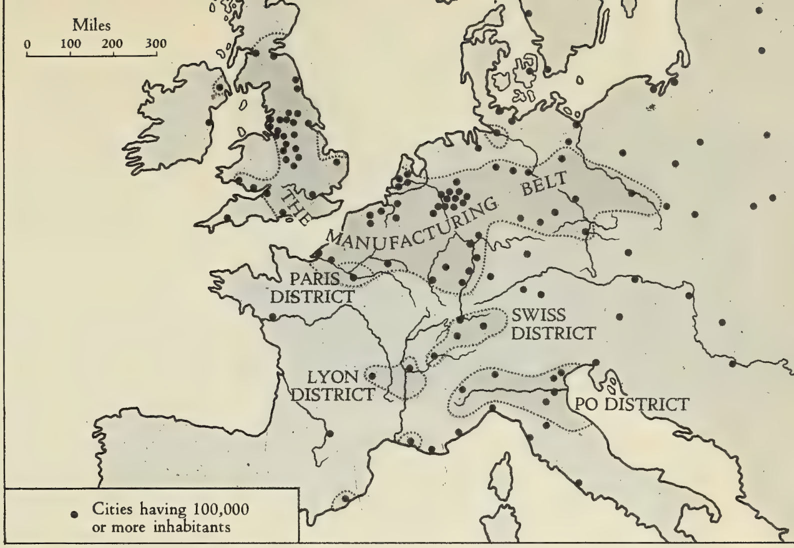
If this should come true on a large scale, the most common type of city as we know it today would cease to exist. By losing its manufacture and the commercial activities that go with manufacture, it would lose its chief reasons for existence. But whatever may be the ultimate fate of the city, one thing seems clear. With steady improvement in all types of transportation and steady expansion of marketing areas, modern world manufacture will present a much more scattered picture in the future than it has presented in the past.

The American Manufacturing Belt. Whatever the future may bring, today not only do most manufacturing industries cluster in a relatively few urban communities, but most of these communities cluster in a relatively few regions. As you can see by the map on pages 254–255, two regions stand out from all others as centers of manufacture: east-central North America and west-central Europe. Lesser but growing regional centers of manufacture are located elsewhere in North America and Europe, and in the Soviet Union, Japan, India, Australia, and South America.

Before the Second World War most of the manufacturing activities of North America were concentrated in a relatively small zone in northeastern United States and southeastern Canada, though several much smaller areas of concentrated manufacture existed outside this zone. The general picture of the distribution of North American manufacture at that time is shown in the map on this page.

During the war new airplane, ammunition, and shipbuilding plants sprang up in the South, in the Rocky Mountain states, and on the Pacific Coast. These new plants

Most of the manufacturing activities of Europe are concentrated in the west-central part of the continent.



After map from Colby and Foster, "Economic Geography"

turned many areas which had previously had only a moderate amount of manufacture or none at all into swarming beehives of activity. The war also greatly stimulated activity in the established manufacturing districts of North America. Inasmuch as these districts were not affected by enemy bombing, they occupy essentially the same locations now as they occupied before the war.

Today, as yesterday, the densest belt of manufacture in North America lies along and behind the Atlantic coast between Portland, Maine, and Baltimore, Maryland. If you should draw a line westward from Baltimore to Cincinnati, then northward through Indianapolis and Chicago to Oshkosh, Wisconsin, then eastward through Toronto to Portland, you would block out the region in which perhaps 75 per cent of the manufacturing activities of the entire continent take place. This general region is sometimes referred to as the American Manufacturing Belt.

The European Manufacturing Belt. West-central Europe, like east-central North America, is a region of smelters, mills, and factories. These two regions have several advantages in common. Both have stimulating climates and energetic people. Both are rich in raw materials, power and fuel, skilled labor, and markets. Both have centralized locations on their respective continents, with highly developed transportation facilities within their own boundaries and excellent oversea connections with the rest of the world.

Western Europe was the birthplace of modern manufacture. It was the first region to use mineral fuels and mechanical energy on a large scale. It was the first to have highly developed systems of transportation on land, sea, and in the air. Before the Second World War no other region could challenge its leadership in manufacture, not even North America. It had about twice as many people engaged in manufacture as North America had, and about twice as many people within its own borders to buy the products.

Before the war most of the manufacturing activities of Europe were concentrated in a relatively small belt in west-central Europe, with still smaller but important outlying districts scattered over the continent as a whole. The chief prewar areas of manufacture in Western Europe are shown on the map on this page.

The so-called European Manufacturing Belt, like the American Manufacturing

Sovfoto

Day and night in far-off Magnitogorsk, this iron and steel plant is helping to build the industrial strength of the Soviet Union.

Belt, which it resembles in many ways, is the region of the most highly developed manufacture in all Europe. Manufacturing plants in great number and variety dot the landscape of this belt all the way from Scotland, England, and Wales through northern France, Belgium, the Netherlands, Germany, and well into Poland and Czechoslovakia. Before aerial bombing during the Second World War disrupted it, manufacture in much of this region clung to the pattern that had developed during the nineteenth century when iron ore, coal, and water power began to be exploited on a large scale. The districts where these resources were most abundant became the districts where manufacture was most highly developed.

Manufacture and the Second World War. When, in the next unit of this book, we study the relationship between manufacture and the political activities of nations, we shall learn more about American and European manufacture. We shall study the development of modern manufacturing in Soviet Eurasia, which helped the people of the Soviet Union to defend themselves against invading German armies during the Second World War. We shall also see how both manufacturing activities and the lack of them are related to political activities in other nations.

One phase of the relationship between manufacture and politics will be mentioned here. Both the events that led up to the Second World War and the war itself had a tremendous influence on manufacture everywhere. Not only did the war reduce many established centers of manufacture, but it stimulated the development of new centers at safer distances from enemy airports. The picture at the left shows an iron and steel plant in the great industrial city of Magnitogorsk, which lies behind the Ural Mountains near the western edge of Siberia. Today this city—which is far from Russia's enemies on both the east and the west—is the greatest center of the iron and steel industry in the entire Soviet Union. Twenty years ago it did not exist.

The Second World War stimulated manufacturing activities in nearly every nation on earth. The world-wide dislocation of trade and transportation which was caused by the war cut off the flow of manufactured goods to many nations and encouraged these nations to build factories of their own. Now that world peace is being established many of these new manufacturing centers are continuing to operate. Many of the "war plants" in the older manufacturing regions, however, have shut down or are being converted into plants for the manufacture of peacetime goods.

In short, the world picture of manufacture is changing and will continue to change. Only the rashest of prophets would dare to predict exactly how it will change. One thing, however, is reasonably sure: many of the essential elements of manufacture as we know them today will probably continue to exist tomorrow. The chief manufacturing regions of today will probably not become utterly unfavorable to manufacture in the future. On the other hand, they will doubtless never again have the overwhelming preëminence which they have had in the past.

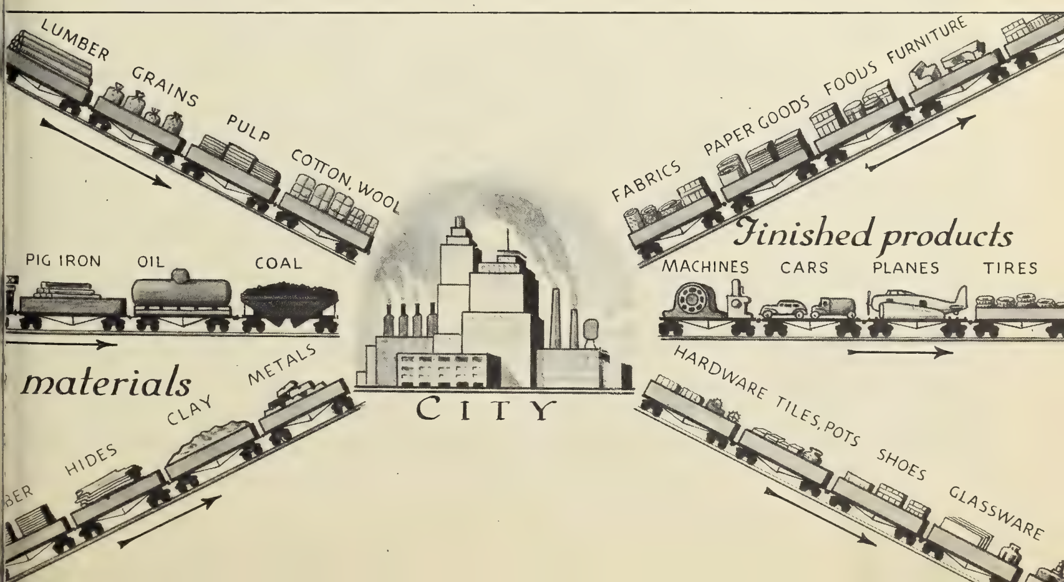
THE UNION OF PEOPLE THROUGH TRADE

The movement of materials. Earlier in this chapter we saw that manufacture exists because people for the most part cannot use the raw materials of the earth in their natural form. In studying the processes through which manufacture changes the *form* of raw materials, we caught glimpses of other, closely related processes through which the *location* of both raw materials and finished products is changed. It is just as important for men to have the things they need in the places where they are needed as to have them in the form in which they can be used. Just as the processes of manufacture are concerned with changing the form of materials, so the processes of trade and transportation are concerned with changing their location.

A store in Chicago, for example, sells men's socks which were made in a mill in New England from cotton that was grown in Georgia. A farmer in Iowa uses a hoe which was made in Indiana from iron ore that was mined in Minnesota. If you look round the room in which you are reading this book, you will probably find many manufactured articles that contain materials which came from a great variety of places. This book itself is made of wood pulp which was once part of a Canadian forest. The wood pulp was turned into paper in New Hampshire; the paper was cut, printed, and bound into a book in Massachusetts. The type, the ink, the cloth, and the machinery of the press that also contributed to the making of this book came from many other places all over the world.

The exchange of materials. The endless flow of materials from place to place is one of the most striking aspects of modern civilization. When we study the separate streams which make up this flow we find that they are related to one another. We find that the streams of materials that flow into any given place are related to the streams that flow out of that place. We can illustrate this fact by a very simple example. Let us say that you are a wheat farmer in Minnesota and that I am a shirt manufacturer in New York. You have more wheat than you can possibly eat and I have more shirts than I can possibly wear. We both need

This chart shows the actual exchange of some of the more important commodities which took place in one American city in a recent year.



wheat and shirts, and we get them both because a stream of wheat flows from you to me and a stream of shirts flows from me to you.

The flow of materials between you in Minnesota and me in New York is, of course, not so simple as this example might make it seem. Many other people are involved before you get my shirts and I get your wheat. The example, however, illustrates the important fact that the flow of materials between you and me is in the nature of an exchange. You have a surplus of one kind of goods and I have a surplus of another kind. By exchanging these surpluses we are both able to get more of the things we need.

The countless streams of materials of all kinds which flow continuously all over the earth are engaged in exchanging surpluses. They are so engaged because of three simple truths:

1. No individual, community, district, or nation can produce for itself all the things it needs.

2. Many individuals, communities, districts, and nations produce more of certain things than they can use.

3. An exchange of surpluses makes it possible for individuals, communities, districts, and nations to get things they need which they cannot themselves produce.

How materials are exchanged. This exchange of materials is known as commerce or trade. When you exchange your extra pocketknife for Bill's extra baseball glove, you make the most simple kind of "trade." Such direct exchange of goods is known as barter. Though a common practice in the past, barter takes place today only locally, occasionally, and on a limited scale. You have seen many reasons in the earlier units of this book why barter is not widely practicable in the modern world.

You have seen how marked differences in climate, land forms, and natural resources from place to place have led to marked regional differences in the activities of men and in the products of these activities. Wheat farming, for example, goes on in Manitoba and rubber growing in Malaya because particular climates favor these particular occupations and their products. Similarly, lumbering is practiced chiefly in mountains and herding chiefly on plateaus because particular types of land surface favor these particular occupations and their products. The fishing villages of the Norwegian coast and the lead-mining towns of Missouri exist because the natural resources of these regions favor fishing and lead-mining. Nearly everywhere you go you will find this sort of regional specialization in occupations and products.

Under such circumstances it is obviously impossible for the people of the world to exchange their surplus products by simple barter. It would take you months to gather together the orange juice, toast, cocoa, and cereal of a single breakfast if you had to get these foods by barter from the widely separated people who produce them. To gather the ingredients for a telephone or automobile by barter might well take you all the rest of your life.

Both the regional specialization in products and the complicated nature of many commodities have made the processes of commerce in the modern world anything but simple. The exchange of most goods today requires an elaborate organization of producers, manufacturers, wholesalers, and retailers. It also requires elaborate systems of money, credit, and transportation. When you go to a grocery store and exchange a few coins for a pound of coffee, you perform what might seem to be a very simple act. But if you study the meaning of that act you will find that it is not simple at all.

The story of a cup of coffee. You probably know that more than half the coffee which is drunk in the entire world is grown in the highlands of southeastern Brazil. You probably know something about how it is grown and brought to market. But do you know how many people must work, and how

This coffee plantation in Brazil is a little state in itself.

many different kinds of work must be done and paid for, before coffee can be placed on the breakfast tables of the world?

The photograph above shows a coffee plantation in Brazil. The plantation is so large that the people who take care of the trees and harvest the crops live in several different villages which are all on the one plantation. Each laborer can take care of about 2000 trees on five to seven acres of land. From November to May, the growing season in Brazil, the work is chiefly keeping down the weeds between the trees. There are about 2,000,000,000 coffee trees in Brazil, which, if you care to do the arithmetic, will give you an idea of the importance of coffee in the lives of the people of Brazil.

From June to October, trees which are four years old or older bear fruit that looks something like our red cherries. Instead of using the skin and pulp, as we do in the case of cherries, we use only the seeds of coffee berries. Many extra laborers must be hired during the coffee harvest to pick the berries from the trees, to remove the skin and pulp, to wash, dry, and sort the beans, and finally to pack the beans in sacks for shipping. The photographs on page 268 show some of these steps in the preparation of coffee for the market.

After the coffee beans are in the sacks they do not all begin traveling at once. Much of each crop is stored in huge warehouses, which are run by the government of Brazil. In this way the coffee is not all poured into the markets of the world during the harvest season. It is made to flow out of Brazil in a steady stream the year round.

Government control of the coffee industry requires a variety of services from many people. The coffee must be checked in and out of the warehouses. It must be inspected

C. I. A. A. Photos

These photographs show a few of the many steps in the preparation of coffee for the market: A, separating the beans from the chaff; B, washing; C, drying; D, testing.

for plant pests which harm it and may entirely destroy it. If pests are found, the coffee beans must be fumigated. The government of Brazil also makes loans to planters and collects taxes for advertising coffee all over the world. It brings in workers from the seacoast cities and sees that they are properly cared for on the plantations. You can imagine how many hundreds of government workers are needed to do all these things.

Thousands of other workers are needed to bring the coffee from the plantations in Brazil to homes all over the world. The sacks of coffee beans are first carried by railroad to the seaport cities of Santos and Rio de Janeiro. There they are loaded into ships which go to many foreign lands. When the boats reach their different destinations, men are waiting on the docks to unload the coffee. Other men are ready to move it once more by rail or truck, still others to store it again in warehouses. Then it must be roasted, ground, and put up in attractive packages. After this it must be delivered to the wholesalers, who deliver it to the retail grocers, who finally deliver it to you.

How trade unites people. This elaborate chain of men and activities is anchored in a simple geographic truth which we have already pointed out. People all over the world like to drink coffee, but the soil and climate of most countries cannot produce it. The people of Brazil have therefore found it profitable to become the chief coffeegrowers for the world. They exchange their great surplus of coffee for surpluses of other commodities in other regions.

It is obvious that a coffeegrower in Brazil who needs a new truck could not conveniently barter his way with goods to a manufacturer of trucks whose factory, let us say, is in Michigan. Such a trade must be made indirectly, with the help of money. Money is much easier to handle than goods, and very early in the history of trading it was invented to represent the value of goods. It acts as a promise to give value in goods equal to the value of goods received. It is the oil that enables the complicated machinery of modern trade to run smoothly and swiftly.

The story of coffee brings out what is perhaps the most significant fact about trade. *Both the materials and the money which trade sets in motion are bonds between people in different regions of the earth.* The millions of people in the coffee industry are working not only for themselves but also for the tens of millions of people who drink the coffee. In getting the coffee from the tree in Brazil to the cup on your table, each worker can do his work only if other workers have done their work. If some great misfortune should strike the coffee industry, if the crops should fail or the coffee boats sink, this whole vast web of work would collapse. There would be no coffee on your table, and the people who help to bring it there would have to look for other ways of making a living.

What is true of coffee is true of practically all other materials of trade. These materials are the blood stream of the modern economic world. Just as manufacture acts as the lungs that put this blood into a useful condition, trade acts as the heart that pumps the blood to the lungs and all the other organs. This truth is one of the most important reasons why individuals, communities, regions, and nations cannot possibly live for themselves alone. Trade binds all men and all the earth into one gigantic union.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. As modern civilization spread over the world, factories became more and more widely distributed.

2. The first requirement for manufacture is power-driven machinery.

3. All factories must be near the source of the raw materials which they use in making their manufactured products.

4. Most factories in Europe are located near coal fields because they must be near to a supply of fuel in order to operate successfully.

5. In locating a factory you need consider only the nearness of the raw materials, the source of the fuel or power, and the transportation facilities.

6. Factories cannot operate successfully unless they are located in or near large cities.

7. Cities are wholly unsuited for manufacture because they are too crowded and the taxes are too high.

8. North America led the world in manufacture before the Second World War.

9. War has a bad effect on manufacture because it destroys so many factories.

10. Trade is one of the least essential activities in our society because it is a way of making money without producing anything.

11. Every country should strive to produce all the manufactured articles it uses and thus do away with much unnecessary effort and expense.

12. Trade between the nations of the earth must necessarily promote war because it creates competition between the nations.

QUESTIONS FOR DISCUSSION

1. Inasmuch as modern machinery in factories can do the work of many men, do you think that there would be less unemployment and more prosperity if the industrial nations returned to the primitive condition of manufacturing commodities by hand?

2. During the Second World War many of the factories of Western Europe were destroyed or seriously damaged. What do you think will be the effect of this on the industrial production of Western Europe and the future location of factories in that region?

3. Do you think that the United States would be more or less prosperous if it had no foreign trade? You might discuss this matter by choosing two teams to debate it in class, with the rest of the class acting as judges.

THINGS TO DO

1. Make a survey of the manufacturing activities in your town or community, or the nearest town or community where such activities take place. If you live in a large city or town you can get most of the information you need from your local Chamber of Commerce. Prepare a report on the following topics:

a. Number of factories.
b. Types of factories and products manufactured.
c. Number of people employed.
d. Location of the factories in the community.
e. Major types and sources of raw materials.
f. Major types and sources of fuel or power.
g. Chief markets for the products.

2. Assume that you plan to open a new factory to manufacture electrical appliances. Write a report on the things to be considered in selecting the location of your factory.

3. Every day in your schoolwork you use paper, a pencil, and an eraser. Look up and report on all the processes of production and distribution which made it possible for you to have these articles.

4. Make a list of the kinds of trade or commercial facilities which your community contains. Prepare a report on the following topics:

a. Types and distribution of retail stores.
b. Types of wholesale houses, if any.
c. Number of banks.
d. Other trade facilities.

5. Look up and report on the effect which tariffs have had on the flow of world trade. Decide whether you believe that tariffs help or hinder the general prosperity of a nation, and state clearly the reasons for your decision.

BOOKS TO READ

1. *Statistical Abstract of the United States*, published each year by the United States Department of Commerce, makes the dullest imaginable reading. But if you are seeking precise and up-to-date specific information about United States manufacture and trade, it is an indispensable reference.

2. There are many textbooks of economic geography which deal with manufacture and trade in considerable detail. A book of this class which is both authoritative and readable is *Economic Geography*, by CHARLES C. COLBY and ALICE FOSTER.

3. The social problems which have developed in the wake of the industrial development of cities are nowhere more movingly set forth than in *Twenty Years at Hull-House* and *The Second Twenty Years at Hull-House*, by JANE ADDAMS. *The Culture of Cities*, by LEWIS MUMFORD, is a scholarly but extremely interesting study of the economic, social, and political problems of cities.

4. *Men and Machines* and *The Economy of Abundance*, both by STUART CHASE, are exciting and informative books on our machine civilization in general. *The Storehouse of Civilization*, by CLIFFORD C. FURNAS, is a very interesting discussion of modern manufacture and trade by a chemist who has firsthand information on the subject.

XV · TRANSPORTATION AND COMMUNICATION

TRANSPORTATION ON LAND

The geographic elements of trade. Many of the institutions and processes which have been developed for the exchange of goods have little to do with the earth, and hence little to do with geography. Fundamentally, however, trade is geographic because it deals with the movement of earth materials. Inseparably connected with trade are the facilities of transportation and communication, which carry and direct it. Without the movement of men, materials, and thoughts, trade could not exist. This movement can be divided into two broadly different types:

1. Transportation of men and goods by animals, automobiles, trains, boats, and airplanes.
2. Communication of thoughts by telephone, telegraph, cable, and radio.

Let us see how these arteries and nerves of modern civilization perform their work.

Early history of land transportation. When we think of the highways, seaways, and airways of the world today, and of the millions of automobiles, ships, and planes that use them, we might well ask how all this came into being. If we search history for the answer we find very few definite facts. We can be sure, however, that ancient peoples were not rooted in the ground like trees. They had to hustle for a living, even as you and I. This common human need of getting from one place to another has made some kind of transportation necessary in every locality and in every age.

It is reasonable to assume that in the beginning men were their own vehicles of transportation. It also is reasonable to assume that men early found ways of shifting the burdens of transportation from their own legs and backs to those of domesticated animals. Nobody knows exactly what kind of animal first acted as a carrier for men and their possessions. We do know that a variety of animals have been used as carriers

Transportation is vital to the welfare of a nation in both war and peace.
It takes this many railway cars to move a single armored division.
Courtesy of Pennsylvania Railroad


Smithsonian Institution

Long before the birth of Christ the Romans built excellent hard-surfaced roads.

in a variety of places since a time that is lost in the mists of the distant past.

In this day of the streamlined train and the automobile we are likely to forget that primitive methods of land travel are still widely used. In many parts of China, Africa, and South America, where good roads do not exist, human muscle is still the chief means of moving both men and freight. In the frozen lands of the Far North, where heavy loads can be easily moved on sleds, dogs are still the chief means of transportation. In South America the llama, in Africa the camel, in Siberia the reindeer, in China the yak and the water buffalo, in India the elephant, in many regions the horse and the ox, are still among the major means of getting about.

Very early in human history, however, men must have discovered that muscle alone, whether of men or beasts, was an unnecessarily slow and cumbersome medium of travel. Since it is obviously easier to draw a burden than to carry it, mechanical aids to this end must have been invented at a very early date. Just what led up to the invention of the wheel and axle nobody knows. We only know that the wheel and axle was invented by some unknown genius of the ancient world. We know that this device was the most significant invention in the whole history of land transportation because it made possible the muscle-drawn cart, which gave rise with time to the train and the automobile.

Vehicles make up only half of the picture of land transportation; roads make up the other half. Though highly efficient vehicles (by modern standards) did not come into existence until the nineteenth century, highly efficient roads were in use long before Christ was born. We know that early civilizations in Europe, Africa, Asia, and South America had roads. Many of these roads, to be sure, were no more than mere tracks worn by the feet of men and beasts and by the wheels of simple carts. The ancient Romans, however, built many superb hard-surfaced roads to facilitate the movement of troops and supplies over their vast empire. The famed Appian Way was built more than 300 years before the birth of Christ so sturdily that its foundations are still in use as a roadbed.

With the collapse of the Roman Empire, scientific road building also collapsed in

Europe. It was not revived until the sixteenth century, when France built a national system of paved highways on the old Roman pattern. But neither roadways nor vehicles showed any great advance until the nineteenth century brought mechanical power to the wheeled cart, and with it the ability to carry much heavier loads much faster.

The coming of mechanical power to vehicles revolutionized transportation, just as its coming to factories revolutionized manufacture. It made possible the locomotive and the automobile. These power-driven vehicles in turn led to the development of roadways along which they could move with a speed and smoothness which the ancient world never approached even in its dreams.

The purposes of roads. When we think of the millions of miles of modern highways and railways we are likely to think of them chiefly in terms of long-distance transportation. We are likely to forget that the original purpose of roads, and still the chief purpose of most roads, is to supply local transportation. The United States, with more than half the automobiles in the world, also contains almost half of all the roads on which automobiles can operate. More than half these roads are unpaved and used chiefly for short-distance transportation.

The earliest roads in North America were foot trails that connected Indian settlements and hunting grounds. For a long period after their arrival the early European colonists in North America used these Indian trails or very similar trails as routes between their own settlements. Such trails were enlarged first to accommodate men on horseback and later horse-drawn vehicles.

As colonization spread, long-distance roads came into existence between far-removed settlements of importance. These long-distance roads served the double purpose of helping to push civilization farther and farther into the wilderness and of tying the new settlements to the old. But even during the periods of most active colonization the long-distance roads were neither so numerous nor so heavily used as the local roads. Then, as now, the local roads furnished connections between settlers in outlying districts and the towns in which they traded. Now, as then, short-distance travel over such roads accounts for much the largest percentage of all land travel.

When the railroad and the automobile made land travel very much easier than it had ever been before, roads became very much better than they had ever been before. In practically all countries roads came to be used for a variety of new purposes. Through high-speed, long-distance railways and highways nations were able to tie their territory together more securely than had ever been possible in the past. Russia, for example, was able to connect the industrial districts of European Russia with the fine port of Vladivostok on the Pacific Ocean, and to open up vast new regions for exploitation along the way. Other European countries were able to develop national systems of military roads which linked the chief cities with border regions where troops and supplies might suddenly be needed. In North America many fine transcontinental railways and highways were built which knit together the industrial East and the agricultural South and West. Through these great arterial roads and the secondary roads that radiate from points along their routes, the lifeblood of trade can reach into every corner of the land.

The patterns of roads. The patterns which roads make on the surface of the land are obviously related to the purposes for which the roads were built. Though roads have many special purposes, they all have one general purpose in common: to connect places in the shortest course that is practical. In spite of this fact roads vary greatly in the directness of their courses, for a variety of reasons.

In Unit III we studied about the different ways in which the surface of the land affects

By Ewing Galloway, N.Y.

This straight road across the plains of Texas was built at relatively low cost.

This curving road through the hills of New York was much more expensive.

By Ewing Galloway, N.Y.

the use to which men put it. In that unit we saw something of the intimate relationships that exist between the forms of land and the routes of travel. If you turn back to the map on page 189, which shows the road pattern round Los Angeles, you will see that roads are more numerous and direct on the plains than in the mountains. The roads of rough lands are generally fewer and more crooked than those of flatlands.

Even in flatlands not all roads can follow the most direct courses. No land surface is without some irregularities. Even on plains a direct course frequently requires "cuts" through minor elevations and "fills" in swampy places. Such engineering works are expensive and not all roads can justify the expense. To cut down expense many flatland roads detour round minor elevations and depressions. Many of them cross rivers at places that lie off the most direct course because more favorable sites for bridges occur there.

In most hilly and mountainous regions the expense of building straight roads is prohibitive. In such regions both railways and highways generally follow river valleys. They must cross the divides between valleys by "switchbacking," as shown on page 164, or through expensive tunnels. Many cuts, embankments, trestles, and bridges are necessary not only to shorten train and automobile routes through such regions, but to make them possible at all. In view of all this it is not surprising that in many rough lands muscle and simple trails are still the most popular means of travel. Porters and pack animals, with all their limitations, can traverse steep slopes at relatively little expense.

In many places, particularly in the flatlands of western United States, wagon roads are turned away from straight courses by legal obstacles. In 1785 a system of land survey was adopted in this country which divided land into "sections," each section one mile square. In much of western United States the section lines became the property lines between adjoining farms and ranches.

From Colby and Foster, "Economic Geography

Railroads are most numerous where people and industries are most numerous.

Many main roads were built before this system of land division was instituted. Such roads make their way across land without reference to the section boundaries. A great many secondary roads, however, follow the checkerboard pattern of the section boundaries. By following this pattern roads can develop without the need of any one person's giving up much of his land for public use. The pattern, on the other hand, does anything but serve the chief purpose of roads, which is to get to where they are going as directly as possible.

Railroad patterns. So far we have chiefly discussed features which automobile roads and railroads possess in common. These two types of roads, however, are different in certain ways. Trains cannot climb as steep slopes as automobiles can. Railroads must therefore bow to many major features of relief which automobile roads can master. Railroads, on the other hand, can afford to follow straight routes over many minor features of relief which automobile roads cannot follow because of the expense. Railroads can also brush aside such legal restrictions as we discussed above because they are given special privileges in laying out their courses.

The continental patterns of railroads, as shown on the map above, are the creations of the modern world. They bring out the vital relationships between population, industry, and transportation in that world. Compare this map with the earlier maps in this book which show the distribution of people and industries. (See especially the maps on pages 18–19 and 254–255.) Notice that with the sole exception of southeastern Asia, railroads are most numerous where people and industries are most numerous.

The automobile versus the train. Before the Second World War the automobile and the train were competing with each other for supremacy in land transportation. Nearly everywhere on earth the automobile was winning the competition. Though trains have marked advantages as carriers of heavy and bulky loads over long distances, automobiles have marked advantages as carriers of lighter and more miscellaneous loads over short distances.

By Ewing Galloway N.Y.

Trucks are ideal for carrying perishable foods quickly and directly from farm to market.

Flexibility of use and economy in operation give the automobile its greatest advantages over the train. Automobiles can reach many communities which rail-bound trains cannot reach. They can carry freight directly from the shipper to the receiver. They can arrange more convenient schedules than can the less flexible trains. Railroads are under great and constant expense in keeping their cars and their roadbeds in repair. Though automobiles must pay license fees and taxes for maintaining roads, as well as occasional bills for repairs on themselves, they are much cheaper to operate than trains.

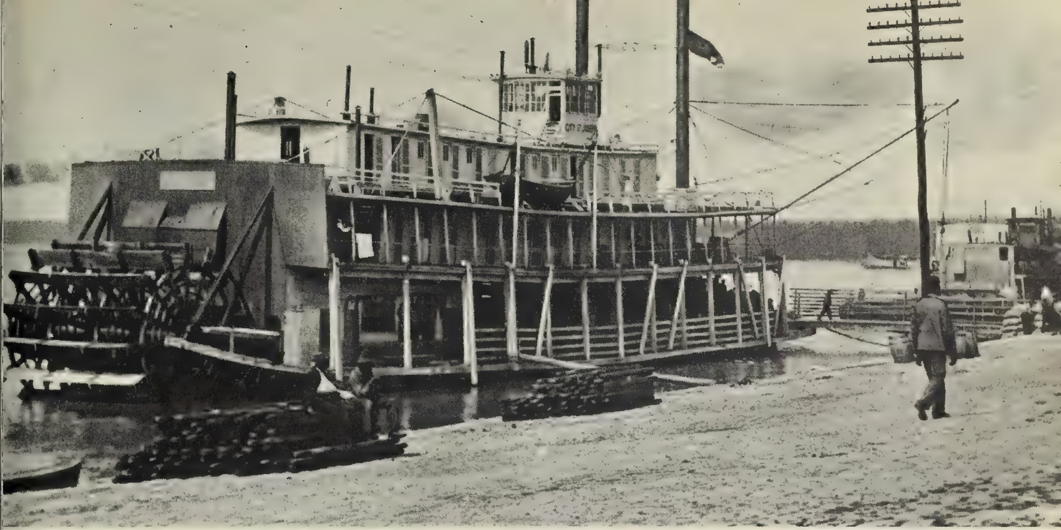
Because of these facts, passenger travel on railroads before the war had steadily decreased, though travelers had steadily increased. Freight carried by railroads had also decreased, but not so much. In most countries, however, war shortages affected the automobile much more than the train. The train regained the importance it had enjoyed in the early years of the twentieth century. Now that the war is over, of course, it will again have to reckon with the automobile. Nobody knows just what the outcome will be. We do know that in this rapidly developing mechanical and industrial age there is need for both.

TRANSPORTATION ON INLAND WATERS

The declining importance of inland navigation. If the automobile should succeed in reducing the train to a position of minor importance in land transportation, it would only do to the train what the train has done to the boat. When Robert Fulton's steamboat *Clermont* moved up the Hudson River from New York to Albany in 1807, a great era of inland navigation began in the United States and Canada. Rivers and lakes came to be widely used, both as avenues of exploration and as arteries of trade after settlements had been built. Such travel reached its peak just before the Civil War, then steadily declined as rail travel steadily increased. At present, traffic is rather notably increasing on some of the inland waterways of the United States, though in most areas it is of little importance. On the other hand, transportation over lakes and rivers is practically the only kind of transportation that exists in the remoter districts of Canada where rails have not yet penetrated.

It is all but impossible to overestimate the importance of inland waters in the pioneer development of a country. Rivers and lakes are ready-made roads into the wilderness. They are level or nearly level highways over which heavy burdens can be moved with relative ease. It is hard for us to realize that most of the large rivers of the United States once were alive with commercial activities. Today we think of such inland cities as Pittsburgh, Cincinnati, St. Louis, and Omaha as railroad centers. Less than a century ago people thought of these places as ports on the Ohio, Mississippi, and Missouri rivers.

Though travel by inland waterways has declined in the United States and in most other regions with highly developed railways, it is still very common in many lands. The Yangtze River is still the chief means of transportation between the interior of China and the sea. The Amazon River and



By Ewing Galloway, N.Y.

Such scenes as this were once common along the great rivers of eastern United States.

its tributaries offer the only continuous passageways through the rain forests of Brazil. The Congo River provides the same service for equatorial Africa, though not so conveniently, because of its many waterfalls. Should these regions become modernized, however, their inland waterways would almost surely lose much of their traffic. Let us try to discover why this should be so.

Transportation by rivers. Rivers vary greatly in their suitability for navigation. Some rivers are so wild and treacherous, so full of rapids, falls, and shallows, as not to be navigable at all. A river cannot be termed navigable unless it is sufficiently slow, smooth, and deep over a considerable distance to permit the movement of boats carrying heavy loads. Long stretches on many rivers of the earth meet these requirements of navigability. But even the most navigable of rivers have certain qualities which are decided disadvantages when the rivers come into competition with railways and automobile highways.

In this modern age of hurry and worry, speed and directness are the first demands which are made on the facilities of transportation. River travel by modern standards is painfully slow, especially on upstream trips. It is anything but direct, even when both the point of departure and the destination lie on the river's banks, because the courses of most navigable rivers twist and turn as the rivers make their way to the sea.

It is, for example, about twice as far from St. Louis to New Orleans by boat down the Mississippi as it is by train. Not even the

Traffic is still heavy on the Yangtze River of China.

By Burton Holmes from Ewing Galloway

James Sawders

The Danube is still the most important east-west highway of travel across Europe.

straightest rivers follow the shortest paths between the upper and lower limits of their navigability. Not only that, but many navigable rivers do not reach places where transportation is needed. One reason for the decline of traffic on the Mississippi was that this river moves in a north-south direction in a country where most trade took on an east-west direction of movement.

Rivers are children of the rain and are obedient to their parent. Rising and falling as the rain demands, they often become too unruly for travel during flood and too shallow for travel during drought. The channels of most navigable rivers tend to shift from time to time, with the deposition of sandbars which both endanger and retard navigation. Similar results are produced by the rapids and falls which many rivers contain. In cold climates rivers may be covered with ice and closed to navigation for several months each year. In warm climates they may be choked with vegetation.

Though men can reduce some of these obstacles to river transportation through a variety of public works, they cannot eliminate them. They can (and in the long run generally do) turn to more satisfactory means of getting themselves and their goods across the land. Western Europe, however, is an outstanding exception to this rule. Such rivers as the Rhine and the Danube, which flow through densely populated and highly industrialized districts, carry tremendous quantities of freight each year. They are still extremely important trade routes in a region where no possible avenue of transportation can profitably be neglected.

Transportation on lakes. Most of the objections to rivers as highways of travel do not apply to lakes. To be sure, many lakes, like many rivers, are in remote places where there are few men or goods that need to be moved. Many lakes, like many rivers, are sealed by ice in winter. The chief objection to lakes as mediums of travel, however, is simply that most of them are too small to furnish more than scattered local transportation. Such large lakes as the Caspian and other inland "seas" of Asia, the three large lakes of southeastern Africa and the Great Lakes of North America are notable exceptions to this rule.

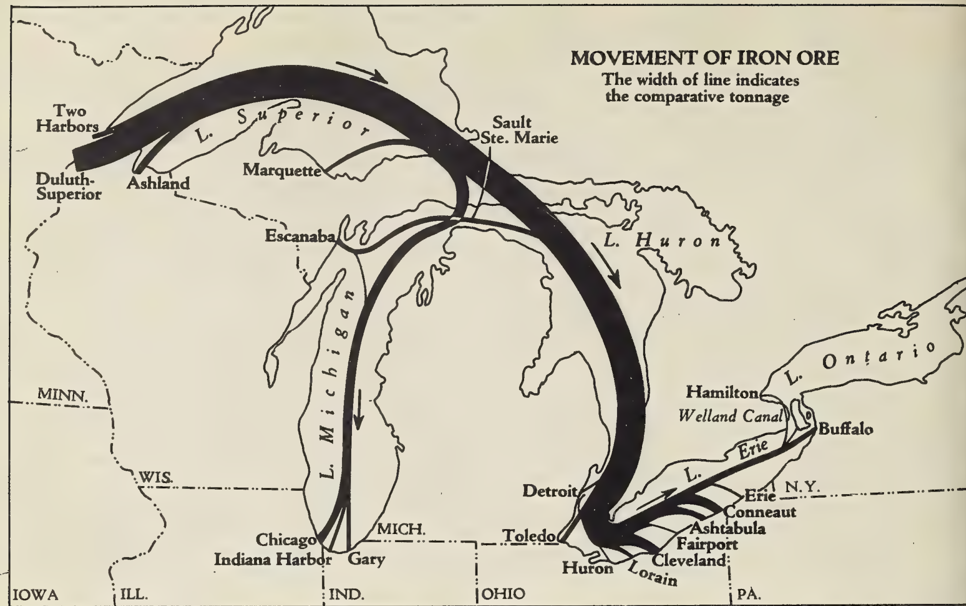
The Great Lakes, alone among the inland waterways of North America, have preserved their greatness in the affairs of men. They are the most important interior waterways not only on this continent but in the entire world. The Great Lakes not only supply the cheapest possible means of bringing iron ore and coal together in the heart of the American Manufacturing Belt; they also connect the agricultural Middle West with the great markets of the industrial East. They are large and deep enough for ships of any size, and at the same time are not troubled by the great storms and the tides of the oceans. They provide some 1700 miles of cheap transportation where cheap transportation is most needed by both Canada and the United States.

Transportation through canals. With all their natural advantages, the Great Lakes could never have become a unified highway of travel without the ingenuity of man. These lakes occupy basins which were scooped out by the continental ice sheets that once moved down through Canada into the United States from the Arctic. When the ice melted and the basins filled with water, the only lakes that stood at the same level were Lake Huron and Lake Michigan. Short but unnavigable rivers connected Lake Superior and Lake Huron, Lake Huron and Lake Erie, and Lake Erie and Lake Ontario.

To make the Great Lakes into a continuous waterway for large ships, men had to dredge channels through the connecting rivers where they were too shallow for navigation. They had to build canals and locks where the connecting rivers were too steep and swift for navigation. The diagrams on pages 280 and 281 show how the Great Lakes serve the needs of a great industrial region. Notice that at present most of the traffic on the Great Lakes moves between the limits of Duluth and Buffalo,

Cleveland on Lake Erie handles more tonnage of freight than most ports on the Atlantic Ocean.

By Ewing Galloway, N.Y.



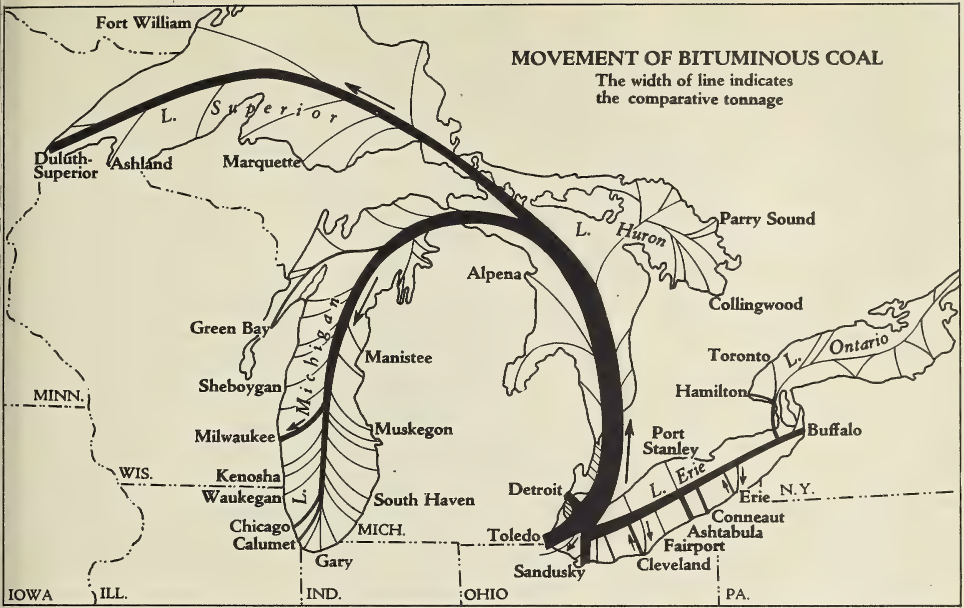
Cargoes that cross the Great Lakes from northwest to southeast are chiefly iron ore and grain.

where a channel of no less than 20 feet is provided all the way. The west to east traffic consists chiefly of iron ore and grain; the east to west traffic consists chiefly of coal.

Though the Welland Canal round Niagara Falls between Lake Erie and Lake Ontario provides a 30-foot channel for ships, the canals along the unnavigable portions of the St. Lawrence River are only 14 feet deep. This is too shallow to permit large boats to move between the Great Lakes and the Atlantic Ocean. The proposed St. Lawrence Waterway would provide a 27-foot channel the full length of the St. Lawrence River, which would be deep enough for large seagoing ships. If this dream should ever become a reality, the North American coastline would be pushed westward tc Duluth. As it is, the canals of the Great Lakes system of waterways are the busiest in the world. More tonnage of freight passes from Lake Huron to Lake Erie in an average year than passes through the Suez and Panama canals combined.

A full description of all the canals in the world would fill many books. These artificial rivers have been built by man since the earliest periods of history. In many low, wet countries today canals furnish transportation during the rainy season, when the ground melts into mud. In many regions besides North America canals have been built either to connect inland cities with the sea or to link up interior waterways into continuous chains of transportation. In Western Europe, railroads, rivers, and canals are bound together in an intimate and intricate partnership.

Among the most important canals are those which are used to shorten travel by sea. The Kiel Canal, for example, enables vessels to pass between the Baltic and North seas without going round the peninsula of Denmark. (See the map on page 342.) By by-passing Africa the Suez Canal cuts off several thousands of miles from the ship distance between Europe and the Far East. Similarly, the Panama Canal,



After map from War Department

Cargoes that cross the Great Lakes from southeast to northwest are chiefly coal.

by by-passing South America, greatly reduces the ship distance from eastern North America to places on the Pacific Ocean. By using the Panama Canal a ship reduces the distance between New York and San Francisco more than 9000 miles. (See the map on page 282.)

Canals such as this one at Antwerp, Belgium, played a vital role in supplying the armies of the United Nations on the Western Front during the Second World War.

© Ewing Galloway, N.Y.

TRANSPORTATION ON THE SEA

The oceans as highways. Man is by nature a creature of the land. His legs and his lungs were not designed for water. In him, however, are a restless spirit and an inventive mind, which have enabled him to do many things he was not designed to do. Among these things has been the extension of his activities into the realm of water.

In the beginning of human history the oceans were formidable barriers to travel and trade, but they were also vastly inviting to the men who lived on their shores. Men were not slow in accepting the invitation. Many ancient languages whose roots are buried in an unknown past contain a word for "ship." Some of the earliest chronicles of human achievement deal with the invention of boats and the development of the science of navigation.

The earliest ocean travel must have stayed close to the shore. The earliest sailors must have feared the open sea—

Trade binds the nations of the world into one mighty whole.

for plenty of excellent reasons. They doubtless never ventured beyond sight of land and at night they probably pulled their small, frail boats up on the shore. Yet long before the birth of Christ such sailors were making long voyages. Herodotus tells of a three-year voyage by some venturesome Phoenicians round the continent of Africa in 600 B.C.

With time boats grew larger and stronger; knowledge of navigation grew fuller and more reliable. Ancient Greek sailors wandered all over the Aegean and Ionian seas; ancient Roman sailors carried trade to every corner of the Mediterranean. In the early centuries of the Christian Era all the large gulfs and bays of western, southern, and eastern Eurasia became highways of commerce. After Columbus the open oceans were quickly mastered. All oceans became highways of travel and trade; all continents, part of one economic world organism.

The nature of ocean trade routes. The oceans provide highways which, except at their landward ends, cost nothing to construct and nothing to keep in repair. *In theory* these highways are as broad as the oceans themselves. *In fact* they are relatively narrow lines which hold to certain definite directions for certain definite reasons. In this regard they are not very different from the highways of the land.

Just as in the case of land highways, the first purpose of ocean highways is to get people where they are going by the shortest practical course. We saw in Chapter I that the shortest course over any part of the earth's surface follows the arc of a great circle. The first requirement of an ocean highway, therefore, is to follow such a path as nearly as possible. Many things, however, interfere with such an ideal course. Few ocean highways can keep to perfect great circle courses throughout their routes.

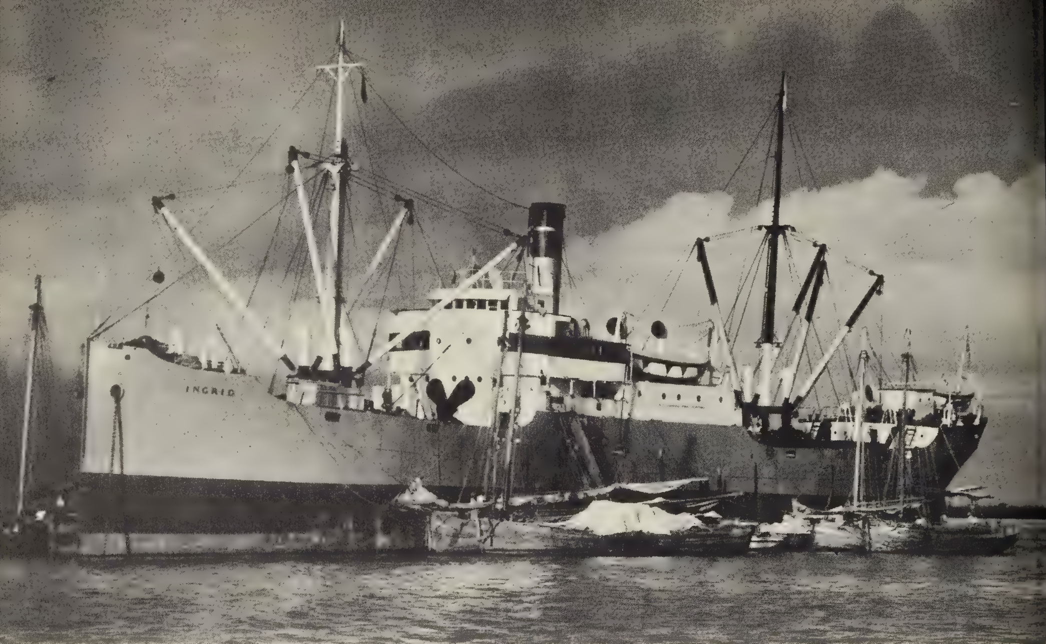
Though the sea is wide, deep, and level, it is full of obstacles and dangers for the sailor. The modern mariner in his power-driven ship does not have to sail with favoring winds and currents, but he still must contend with fog, ice, and storm. Certain regions of the sea are especially hazardous at certain seasons of the year; many ship routes turn away from great circle courses to avoid such places at such seasons.

Even more of an interference with the directness of ocean highways are the hazards and obstacles of land. The shape and position of land masses in many cases make ships depart from great circle routes. The projection of capes and peninsulas, the presence of islands and dangerous reefs, the absence of good harbors, are some of the reasons why ships cannot always follow the shortest possible routes to their destinations.

Nature is not alone in determining the location of ship routes. The chief reason for the existence of these routes is trade, which depends on the activities of men. The shortest possible route across the Atlantic Ocean, as you can see if you look at a globe, runs from the eastward bulge of South America to the westward bulge of Africa. Such a route would be an ideal trade route if the people at the ends of it had commodities to trade with one another. At present they do not have such commodities and the route has no importance—except as a possible avenue for naval movements in time of war.

Much the most important influence on the location of ocean trade routes is the trade which they carry. In the ancient world most ocean commerce moved over the waters of the Mediterranean Sea. Today most of it moves over the waters of the Atlantic Ocean. Some people predict that the ocean commerce of the future will be heaviest on the Pacific. But in any age *ocean commerce and the routes over which it moves depend first of all on the existence of large populations with surplus commodities on the lands which the routes connect.*

Ocean trade routes of today. The map on page 282 shows the chief ocean trade routes of the modern world and some of the chief commodities that move over them.



By Ewing Galloway, N.Y.

Little tramp freighters carry most of the burdens of international trade.

The outstanding feature of this map is that most of the great highways of the ocean run in a general east-west direction. The main reason for this is that the great land masses of the globe are like fingers stretching southward from a giant hand which is resting on the north pole. Oceans stretching northward from the south polar region fill the gaps between the fingers of land—gaps which only east-west highways can bridge.

The second most conspicuous feature of this map is that the ocean highway in heaviest use today connects eastern North America and Western Europe. This should be no surprise, because we have already seen that the people of these two regions are the world's greatest producers of surplus goods. Second in importance to this *North Atlantic Route* is the *Mediterranean–Far East Route*, which connects the trading areas of the entire North Atlantic region with southern Asia and Australia. Third in importance is the *South American East Coast Route*, which enables South America to exchange its agricultural products for the manufactured products of Europe. Other important trade routes connect the main land masses of the earth by way of the Pacific, South Atlantic, and South Indian oceans.

The carriers of ocean commerce. Time has clothed the merchant vessels of earlier centuries in glory and romance. The slave-driven galleys of ancient Rome and the little sailing vessels that succeeded them enabled men to discover the world. The noble clipper ships of later years enabled men to bind the world together into a commercial whole. The boats that carry most of the world's ocean commerce today trail no clouds of glory. They are little "tramp" freighters, dirty and ugly, but they make up in efficiency what they lack in romance.

These little boats are the work horses of the sea. They go wherever there is freight to be moved. If this means staying away from their home ports for several years, they stay away. Great modern ocean liners, to be sure, also carry freight, but their schedules, routes, and construction are designed chiefly for the convenience of passengers. With the Second World War the freight-carrying airplane began to compete with the cargo vessel. This competition will doubtless increase in the future because airplanes can travel much faster and much more directly than ships. But ships are still the cheapest means of carrying heavy cargoes long distances. The little tramp steamer is not likely to give way completely to his more glamorous brother of the sky.

Before the Second World War the ships of eight nations carried the bulk of the world's ocean commerce. These nations, in the order of their importance in this regard, were Great Britain, the United States, Japan, Norway, Germany, Italy, the Netherlands, and France. Great Britain carried more than half again as much commerce as the United States, and more than seven times as much as France.

The war had a tremendous influence on the merchant fleets of the world. It greatly reduced those of most nations but greatly increased that of the United States. Though the foreign trade of the United States was almost as great as that of Great Britain before the war, the United States let much of this trade be carried in ships of other nations. It had let the great merchant marine which it built up to meet the emergency of the First World War decline when that war was over. Whether or not it will do the same thing after the Second World War is a question which only the future can answer.

The nature of seaports. The ports that lie at the ends of a sea route are the most important parts of the route. Ships must be protected from wind and waves when they are being loaded and unloaded. To give this protection a seaport should possess a deep, sheltered, and ice-free harbor, with plenty of wharves and anchorage ground for the vessels that use it. Bays on irregular coasts and the mouths of rivers make the best natural harbors; dredged tidal streams on low coasts make the best artificial harbors. California possesses fine examples of the first type at San Francisco and of the second type at Los Angeles.

San Francisco is built on one of the finest natural harbors in the world.

Spence Air Photos

Los Angeles built this great artificial harbor by deepening tidal streams on a coastal plain.

Harbors alone do not make seaports. The coastlines of the earth contain thousands of protected bays and inlets which are visited only by birds. *Seaports are instruments of trade*; unless the area behind a harbor (the so-called hinterland) is developed for trade, the harbor is useless to men. If you look at a map of Chile you will see that the southern coastline of this country is broken into many islands, promontories, and inlets which provide innumerable splendid natural harbors. The seaports of Chile, however, are all farther north where practically no good natural harbors exist but where there are people and products to demand the service of the sea.

All the great seaports of the world serve the basic purpose of trade: the exchange of surplus commodities. All occupy locations that favor this exchange. The importance of seaports in the destiny of nations can hardly be overestimated, but this is a story that must wait until the next unit.

TRANSPORTATION THROUGH THE AIR

The importance of air transportation. The patterns of transportation on land and sea were established before the airplane was invented. When Orville Wright made the first successful flight in a gasoline-driven airplane in 1903 he opened the way to the development of the fastest and most direct transportation in all human history. Few, if any, people realized what such transportation might someday do to familiar forms of travel, to familiar methods of trading and waging war, and to familiar ways of thinking about themselves and the world at large.

Even as late as that fateful day when Germany sent her fleets of bombing planes into Poland, many Americans regarded the airplane as little more than a plaything of our modern civilization. They recognized its value as a carrier which conveniently speeded up the mail. They admitted that it could rush a man across a continent or even an ocean if his business was sufficiently urgent to warrant the risk. But Americans as a whole did not believe that the airplane might change the pattern of our whole world civilization until people in other nations who did believe in this possibility began to attempt to put it into effect.

As the Second World War went along its deadly way, the military importance of the airplane became clear to all. The very people who had scarcely noticed the existence of the airplane in the past made extravagant claims for the role it would play in the future. Such prophets seemed to take it for granted that the airplane would carry over into a world at peace the importance it had achieved in a world at war. In their speculations on the future possibilities of air transportation they seemed to assume that no limitations existed.

The only way we can surely know just what the possibilities and limitations of air transportation may be in the future is to wait and see. Today's prophecy about so rapidly developing a field of activity is more than likely to turn up as tomorrow's embarrassment. Two things, however, seem certain: (1) The airplane has come into the world to stay. (2) Though certain of its wartime uses will not carry over into peacetime, certain other uses will.

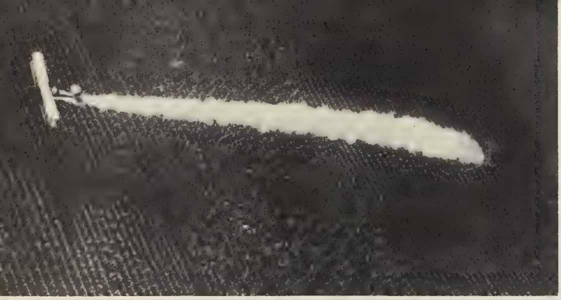
Commercial status of the airplane. Speed and directness are the outstanding advantages of the airplane as a means of transportation. No other carrier can rival the airplane in these respects. No other attributes are more urgently needed by a carrier during war. In peace, however, extreme speed is at a discount. The faster an airplane travels, the more it costs to fly it. The time saved by excessive speed is of vital concern during war; the money saved by slower speed is of vital concern during peace. Air transportation in a world at peace must compete with land and sea transportation chiefly on a basis of operating cost. In view of this fact it is doubtful that high speed warplanes can be put to general peacetime commercial uses.

Directness, like speed, is less vital in peace than in war. In Chapter I we saw that some of the shortest routes between distant cities follow the arcs of great circles over the north polar regions. Short as these routes are in comparison with ship routes between the same cities, they are still too long for most peacetime purposes. They require nonstop flights over vast stretches of uninhabited lands and frozen seas, where fueling and repair stations are still few and far between.

The longer the flight, the more fuel a plane must carry. The longer the flight, the fewer the passengers and the less the amount of baggage a plane can transport. The longer the flight, therefore, the more expensive and less efficient it becomes. Even during the Second World War military air travel avoided great circle routes within the arctic circle in order to touch places outside of it where airplanes could stop for fuel and repairs. Great circle routes that require long nonstop flights are not likely to be important in a world at peace until planes are invented which can follow such routes and at the same time compete with other types of transportation.

It is reasonable to presume that the airplane of the future will be practically independent of the weather. De-icing devices and many other mechanical aids to safety have already gone far toward creating this independence. Planes that can fly in the stratosphere, above the storms, will also probably become increasingly abundant. It is less reasonable to presume—as some people do—that the commercial airplane will also become independent of the established patterns of trade.

Though commercial airplanes will doubtless carry increasing numbers of passengers and increasing amounts of goods, there will doubtless still be need for trains, automobiles, and ships. Though commercial air service will doubtless penetrate into



From Ewing Galloway

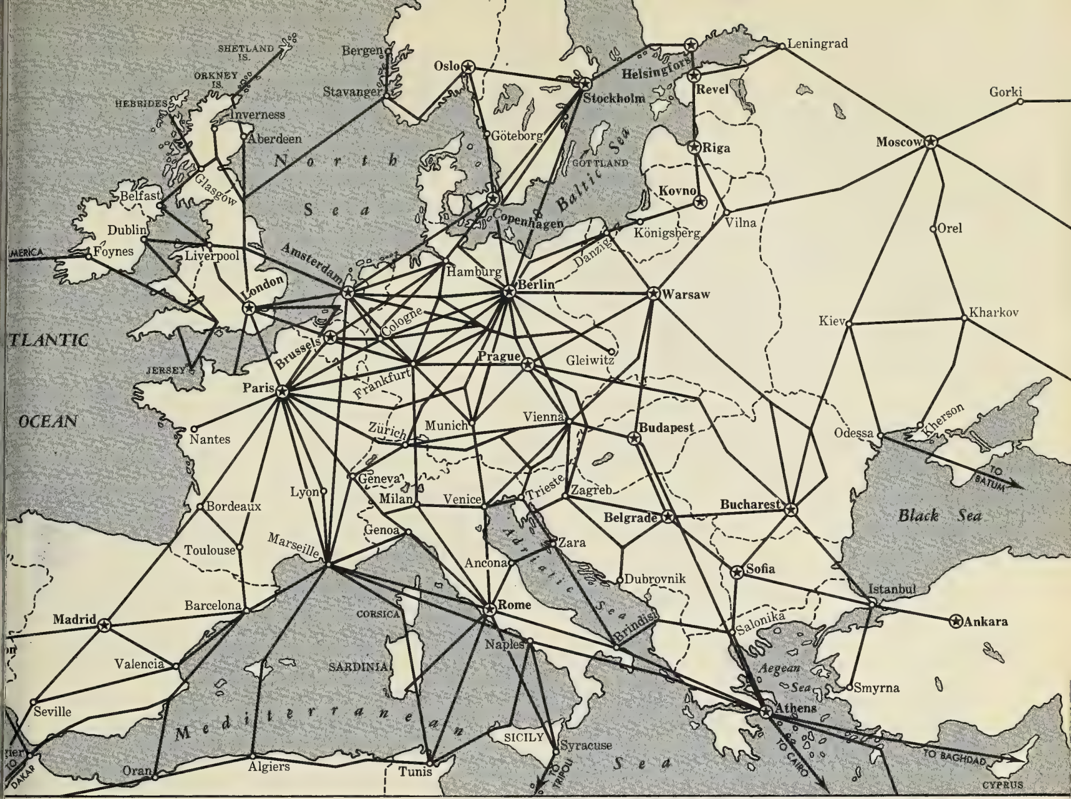
This airplane is spraying a field of cotton.

places it has never reached before, established industrial regions will doubtless continue to exist. On the whole, it is reasonable to presume that the airplane will fit into the established pattern of world trade relationships; that it probably will not revolutionize the economic pursuits of a world at peace as it has revolutionized the political and military pursuits of a world at war.

Domestic use of the airplane. Even before the Second World War the airplane was serving a variety of domestic purposes in the modern world. It was used in agriculture as a rapid and convenient means of spraying crops on large farms. It was used as a means of spotting forest fires and of getting parachute "smoke chasers" to the fires before they spread. It was used to bring supplies and equipment into remote mining and trapping centers. Its chief domestic use in well-developed countries was in carrying passengers, mail, and a small amount of express between the larger centers of manufacture and trade. Its chief domestic use in less well-developed countries was in linking the larger centers of population with outlying districts which could not conveniently be reached by any other means.

Such services will undoubtedly grow with time. The map on this page shows the commercial air routes that existed in the United States at the time this book was written. Two characteristics of these routes stand out

These commercial air routes connect the larger cities of the United States today.

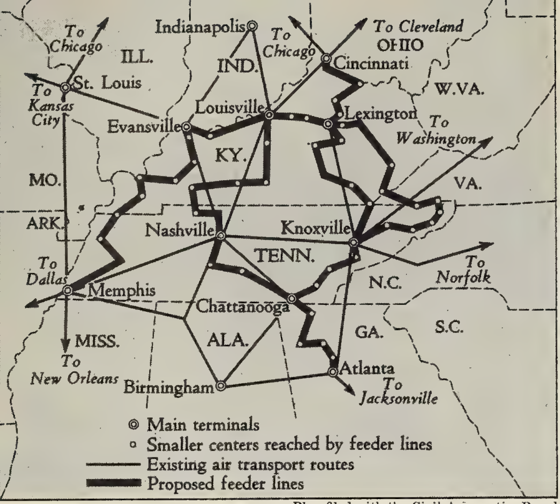


These commercial air routes connected the larger cities of Europe before the Second World War.

sharply: (1) They follow the general pattern of highways and railways that link up the large cities of the country. (2) They serve relatively few cities directly. These same characteristics marked the prewar routes of Western Europe, as the map above shows.

These maps show that commercial air transportation over highly developed land areas is focused on pre-existing centers of trade and is supplementary to pre-existing means of transportation. They show that air transportation in the early stages of its development differs from all other types of transportation in their early stages of development by specializing in long-distance rather than in local transportation. This specialization is a limitation which commercial air lines have already begun to overcome. The map on page 290 shows the chief air lines in one section of the United States and the feeder lines which one airline company has proposed. No hop on any of these feeder lines is longer than 75 miles. Such lines will doubtless greatly extend commercial air service in the future.

Even while the war was encouraging the development of faster and faster planes, certain farsighted inventors were experimenting with slower and slower ones. These men looked forward to the day when small, slow airplanes which were cheap to buy and cheap to operate might be in great demand for private use. They knew that the end of the war would turn hundreds of thousands of skilled pilots into civilian life, people who would probably like to have their own planes for private use. They knew that many fine airports all over the world would be available for private use.



Plan filed with the Civil Aeronautics Board

The plan of the Kentucky-Tennessee Airlines for the development of feeder lines in one section of the United States.

It is still too early to know what the future of the private plane will be. It is not beyond reason, however, to look forward to the time when helicopters, which can land on and take off from a very small space, will compete with the automobile as a means of private transportation. One large American bus line has already expressed the desire to replace its auto busses with large air busses of the helicopter type.

Among the advantages of the helicopter is its ability to hang in the air without moving.

Official U.S. Army Photograph from Ewing Galloway

The international use of the airplane. The nature of the airplane, as we have seen, especially favors long-distance transportation. Whatever the future may bring in the way of short-distance domestic air transportation, long-distance international air transportation has already arrived. Even before the Second World War, clipper airships made regular commercial flights between the United States and southeastern Asia, South America, and Europe. German and British planes made similar long-distance flights.

This prewar international flying was dedicated to the transportation of passengers, mail, and a little express. During the war the loads shifted to bombs, troops, and increasing amounts of fairly heavy freight. In the future, let us hope, the bombs will be eliminated. We can know for a certainty that the passengers, mail, and express will greatly increase. The freight will probably also greatly increase—at least between places where ship routes are much longer than air routes—as larger and more efficient cargo planes are invented.

The map on page 291 suggests the pattern which the chief international air routes of the future are likely to follow. Many of these routes were in use before the war; some continued in use during the war. Notice that these routes follow great circle courses, but only in a general way. Like all other transportation routes their location is determined chiefly by the location of the trading centers which they serve.

One of the greatest international problems of the future will be to determine who owns these airways. Will each nation own the air above it, or will planes of all nations be allowed to go anywhere they please? There will be much debate, and a whole new code of international law will have to be drafted, before this important problem is settled.

Its commercial functions make up only part of the influence of the airplane on international relations. The days when a

The chief airways of the future will probably follow this pattern. Notice that exact great circle routes within the arctic circle are avoided because no trading centers exist there.

nation could build its foreign policy on the basis of its remoteness from its neighbors are gone forever. The bombing airplane, which can drop its load of destruction anywhere, has destroyed the traditional safeguards of both distance and natural barriers. It has forced nations to choose between coöperation and death. It has made it imperative that a whole new code of international relations be created if civilization is to survive. In doing so the bombing airplane and the airplane in general have become a force of incomparable importance in human relations. This social and political importance of the airplane is not likely to diminish even if its commercial importance fails to grow to the size which the more enthusiastic prophets of the Air Age predict.

From "Lion," by Martin Johnson, G. P. Putnam's Sons

In many parts of Africa today, the means of communication and the means of transportation are the same. In carrying letters from place to place these runners may travel fifty miles a day.

COMMUNICATION OF THOUGHT

The transportation of thoughts. The manufacture and movement of goods are much the most conspicuous elements in the life processes of the modern economic world. But the manufacture and movement of goods are made possible only through the manufacture and movement of thoughts. Try to imagine how limited you would be if you had no larynx and hands with which to speak and write the thoughts that your brain creates, no ears and eyes to hear the speech and to read the writing of others. Civilization would be almost equally limited if it had no telegraphs, telephones, cables, and radios.

Even the simplest societies cannot function unless men communicate with one another. From the beginning of human history men used sound as one of the chief means of doing this. The human voice, though wonderfully capable of expressing a wide range of thoughts, is severely limited in the range through which it can transport these thoughts. A large part of the history of civilization deals with the progress which men have made in getting their thoughts more accurately expressed and more widely and rapidly distributed.

The speed-up of communication. Messages, like goods, were probably first carried from place to place by the muscles of men and beasts. For centuries the means of transportation were also the means of communication between people who were out of range of one another's voice. Messages, like goods, were carried ever farther and faster as the means of transportation steadily improved. When railways began to take the place of stagecoaches on land, and steamships the place of sailing vessels on sea, a web of world-wide communication had already been set up.

Then, suddenly, something happened which speeded up communication more than anything had ever done before. On May 24, 1844, Samuel Morse sent a message between Baltimore and Washington by telegraph. From that time on, communication has never had to depend wholly on transportation. There has been an ever-increasing number of ways of sending messages much more rapidly than even the fastest airplane could possibly carry them.

Soon a network of telegraph lines began to take shape over every civilized country. In 1851 the first successful telegraph cable line united England and France; in 1866 the first cablegram crossed the Atlantic Ocean from North America to Europe. With it the time needed to communicate between these two continents was cut from weeks to minutes.

In 1875 Alexander Graham Bell invented the telephone, and the human voice began its travels round the world. In 1896 Marconi invented the wireless telegraph, which soon developed into the wireless telephone, or radio. Today messages of every kind are carried by radio to the ends of the earth, and with scarcely a moment's delay. Every house has become a meeting hall of nations.

Communication in war. How modern devices of communication unite people the world around is a story too well known to need to be told here. We should note, however, that modern communication, like modern transportation, can be made to serve the evil ends of war. A large part of modern war is actually fought by radio—by governments using the radio to encourage their own people and to discourage the enemy.

On the field of battle itself, modern means of communication are weapons of great power. A battlefield today may be a combination of land, sea, and air. It may extend over thousands of square miles. The task of directing a battle on such a battlefield would be impossible without the help of telephone and radio.

Study the drawing on page 294, which shows how a modern battle is directed by modern means of communication. The men in the observation post in the foreground are directing the battle with the help of telephone, teletypewriters, and radio. The air commander in one of the planes at

Through modern communication, messages can be sent instantly to every corner of the earth.

Keystone View Company

Courtesy of Western Electric

Modern methods of communication play a large part in the conduct of modern warfare.

the upper left has just radioed his squadron to bomb the enemy tanks at the upper right. In the middle ground, artillery and tanks are operating under telephoned directions from the officers in the observation post. On the water at the left transports are landing troops with the help of an electrical announcing system. The PT boats have just received orders by radio to torpedo the cruiser on the right.

Communication in peace. In peacetime the facilities of communication, like the facilities of transportation, are devoted chiefly to the service of manufacture and trade. They are, accordingly, most densely grouped where these activities are most intensively developed. Over half the telegraph lines of the world are in the United States and Europe; over three fourths of the telephone lines are also in these two most highly developed regions of the earth. These lines closely follow the routes of railways and highways. Similarly, the cable lines which unite the lands that lie on the opposite sides of oceans follow the routes of ships. Like telegraph and telephone lines, cable lines are most abundant where trade is most abundant.

Though radio has only recently come of age as an instrument of world-wide communication, it has already become much the most important means for the rapid transmission of thought. As in the case of the telephone, more than three fourths of the world's radio receiving sets are in the United States and Europe. Out of these sets flows a steady stream of entertainment, advertising, propaganda, news, and instruction. Through radio direction-finders for the guidance of ships, radio "beams" for the guidance of airplanes, radio signaling and detecting devices of many varieties, radio is weaving the communication and transportation systems of the world into one vast interrelated whole. Communication, which was once so largely dependent on transportation, is rapidly becoming the master of transportation.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. The elephant is widely used for hauling freight in India because the people do not like to use trains and trucks.

2. The Pilgrims built the first roads in America.

3. The roads in flatlands are straighter and fewer than the roads in rough lands.

4. The railroads in the United States are more numerous west of the 100th meridian because most of the people live in that section of the country.

5. The chief advantage of the automobile is its ability to carry heavy freight farther, faster, and more cheaply than can any other means of transportation.

6. Transportation on inland waters throughout the United States has been steadily increasing since the Civil War.

7. Transportation by rivers is cheaper than transportation by railways and highways because there are no construction or maintenance costs in connection with river transportation.

8. The busiest inland waterways in the world are in Western Europe.

9. Since the invention of the steamboat every part of every ocean has become a portion of some international highway.

10. Seaports tend to grow up wherever good harbors exist.

11. The commercial future of the airplane lies chiefly in the development of short-distance transportation, which will put the railroads out of business.

12. The airplane has no political importance in a peaceful world.

QUESTIONS FOR DISCUSSION

1. What inventions do you think have been the most important aids to progress in transportation? How did they change existing methods of transportation? How are these inventions used today?

2. Under what circumstances is it necessary to use human porters, dogs, llamas, camels, or

horses for transportation? How do you think the expense of this kind of transportation compares with the expense of other methods of transportation?

3. What in your experience are the advantages of using the automobile for transportation in place of the train? What are the advantages of using the train?

4. Why are inland waterways used in countries where train, automobile, and airplane services are well developed?

5. Has air transportation affected the general life of your community, and if so, how?

THINGS TO DO

1. Study the transportation and communication facilities of your community by marking in different colors the following things on a map of the area in which you live: railroads, main roads, secondary roads, main streets, secondary streets, airports, navigable waterways. Also, mark the main telegraph lines or telegraph offices, and the radio stations. Find out from your local telephone company the number of telephones in your community and put this information on your map.

When the map is completed decide whether the facilities of transportation and communication in your community are adequate. If you think they are not adequate list the ways in which they should be increased or improved.

2. Obtain a road map of the United States and make a list of the major highways of the country as a whole. Compare the density of major highways with the density of population as shown on the map on pages 18–19. If there are any districts in the United States where more major highways seem necessary, list them and give your reasons for doing so.

3. Study the map on page 282, which shows the chief ocean trade routes of the world. Make a list of these trade routes in the approximate order of their importance. Indicate which continents and which countries each of the major trade routes serves. List the chief commodities which flow over these trade routes. Then compare the trade route map with the population map on pages 18–19. Write a short account of the relationship between the density of population and the location of the chief trade routes.

4. Draw up a simplified table of comparisons for the major means of transportation which will show at a glance how they differ from one another in speed, expense, and approximate amount of freight which can be carried, and whether they are best suited to heavy freight, light freight, express, mail, or passenger service. You can get much of the information for this table from this chapter; any good up-to-date encyclopedia can furnish additional information.

5. Go to the library and prepare a report on how the Diesel engine has influenced modern transportation.

BOOKS TO READ

1. There are so many good books on the various aspects of transportation and communication that to list only a few is to work an injustice on the many. Among the more general and less technical books on transportation, *The Story of Transportation*, by JEANETTE EATON, and *How They Carried the Goods*, by CHARLES G. MULLER, will provide an excellent historical background for more specialized reading.

2. Books on special phases of transportation are likely to be out of date shortly after they are published. In this rapidly developing age of machines, the most recent books on railroads, automobiles, ships, and airplanes are likely to be the best, at least from the standpoint of up-to-the-minute accuracy. For the *spirit* of transportation two books which are likely to keep their freshness for a long time are *Life on the Mississippi*, by MARK TWAIN (which deals with old-fashioned river travel), and *Listen! The Wind*, by ANNE M. LINDBERGH (which deals with modern air travel).

3. *Wizard of the Wires*, by HELEN NICOLAY, is an interesting book on Samuel Morse and the history of telegraphy. *The Story of the Telephone*, by SUSAN MERIWETHER, is an interesting history of communication up to the development of the modern telephone. *Magic Dials*, by LOWELL THOMAS, is an interesting book on radio and television by one of the most experienced radio commentators in the world.

4. *Trade Centers and Trade Routes*, by EUGENE VAN CLEEF, is a scholarly and rather difficult book. There is no better book, however, to round out the material of this unit as a whole.

Unit VI
The Geography of Nations

THE GROWTH OF NATIONS

The behavior of nations. The facts which we studied in the last unit of this book add up to one great truth: *The welfare of people in any one part of the earth is intimately related to the welfare of people in other parts of the earth.* The elaborate processes of modern manufacture, trade, transportation, and communication are possible only through the coöperation of many different people in many different places. Through these processes the various peoples of the earth become united much as the various organs of a human body are united. If such a union were to have a motto, it might well be that of the Three Musketeers: "All for one and one for all."

"But," you might say, "the people of the modern world are not united. They are divided by hatred and war. How could we have such a terrible conflict as the Second World War if the people of the world were united?" It is only too true that the world union of manufacture, trade, transportation, and communication is no guarantee of world peace. War comes to the body of civilization as disease comes to the body of a man. It disturbs the coöperative union of peoples in the body of civilization as disease disturbs the coöperative union of organs in the body of a man.

When we search for the causes of war we come at once to those organized groups of human beings that go by the name of nations. The quarrels between nations are clearly the chief cause of disunion and war among the peoples of the earth. They are the chief reason why the peaceful bonds of manufacture, trade, transportation, and communication are periodically torn asunder. To understand the quarrels of nations we must first understand the general nature of nations.

What is the nature of the urge that makes men band together in groups under different flags? Why do men gladly die to preserve the particular group to which they belong? Why do they gladly kill the people of other groups so that their own group may continue to exist? These questions are not easy to answer. The bonds that hold people together in national groups are not in all cases the same. About all that can be said about these bonds in general is that they are very strong.

Any union of human beings for the purpose of government is known as a political union. The story of political union begins with the beginning of human history. Anthropologists tell us that the tribe is the most primitive form of human society; historians tell us that the nation is merely a more complicated form of the tribe. A common religion, a common language, a common background of traditions and customs, a common use of natural resources and transportation facilities, a common love of the land, a common fear of people with different customs and physical surroundings—these are the ingredients which, variously blended, have gone into the making of nations.

It is the job of the sociologist rather than the geographer to explain the deep-rooted emotional forces that enter into the behavior of nations. Nations are not run solely by such forces. All nations occupy space on the surface of the earth. *The fundamental basis of every nation is the ground in which it is rooted.* The people of a nation may lack the ties of common religion, language, and traditions, but they still constitute a nation if they are united in common possession of the land on which they live. The behavior of every nation is greatly influenced by the nature of the ground it occupies. The geographer's task is to discover what this influence is.

The tendency of nations to grow. If you examine a political map of the world you

De Cou from Sawders

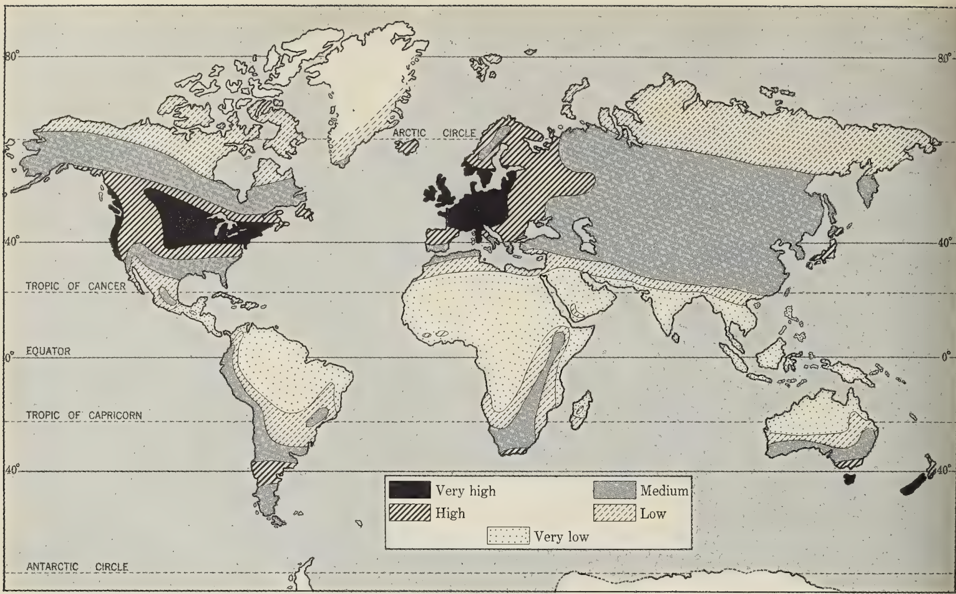
The Soviet Union was once only a cluster of people round the ancient city of Moscow.

will see that nations occupy immensely different amounts of space on the surface of the earth. Nations range in size from the midget principality of Monaco, which gets along on a modest half square mile of land, to the giant Soviet Union, which sprawls over more than eight million square miles of land. If you read a political history of the world you will find that nations change in size from time to time. The Soviet Union, for example, was once only a cluster of people round the ancient city of Moscow. The Italian nation, which all but disappeared as a sovereign state during the Second World War, once embraced practically all the civilized people of the ancient world.

This expanding and contracting of nations with time suggests the growth and decay of living creatures. Though nations are involved in the life processes of civilization as a whole, they obviously possess certain life processes of their own. The most significant of these processes—both for individual nations and for the world at large—is the tendency to grow.

Nations do not all grow in the same way or for the same reasons. One nation may grow by annexing districts which are valuable for their natural resources. Another nation may grow by annexing districts which offer new possibilities for trade. Yet another nation may grow because its people want more living space. Whatever the reason or reasons, territorial growth is a common characteristic of vigorous nations.

Major powers. The most important fact concerning the growth of nations is that some nations grow both stronger and larger than other nations. Though not all large nations are strong, nations which have grown strong tend also to grow large. The only way nations can grow in size is by swallowing the territory of other nations. In some cases weak nations are willing to be annexed by strong nations because they expect to gain advantages which will repay



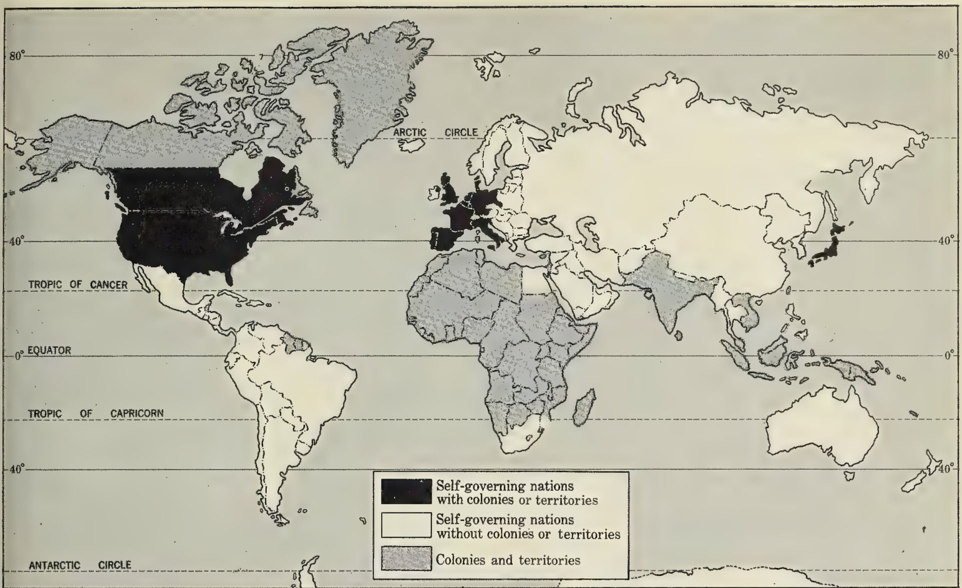
The world is made up of people whose energy grades from very high to very low. Notice that the people with the most energy live chiefly in the middle latitudes of both hemispheres.

them for the loss of their independence. In other cases they are unwilling to be annexed, but they are too weak to prevent it. Willing or unwilling, the weaker nations of the earth tend either to become actual parts of the stronger nations or to fall under their control.

At the start of the Second World War seven great nations controlled most of the earth and its people. These major powers were the United States, Great Britain, the Soviet Union, France, Germany, Japan, and Italy. At the close of the war these seven major powers were reduced to three—the first three on the list. Other nations or unions of nations will doubtless rise from time to time to the status of major powers, just as nations have risen before. China, for example, which is already one of the largest nations on earth, might some day also be one of the most powerful. France and Germany, which were once major powers, may well become so again.

Political geography and geopolitics. A nation grows into a major power through a highly complicated succession of acts. Many of these acts are definitely related to the earth. The relationship between the activities of nations and the earth on which these activities take place is known as *political geography*. The broader aspects of political geography are sometimes called *geopolitics* ("earth politics").

"Geopolitics" is a convenient term which was invented by a Swedish geographer for a very important branch of human geography. Unfortunately, German geographers have used it to cover so many vague and false teachings that not a few geographers in many countries hesitate to use it. There is much in geopolitics, however, which is neither vague nor false. This unit will deal with that kind of geopolitics, and with the more detailed elements of political geography on which a sound science of geopolitics must be based.



If you compare this map with the map on page 300, you will see that the great self-governing nations lie in regions of high energy; their colonies and territories, in regions of low energy.

FUNDAMENTALS OF NATIONAL STRENGTH

Climate and the strength of nations. Many things influence the strength of a nation but nothing more than the energy of its people. Without energetic people a nation cannot become a great power, whatever other advantages it may possess. Human energy is the result of many conditions. Climate is one of the most important of these conditions.

In Chapter VII we saw that the wet middle latitudes of the earth are free from long periods of extreme heat and extreme cold. We saw that the parade of cyclonic storms which passes endlessly over these latitudes brings moisture and frequent refreshing changes in the weather. These are the elements of climate which help to make the people of these latitudes the most healthy and most vigorous people on earth. Throughout this book we have seen illustrations of how the people of the wet middle latitudes lead the world in all major human activities. Not least important among these activities is the building of vigorous political states.

If you examine the map on page 300 you will see how human energy varies with the climate. Only three of the climatic regions which we studied in Unit II contain people whose energy can be described as generally "very high" or "high." These regions, all in the middle latitudes, are the mild west coast lands, the mediterranean lands, and the wet middle latitude lands. The dry grasslands and both the wet and dry subtropical lands contain people who in most localities have no more than "medium" energy. The high latitude tundras and taigas and the low latitude deserts, savannas, and rain forests contain people whose energy for the most part varies from "low" to "very low."

If you compare the map on page 300 with the map on this page, you will find that the

De Cou from Sawders

The people of middle latitude London have been entirely self-governing for centuries.

Until 1947, the people of low latitude Bombay had not been entirely self-governing for centuries.

Pnilip Gendreau, N.Y.

most energetic people are citizens of the strongest nations. The seven powers that dominated the world at the start of the Second World War were all centered in middle latitude regions of favorable climate and high energy. Nearly all these major powers had grown by absorbing colonies and territories in regions of less favorable climate and lower energy. Though some self-governing nations, notably in South America, occupied regions of unfavorable climate and low energy, no such nation possessed any colonies or territories. These maps thus bring out a most significant fact concerning the strength and growth of nations. *Energetic people of favorable climates tend to form nations which grow stronger and larger at the expense of less energetic people of unfavorable climates.*

How population influences nations. If a nation is to be strong it must have not only energetic people but a great many of them. If you turn back to the map on pages 18–19 you will see that more than half the land areas of the globe support few people or none at all. Great nations have never had their beginning in such areas of low population. Great nations, to be sure, spread into regions of sparse population, but they have invariably originated in districts of dense population.

We have seen that nations grow strong through the activities of energetic people. Two energetic persons are more effective than just one energetic person when there is work to be done. If all other assets are equal, a nation with a greater number of people will be more powerful than a nation with a lesser number.

The value of manpower has been made only too apparent in the war-torn world of today. One of the reasons for the fall of France in 1940 was that her citizens numbered some 27 million fewer than the citizens of Germany. The 17 million citizens of Austria and Czechoslovakia, whom Germany controlled at that time, gave Germany more than twice the manpower that was available to France. Population has always been one of the determining factors of war. If all other assets are equal, the nations with the most people will win a war.

Even if all other assets are not equal, an advantage in population can help to stave off defeat. In 1931 Japan set out to crush China with the help of vastly superior weapons and equipment. When, fourteen years later, the United Nations crushed Japan, that country was still trying to crush China. There have been a variety of reasons for its failure to do so. Not the least important reason is that the Chinese outnumber the Japanese about 5 to 1.

Nations grow strong through peace, as well as through war. Industries of production and manufacture give a nation the surplus commodities with which it can trade with other nations. Foreign trade has often been both the incentive to achieving national strength and the means of achieving it, as we shall see when we study the leading nations of the modern world in detail. Similarly, highly developed systems of transportation and communication enable nations both to grow strong at home and to expand abroad. All these activities require large numbers of people.

At this point you might feel like interrupting the discussion to call attention to a striking and seemingly inconsistent fact. You might refer to the map on pages 18–19, which shows that two of the world's three densest centers of population are in China and India, where no very powerful nations exist. You might reasonably ask, "If population is so important in determining the strength of nations, why are China and India the homes of relatively weak and backward nations?"

Obviously, mere numbers of people, like mere acres of land, are not an element of national strength. A large population may actually be an element of national weakness where the people are not very energetic and not industrially advanced, or the land not very rich. Large numbers of people are an asset only to such nations as possess the other


From Ewing Galloway, N.Y.

These coal cars indicate one of the reasons why the United States is a strong nation.

important elements of national strength. A large population in a nation is like a full tank of gasoline in your automobile—good for getting ahead if all the other necessary things are present, but just so much extra weight if they are not.

The influence of natural resources. People alone cannot build a strong nation, because only the earth can supply many of the building materials. If a region does not contain these materials, and if its inhabitants cannot get them from other regions, it cannot support a strong nation. In the modern world geopolitical strength depends largely on industrial strength. In the preceding two units of this book you had plenty of evidence to prove that the industrial strength of a nation depends largely on its natural wealth. Such products of industry as airplanes, tanks, automobiles, houses, beef, and wheat are the measuring rods of national power in both war and peace. All such products in turn depend on the farms, forests, and mines that produce the raw materials from which they are made.

The most important fact about natural resources from the point of view of geopolitics is that they are not spread evenly over the surface of the lands. Some nations have more than they need of many of them; some nations have less than they need of many of them; no nation has all it needs of all of them. One of the chief reasons why great powers have never been very numerous at any given period in history is that most nations have been too poor in natural resources to rise to the position of great powers.

Even the richest and most highly developed nations today must depend on other nations for some of their needs and for many of their luxuries. Food is the outstanding need of all nations; the richness of the soil and the extent of farm and grazing lands are among the outstanding factors in the production of food. Only a few nations today can be said to be self-sufficient in the production of food. The people of the United States, the Soviet Union, and China could, if necessary, live entirely on food produced at home. But even these nations must import food from other nations if their people are to enjoy well-balanced and pleasantly varied diets.

Some nations draw heavily upon other nations for both the essentials and the luxuries of diet. Before the Second World War, Germany imported about one third of its food supply from other nations. Great Britain depended on its colonies and on other nations for about half its supply of food. Though the war stimulated the domestic production of food, Great Britain is too small, too densely populated, and too highly industrialized to produce all the food it needs. If its life lines of overseas trade and transportation were cut for any considerable period of time, millions of its people would starve.

Second in importance only to food are the mineral resources of a nation. Here, again, great national differences exist. Not a single nation on earth produces all the mineral materials that modern civilized living demands. The United States is one of the most generously endowed of all nations, but it depends on other nations for practically all the tin it needs and for considerable amounts of other metals. It also normally imports large quantities of fertilizers and chemicals.

Examples of the unequal distribution of natural resources could be multiplied indefinitely. There are only three ways in which a nation can adjust itself to this condition.

1. It can get along as well as possible with the resources it has.

2. It can get the resources it lacks by peaceful trade with other nations.

3. It can steal the resources of other nations through war.

Later in this unit we shall see which ways the various leading nations of the modern world have chosen to follow.

The influence of manufacture. A nation may be rich in natural resources, but unless it is also rich in manufacture it cannot take its place among the major powers of the

New Zealand ships much of its surplus food products to Great Britain, half-way round the globe. Here butter is being moved from a refrigerator car to a ship.

The High Commissioner for New Zealand

Keystone View Company

Mass production in manufacture is essential for national welfare.

modern world. Manufacture enables a nation in peacetime to grow strong at home by raising the standard of living of its people. It enables a nation to grow strong abroad by creating a surplus of commodities which less highly industrialized nations are willing to make sacrifices to obtain. In wartime the very life of a nation depends on the capacity of its factories to turn out planes, tanks, ships, and the other paraphernalia of mechanized war.

Russia was one of the richest nations that took part in the First World War, but it had few factories for turning its natural wealth into effective instruments of war. Largely because of this lack the Russian armies were soon destroyed by the well-equipped armies of highly industrialized Germany. In the Second World War, Russia was no richer in natural resources than it had been at the time of the First World War. But between the two wars it had developed great manufacturing industries. However, Russia's chances for victory over the German army were greatly improved by the vast amount of supplies and equipment sent to Russia by the United States.

After the tremendous blows of the well-prepared Axis nations had failed to achieve complete victory at the beginning of the Second World War, the character of the conflict changed. It stopped being merely a struggle between opposing armies, navies, and air forces, and began being also a struggle between opposing mills and factories. As the war went on, it became more and more clear that the side with the more productive industries would win. Now that the war is over, there is no doubt at all that the United Nations won chiefly because theirs was the greater wealth of raw materials and the greater capacity for turning raw materials into instruments of war.

The influence of trade and transportation. In the preceding unit of this book we saw how trade and transportation tend to bind people together in one great economic world union. The national unions of people within this world union are also greatly furthered by trade and transportation. No nation can rise to power unless its people are both physically and spiritually united. All through history, trade and transportation have ranked among the chief means of achieving such union.

Throughout history trade and transportation have been not only factors in building up the strength of nations but also fairly accurate measures of that strength. It has been generally true that strong nations have had well-developed trade and transportation and that weak nations have not. The Roman Empire, for example, was at its peak of power when its trade and transportation were most highly developed. When the Roman Empire broke down politically its vast network of trade and transportation also broke down.

When trade and transportation are poorly developed, people tend to form small and relatively weak political states which are determined chiefly by the surface of the land. For centuries after the collapse of the Roman Empire, Italy consisted of many little independent states, some of them no larger than a fertile valley between mountain ranges. In Unit III we saw how the people of the Balkan countries are in somewhat the same condition today. They are divided into several independent and more or less uncoöperative groups by mountain ranges. Only through trade and well-developed facilities of transportation can the people in such groups come to know, respect, and trust one another. And only after this has happened can such groups be welded into a nation whose people have common interests and a common policy in dealing with the rest of the world.

Well-developed trade and transportation are earmarks of national strength.

J. I. Case Company

THE SIZE, SHAPE, AND LOCATION OF COUNTRIES

The size of countries. When we speak of the "size" of an object we refer to the amount of space it occupies. The size of a football field is thus 100 yards long by 50 yards wide. We may speak of the size of a country in the same way. The size of Canada is thus 3,694,863 square miles, which is the space it occupies on the continent of North America according to the official measurements of the Canadian government. Similarly, the size of the United States is 3,022,387 square miles, which is 672,476 square miles smaller than Canada.

There are other ways of measuring the size of these two countries which will give very different results. Their size might be measured, for example, in terms of the number of their inhabitants. So measured, the United States, with about 132 million people, is about 11 times as large as Canada, with about 12 million people. By measuring size in terms of population we find that "little" Java is almost four times as large as Canada, though its area is only about $\frac{1}{73}$ as great.

There are still other ways in which we can measure the size of countries. We can measure it in terms of the relationship between the number of people and the number of square miles of productive farm lands. We can measure it by the value of imports and exports, by the number of men in the armies and the tonnage of ships in the navies, and in a variety of other ways. There are, in fact, so many ways of measuring the size of a country that merely to call a country "large" or "small" has very little meaning.

Unfortunately, there is no way in which the size of a country can be stated in terms

Countries can be divided into five classes on the basis of the space they occupy.

Royal Canadian Air Force Photograph

Much of the 3,700,000 square miles of Canada is an undeveloped forest wilderness.

Dorien Leigh, Ltd., from Black Star

Most of the 1,000,000 square miles of Arabia is worthless desert.

of *all* the geographical elements which affect it. As far as geopolitics is concerned, the size of a country is measured chiefly by its political strength, which, as we have already seen, depends on a variety of things. We shall use this geopolitical measure of size in the following discussion, but we shall also try to discover what relationships exist between the strength of nations and the space they occupy on the surface of the earth.

Area and the strength of nations. We have already seen that the areas of countries vary tremendously. The map on page 308 will give you a general idea of the amount of this variation. For the sake of discussion we can divide countries into five broadly different classes on the basis of the space they occupy.

(1) Countries such as the United States and Canada, the area of which is greater than 1,000,000 square miles, may be termed "very large." (2) Countries such as Colombia, the area of which is less than 1,000,000 but greater than 100,000 square miles, may be termed "large." (3) Great Britain can be taken as an example of "medium-sized" countries, the area of which is less than 100,000 but greater than 50,000 square miles. (4) Belgium typifies the "small" countries, with areas of 50,000 to 1000 square miles, and (5) Luxembourg the "very small" countries, with areas of 1000 square miles or less.

When we look at the nations within any one of these five classes, we find great variations in political strength. All the "major" powers which we listed earlier in this chapter, except Great Britain, are located on "large" or "very large" areas of land. Certain other nations,—such as Sweden and Turkey,—which are powerful enough to be called "minor" powers, are also located on large areas of land. Much of the power of these nations is related to the large size of the space which they occupy. It is generally true that the larger the space which a nation occupies, the greater are its chances of obtaining the elements of national strength which we discussed earlier in this chapter.

Certain other nations with large or very large areas of land are not so fortunate. Such nations as Canada, Brazil, Arabia, and Australia are richer in land than some of the major powers without being nearly powerful enough to rank with them. How have such nations grown extremely large without also growing extremely strong?

In the case of each large but relatively weak nation we find a considerable percentage of land which is of little use. Canada, for example, is chiefly a wilderness of

Photograph by Wehrli

Bern, the capital of Switzerland. Though surrounded by large, strong nations, little Switzerland preserved its independence, neutrality, and democratic government through two world wars.

thinly populated tundra and coniferous forest; Brazil is chiefly a wilderness of savanna and tropical rain forest; Arabia and Australia are chiefly wilderness regions of thinly populated desert and steppe. From the point of view of geopolitical strength these countries are only apparently large. They are *actually* small because the highly developed and thickly populated areas which produce their geopolitical strength are small.

The problems of small nations. No nation which is both rich in land and strong in geopolitics has ever begun that way. We have already seen that the largest nation on earth, the Soviet Union, began as a little city state round Moscow. Similarly, modern Germany sprang from the small ancient principality of Prussia. Great Britain was once little more than London, the United States little more than Jamestown and Plymouth, Italy little more than Rome.

Why did these and the other large, strong nations grow both strong and large? Though no one answer will sum up the history of all such nations, one significant geographic advantage was possessed by all. All budding great powers contained steadily increasing numbers of progressive people. To all there were available large and, in some cases, vast areas of rich land which invited expansion. The smaller, weaker nations of the world are smaller and weaker chiefly because they have lacked these advantages.

Though not all large nations are relatively strong, all small nations are relatively weak. We who live in a nation which is large both in area and political power find it difficult to realize the problems of smaller, weaker nations. The chief problem of such nations is simply to stay in existence. We have seen how well-favored nations tend to grow at the expense of less well-favored nations. How, then, do smaller, weaker nations manage to preserve their independence?

At a time when so many of the smaller, weaker nations of the earth have lost their independence through military pressure or the threat of it, one might forget that many such nations have survived through many periods in history. Even in Western Europe, where nations are crowded and extremely ambitious, little Denmark, Belgium, Luxembourg, Switzerland, and Portugal have had long periods of independent existence. Little Netherlands has had not only a long history of independence in Europe but a large colonial empire overseas. How did these nations keep from being permanently absorbed long ago by much larger and stronger Great Britain, France, Germany, Russia, and Italy?

There is no one answer to this question which will fit all the small nations of Western Europe. Nevertheless, there are three reasons for their existence which in modern times have applied in some degree to all.

1. The larger and stronger nations of Western Europe have not feared that their smaller and weaker neighbors would try to grow larger by force, at least on the continent of Europe.

2. The larger and stronger nations have for the most part felt that they would receive more commercial benefits from the smaller and weaker nations by letting them keep their independence than by conquering them.

3. The larger and stronger nations accordingly made agreements to protect the smaller and weaker nations, so that the large, strong nations might share with one another the advantages of trade with the small, weak nations. Because of these agreements, any strong nation that attacked a weaker nation ran the risk of war with another strong nation or combination of nations. Within a quarter of a century Germany, as we all know, twice violated these agreements, twice destroyed the independence of small nations, and twice plunged Europe into war. It also twice failed to get what it wanted from its neighbors.

Tin deposits in the Netherlands Indies are among the most valuable of all natural resources. This workman is concentrating the pebbly tin ore with a powerful spray of water.

Keystone View Company

By Ewing Galloway, N.Y.

Central American countries suffered for their specialization in bananas during the Second World War when few boats were available for carrying the crops to middle latitude markets.

Small nations have not only the problem of avoiding destruction in war. They also have the problem of keeping alive in peace. Nations with limited area are almost invariably limited in other regards as well. They seldom enjoy well-rounded economic development. One small nation, such as Denmark, becomes chiefly a nation of farmers because it contains rich agricultural lands but few other valuable resources. Another small nation, such as Belgium, becomes chiefly a nation of manufacturers because its richest resources are coal and other minerals. Such specialization may go so far that a small nation may come to depend almost entirely on one activity. El Salvador, for example, exists almost exclusively through the production of coffee.

We have seen the dangers of such specialization in our study of the wheatlands of western North America. Diversified activities are just as necessary for the safety of small nations as they are for the safety of the subdivisions of large nations. Unfortunately, a high degree of diversification is impossible in nations which are too small to embrace the geographic elements on which diversified activities are based. Squeezed both politically and economically by their larger and stronger neighbors, smaller and weaker nations can exist only through the greatest shrewdness in diplomacy and trade. Even then their existence hangs by a thread which may easily be broken, as many nations of the modern world have learned only too well.

Shape and the strength of nations. The shape, like the size, of countries plays an important part in national development. Like the size, the shape varies greatly. Certain shapes have decided disadvantages. Long, narrow countries, such as Norway and Chile, have many more miles of boundaries in proportion to area than compact countries, such as Rumania. In wartime an abundance of boundaries creates exceptionally serious problems of defense, as Norway and its British allies discovered when Germany invaded Norway in 1940.

In peacetime the problems of administration in long, narrow countries are exceptionally difficult. Chile is 2600 miles long and until recently the only railroads ran with the width of the country. People at one end of the country had little in common with people at the other end; the center of government at Santiago, near the middle of the country, acted chiefly in the interest of the provinces which were located near the middle. Today improved rail and air transportation is helping to bind the people more closely together, but Chile will never be able to overcome the handicap of its long, narrow shape completely.

Countries with highly irregular boundaries, and those which are not all in one piece, have some of the problems of long, narrow countries. After the First World War, Czechoslovakia jutted deeply into southeastern Germany, and the Polish Corridor cut off East Prussia from the mother country on the northeast. (See the map on page 342.) Greece, Great Britain, and Japan have highly irregular boundaries, and each of these countries is broken into several pieces by the sea. Irregular and broken boundaries increase the proportion of boundaries to the area bounded. Countries with such boundaries are likely to feel the need of strong armies and large navies for defense, and of elaborate and costly administrative facilities for peacetime pursuits.

The long narrow shape of Chile has been a handicap to the development of that country.

The closer a country approaches the simple shape of a circle or a square, the more fortunate it is. If such a country is bounded by oceans, mountains, deserts, or some other kind of natural barrier, its problems of defense are very much simplified. If its dens-

The long and deeply indented coast of Norway is an invitation to invasion.

Norwegian Official Photo

est population and its major activities are located near the center of its territory rather than round the edges, its people have a better chance of becoming strongly united economically and politically. They also have a better chance of avoiding border quarrels with the people of neighboring countries. Unfortunately, no country has all these advantages. Which ones would you say come nearest to the ideal?

Mathematical location. All through this book we have had evidence of the supreme importance of location in the lives of human beings. Where people are has a definite relationship to what people do, and this is true both of people as individuals and of people as nations. We have seen how latitude affects the climate of a locality (and thereby the lives of the people who live there) by giving the locality its location with reference to the general heat zones of the earth. We have seen how longitude affects the climate of a locality by giving it its location with reference to the oceans. Location expressed in terms of latitude and longitude may be called mathematical location because it is determined by mathematical measurements on the surface of the earth.

Many of the differences between the people of the cold arctic tundras and the people of the hot equatorial forests are due to the

Revillon Frères and C. I. A. A.

Latitude determines the chief differences in the lives of these natives of Baffin Island and Brazil.

Longitude determines the chief differences in the lives of these natives of Italy and Arabia.

James Sawders and Keystone View Company

Swiss Railways

Switzerland has overcome many of the drawbacks of its rugged surface and its remoteness from world markets and seaports by building a system of fine railroads.

difference in the mathematical location of these two regions. Many of the differences between the people of the moist middle latitude west coasts and the people of the dry deserts, which in places lie behind these coasts, are due to a difference in mathematical location. In one case the difference is in latitude, in the other case in longitude.

Earlier in this chapter we observed the fact that all the major powers of the modern world are centered in the middle latitudes, where climate is most favorable for the development of vigorous people and powerful nations. We also observed that the high and low latitudes, with their less favorable climates, contain weak nations, which tend to be absorbed by the strong nations of the middle latitudes. Mathematical location is thus one of the vital influences on the destinies of all nations.

Natural location. A nation can be located with reference to the natural features of land and water which it occupies and by which it is bounded. When we say that Cuba is an island we describe its natural location. We say that it is a mass of land separated from other masses of land by water. Similarly, when we say that Italy is a peninsula and Panama an isthmus, that Russia is a continental power and Japan a marginal power, we describe them in terms of their natural location.

Natural location has greatly influenced both the internal development of nations and their policy in dealing with other nations. Great Britain, for example, is an island, and much of its trade has been carried on with people over the sea. That is one reason why Great Britain has built one of the largest fleets of merchant vessels in the world. Switzerland, on the other hand, lies in the Alps, far from any ocean. That is one reason why Switzerland has built one of the finest railway systems in the world.

Most nations derive both advantages and disadvantages from their natural location. Strong nations strive to increase the advantages and to decrease the disadvantages. Cramped by their island location, Great Britain and Japan have reached out for territory with a mainland location. Germany and Russia, on the other hand, have been cramped by their interior location, and have reached out for territory with better access to the great avenues of sea-borne trade. As we go on with this unit we shall see in detail how natural location affects national behavior in both peace and war.

Relative location. All through this book we have emphasized the relationships between men and the earth because such relationships make up the body of human geography. All through this book we have had illustrations of how human activities which are carried on in one place are related to human activities which are carried on in other places. It is not merely the mathematical and natural locations of a place that influence the behavior of its inhabitants; it is also the location of a place with reference to the location of other places and the behavior of other people. This type of relationship may be called relative location.

We have already had examples of how relative location plays a part in the behavior and fate of nations. One of the most vital elements in the location of any nation is its location with reference to the main arteries of world trade and transportation. We have seen that the nations of Western Europe and eastern North America are most favorably located, and the nations of the Southern Hemisphere least favorably located, in this respect.

At least partly because of its central location among the nations of Western Europe Germany felt hemmed in and threatened; at least partly because of this feeling it developed into a dangerous military power. At least partly because of its marginal location in northern Europe, Sweden has been able to avoid much of the strife which has torn that unhappy continent in modern times. Relative location enters into the behavior of nations in so many vital ways that we shall spend much of the remainder of this unit in discussing it.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. Both history and the study of geography teach us that nations should become self-sufficient and should have as little contact as possible with other nations.

2. Nations exist for emotional rather than for geographic reasons.

3. If a nation has a climate which promotes high energy among its people, it will undoubtedly become a great power.

4. Nations with very large populations will become major powers if neighboring nations have smaller populations.

5. If a nation is well supplied with food and mineral resources, it does not need to deal with other nations.

6. The transcontinental highways and railways of the United States are important in moving goods and passengers, but they have little political importance.

7. All nations that occupy large areas of land are seriously handicapped because it is almost impossible for their people to form a close political union.

8. The only way a small nation can survive is by developing a large army.

9. All small and weak nations sooner or later become parts of larger and stronger nations.

10. Any country in the middle latitudes has a good location because it has a good climate and good transportation facilities.

11. All the major powers of the world have equally good locations.

QUESTIONS FOR DISCUSSION

1. Can you think of any way in which a nation can grow larger without doing harm to other nations? Wherever possible, you should base your discussion of this question on history.

2. Which natural resources do you consider most necessary for national strength? Why?

3. Is there any great power in the modern world which is not well developed in manufacture? If not, why not?

4. Some people believe that there are too many nations in the modern world. Do you believe that the world would be more peaceful if there were only one nation for each continent of the earth? This question would make a good subject for a classroom debate.

5. Are there any countries in the world which have what you consider a good location but which are not strong nations? If so, why are these nations not strong and what are their chances of becoming strong in the future?

THINGS TO DO

1. List the areas in square miles of the twelve largest nations in the world. You can find this information in an atlas, an encyclopedia, or *The World Almanac*. Indicate which of these nations you would call great powers and state your reasons. State the reasons why you think the remaining large nations are not great powers.

2. Look up the populations of the six most densely populated nations in the world and list them in the order of their populations. Then arrange the same nations in what you consider the order of their geopolitical strength. If the order of the nations in the two lists is not the same, state what you consider to be the reasons for the differences.

3. Examine the countries of the world on a world map. Make a list of the six countries which you think have the best shape for economic and political development. Make another list of the six countries which you think have the poorest shape. State all your reasons for each selection.

4. Study a political map of the world and make a list of the six nations which seem to you to have the best location with reference to climate, natural resources, and the facilities of trade. State in detail the reasons why you have placed each nation on your list and then compare your list with the lists of your classmates.

BOOKS TO READ

1. The Second World War inspired a great many books on political geography and geopolitics, but not all the good books on this tremendously important phase of geography are recent. Two of the best were written at the time of the First World War: *Geography and World Power*, by JAMES FAIRGRIEVE, and *Democratic Ideals and Reality*, by HALFORD J. MACKINDER. Both these books have even more significance now than when they were written. They should interest anybody who is alive to the extreme importance of national relationships.

2. The influence of raw materials on the behavior of nations is clearly set forth in *The Strategy of Raw Materials*, by BROOKS EMENY, and *Strategic Materials and Natural Strength*, by HARRY N. HOLMES. The geopolitical effects of the airplane are entertainingly described in *Human Geography in the Air Age*, by GEORGE T. RENNER.

3. *The New World*, by ISAIAH BOWMAN, contains a clear and sound discussion of the larger problems of political geography. *Geopolitics*, by ROBERT STRAUSZ-HUPÉ, is a fascinating treatment of political geography with particular reference to the aims and ambitions of Germany. *Compass of the World*, edited by HANS W. WEIGERT and VILHJALMUR STEFANSSON, is a timely collection of stimulating articles on political geography by several of the world's leading geographers.

XVII · THE BRITISH EMPIRE

GREAT BRITAIN

The greatness of Great Britain. If you look up the island of Great Britain on a globe map of the world, you will see that it must be "Great" for some reason other than its size. Though it must be ranked among the large islands of the earth, Greenland, New Guinea, Madagascar, Borneo, Baffin Island, and Sumatra are considerably larger. As a matter of fact, Great Britain covers less than 90,000 square miles—which is considerably less than the area of Wyoming. If by some magic Great Britain were to be welded to the territory of the United States, the appearance of the latter would be little changed.

Great Britain falls short of greatness in a variety of other ways. Though one of the most densely populated regions on earth, it has a total population of only about 45 million. Germany has a great many more inhabitants; the United States has almost three times as many. Even so, Great Britain is not rich enough in natural resources to feed, house, and clothe all the people who live there. Much of its land is too rough for farming and its soil is only fairly good. Its cool, wet climate will not permit the growth of corn and several other crops. Its area is too small to contain great forests and extensive grazing lands. It can raise only a small percentage of the grain, meat, and wood which it needs, and none of the cotton for its textile industries.

In spite of these shortcomings Great Britain was able to acquire—in the comparatively short period of three centuries—much the largest empire on earth. At the start of the Second World War this empire occupied nearly one fourth of all the dry land on the globe and embraced nearly one fourth of all the people. Its lines of trade, transportation, communication, and exploration reached deep into every continent and spanned every ocean. Its people spoke hundreds of different languages, professed all the major religions, and represented most of the known races of mankind. In building such an empire Great Britain has more than earned the "Great" in its name. But how was Great Britain able to do it?

The people of Great Britain. By far the most valuable resource of Great Britain is the British people. It was only through their energy and ingenuity that the British Empire was brought into existence in the first place; it was only through their stubborn courage that the empire has not fallen to the forces which have repeatedly tried to destroy it. The earliest human history of this island is vague, but it seems to have first been settled by people from southern Europe. These pioneer Britons had little contact with the more highly civilized people of the European mainland until the Romans arrived in the first century of the Christian Era and occupied the area which is now called England.

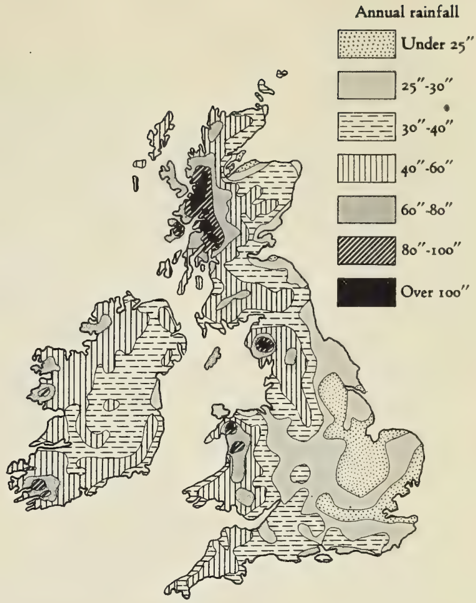
The Roman invasion of Great Britain was followed by several other military invasions and peacetime migrations. A great many different types of peoples and cultures from various parts of Europe mingled to create the British people and the British government of today. Just how this mingling took place is a story for the historian to tell. The geographer must try to discover how the story is related to its setting.

British climate, lands, and agriculture. Climate is certainly one of the factors which have helped to mold the British mind and character, and which have influenced the building and behavior of the British nation. You may remember from our discussion of climate in Unit II that Great Britain (along with much of the rest of Western Europe) has a west coast marine type of climate. Though summers are too cool and rainy for growing certain crops, this type of climate is generally favorable to agriculture because of its mild temperatures and fairly even distribution of rainfall throughout the year.

The map on the right will show that the climate on the western side of Great Britain is strikingly different from the climate on the eastern side. The moisture-laden westerly winds drop as much as 100 inches of rain on some of the more exposed west coast highland areas. Certain sheltered east coast lowland areas, on the other hand, get less than 25 inches a year.

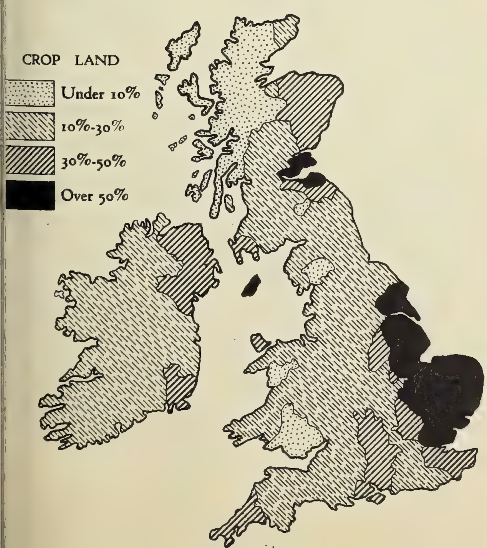
This regional difference in rainfall is reflected in the agriculture of Great Britain, as the maps at the bottom of this page will show. The wetter western portions of the island (and the higher and rougher areas wherever they occur) are given over chiefly to grass and the grazing of sheep and cattle. The drier eastern portions (except where the soil is too poor) are given over chiefly to wheat, barley, and other food crops.

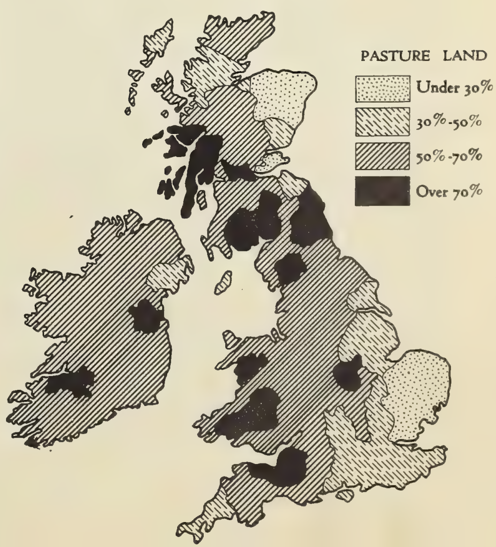
Next to the small size of Great Britain, the large proportion of rough land is the most severe check on its capacity to produce food. Except for the narrow belt between the Firth of Clyde and the Firth of Forth,



The western side of Great Britain gets much more rainfall than the eastern side.

Compare these maps with the map above. Notice that the districts with heavier rainfall are given over chiefly to grass and grazing, the districts of lighter rainfall chiefly to food crops.





The industrial districts of Great Britain produce a great variety of commodities.

Scotland in the north is made up chiefly of low mountains and hills where little crop farming is possible. Wales in the southwest is also made up largely of highlands which are more suitable for grazing than for crop farming. Most of the cultivated farm lands of Great Britain are crowded into the lowlands of central and southeastern England. Most of the people of Great Britain are crowded into this area, too, and most of the industries other than farming. With so much rough land, and so many people and activities competing for space on the flat land, it is not surprising that Great Britain cannot feed its people without help from other nations.

Though Great Britain is thus hampered in reaping the full harvest of its mild, moist climate in terms of food, it reaps a full harvest in terms of health and energy. Some geographers believe that Great Britain has the best climate on earth for both the mental and the physical welfare of human beings. (If you wonder why they should believe so, reread pages 68–69.) Certainly the British people stand high among the most vigorous people on earth, whatever the cause of their vigor may be. With the help of this vigor they have turned the shortcomings of their physical environment into an asset. The British Empire is very largely the result of the attempt to find in distant lands the necessities and luxuries which the homeland could not produce.

British manufacture and trade. Whatever may have produced the energy of the British people, manufacture and trade have certainly provided the chief outlets for it. Though poor in many resources, Great Britain is rich in coal and iron. With the help of its coal Great Britain became the first nation to use the steamship instead of the sailing vessel for world trade. With the help of its iron Great Britain became the first great manufacturing nation. With energy, ships, and manufacture, Great Britain was the first nation with many things to sell and the means of delivering these things to the markets of the world.

Modern manufacture in Great Britain grew up round the coal fields which occur in several places in England, Scotland, and Wales. Though British manufacture has been highly diversified almost from its beginning, certain industrial centers have come to specialize in certain commodities. The first heavy industries were established in the "Midlands" district of England. Birmingham and other cities of this central district have come to be famous for their automobiles and other heavy machinery. Manchester has come to be famous for its cotton goods, Glasgow for its ships, and Sheffield for its cutlery. In spite of such specialization, British manufacture and the commerce with which it is related make a web of intimately related activities. This web has strands that encircle the globe.

Philip Gendreau, N. Y.

Smoke from many furnaces hangs over Sheffield, where much of the world's fine cutlery is made.

If you study the outline of Great Britain on a map, you will see how beautifully it is fashioned for overseas trade. No point on the entire island is far from the ocean. Both the west coast and the east coast are deeply indented in several places by navigable arms of the sea. Many smaller bays and inlets provide harbors where ships can load and unload cargoes. The coastline of their country was an invitation to a seafaring life, which Britons first accepted as a means of increasing their food supply with fish. Fisheries soon led to the development of trade with the people on the nearby mainland of Europe. As time went by the British people learned more and more about the ways of the sea, and ventured farther and farther over the sea in search of fortune.

The location of Great Britain. Perhaps the greatest single advantage of Great Britain is its location. The fact that Great Britain is an island has been of tremendous help in the development of the British nation. The strip of water that separates this island from the mainland of Europe does not look very wide in this day of the bombing airplane and "amphibious" naval operations. But ever since 1066, when William the Conqueror invaded England from France, it has been wide enough—with the help of the British navy and more recently the Royal Air Force—to keep out aggressive neighbors. The privacy and security thus provided have enabled the people of Great Britain to develop a strong government and productive industries at home with a minimum of interference from outsiders.

The fact that Great Britain is an island which is not very far from a densely populated mainland started the British people, as we have seen, on their career as foreign traders. One often hears of the "luck of the Irish," but the luck of the British should not be overlooked. Two events which might almost be called historical accidents gave Great Britain a tremendous push in its drive for world trade and the world power which comes with world trade. These events were the discovery of America and the invention of the steamship.

Close to the center of the land masses of the earth, Great Britain is ideally located for international trade.

With the discovery of America, Europe was presented with a vast new world to exploit. France, Portugal, and especially Spain were the first European nations to rise to this opportunity; they acquired vast holdings in both North and South America long before Great Britain seriously entered the race. After the defeat of the Spanish Armada in 1588, however, Great Britain found itself located close to the center of the land masses of the earth, with plenty of ships through which it could reach out in all directions and with no rival nation strong enough to challenge the movement of its ships. (See the map on this page.) After the beginning of the seventeenth century the history of navigation and exploration was in no small measure the history of how British traders attempted to widen their horizons of trade.

With the invention of the steamship British seamen were able to reach their goals over the shortest possible paths, without concession to the habits and whims of the wind. With plenty of coal to drive the ships and plenty of manufactured articles to exchange for the raw materials of other lands, Great Britain created the great union of economic and political power which is known as the British Empire.

THE DOMINIONS AND DEPENDENCIES

Structure of the British Empire. The political growth of Great Britain kept pace with its economic growth, except on the mainland of Europe. The people of that region were already gathered into strong national groups before the first British traders arrived. They were glad to accept the opportunity of doing business with the British, but they were not at all interested in being governed by them. In most other directions Great Britain found much less opposition to its political growth. As business increased, more and more Britons settled down in foreign lands and the government of the mother country took a greater and greater part in the government of these lands.

Where the natives were backward and unable to govern themselves well, Great Britain became their ruler. Where they had some ability to govern themselves, Great Britain acted partly as ruler and partly as adviser. Where they were as intelligent and energetic as the Britons themselves, Great Britain acted as a partner. Its enemies charge Great Britain with using ruthless methods in extending its political power. The friends of Great Britain point out that the nations which from time to time have tried to destroy the British Empire had never belonged to it; that most countries which Great Britain had drawn into its empire from time to time gladly helped the mother country to fight for its life during the critical years of both the First and the Second World War.

It is not the geographer's business to decide what is morally right and wrong in the behavior of nations. His job is to find out how that behavior is related to the earth. As he looks at the British Empire he sees that it falls into two broadly different parts. One part lies almost entirely in the middle latitudes. It is made up of several self-governing countries, or "dominions," which, along with the mother country, are called the British Commonwealth of Nations. The other part lies almost entirely in the low latitudes. It is made up of a great many "dependencies," in which Great Britain exercises a great many different degrees of political control. (See the map on pages 330–331.)

Ireland. Near to Great Britain in miles but not nearly so near in sympathy, Ireland has long been a political sore spot in the British Empire. Physically, the island of Ireland is a twin of Great Britain; together they make up the so-called British Isles. Politically, most of Ireland has resisted the attempt of Great Britain to dominate it. For nearly three centuries most of Ireland has been an unwilling—and frequently a rebellious—member of the British Empire.

Today the political status of Ireland presents a strange picture. The northeastern one sixth of the island, which is separated by a very narrow channel from Scotland, was originally settled by Scotsmen. The sympathies of most of the people in this part of Ireland are and always have been strongly pro-British. While the southern five sixths of Ireland has remained more largely an agricultural region than a manufacturing one, the northeastern one sixth has come to specialize in manufacture. Today northeastern Ireland is industrially and politically one with Great Britain. This part of the island is known as Northern Ireland and has Belfast as its capital. Scotland, England, Wales, and Northern Ireland make up what is known as the United Kingdom. They are the core of the British Empire.

The southern five sixths of Ireland is known as Eire. It is affiliated for certain purposes with the British Commonwealth of Nations. Its status resembles that of the dominions of Canada, Australia, New Zealand, and the Union of South Africa in that it is entirely self-governing. But, unlike those dominions, Eire has not pledged allegiance to the Crown. It is neither morally nor legally obligated to support the British

De Cou from Sawders

Creameries are common in grassy Eire, where the dairy business thrives.

Commonwealth of Nations in either peacetime or war.

Though thousands of its citizens enlisted privately and fought with conspicuous valor in the armed services of the United Kingdom in the Second World War, Eire remained neutral. Though the United Kingdom respected this policy, it also deplored it because the neutrality of Eire denied Great Britain the use of the highly strategic ports of southern Ireland. Regardless of the fact that Eire has the status of a dominion, the "Irish problem" is obviously not yet solved.

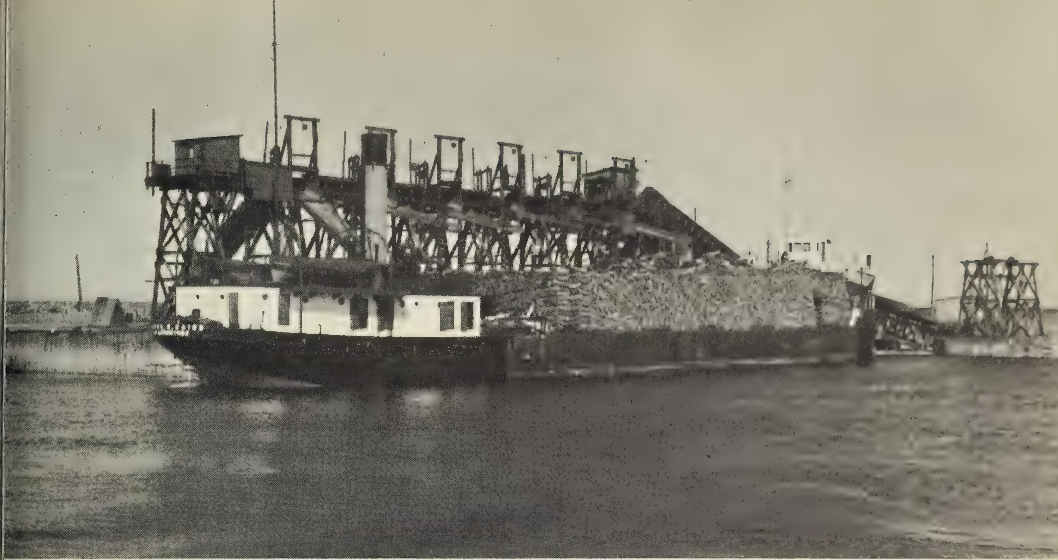
Though this problem is chiefly emotional, it grew out of conditions which were partly geographic. Southern Ireland and Great Britain seem close together on a map, but they are actually separated from one another by an exceptionally stormy sea. This sea long acted as a barrier—even to the hardy seamanship of the British. This physical barrier, added to the emotional barrier of religious differences between the peoples of the two regions, accounts for much of their failure in the past to become helpful partners in national development. Today, on the other hand, there are no great geographic barriers to friendship between Eire and her neighbors. On the contrary, there are strong geographic reasons why they should be the closest of friends.

Although in recent years Eire has developed considerable hydroelectric power and has built a number of manufacturing plants, it is by nature and tradition an agricultural country. Its cool, moist climate and its abundant hills and swampy lowlands are much more favorable to stock raising than to crop farming. Potatoes, barley, turnips, and cabbage make up most of the vegetable foods produced in Eire; for most other elements of a varied and balanced diet Eire, like Great Britain, must depend on imports from other nations.

On the other hand, Eire exports increasing amounts of livestock, bacon, butter, eggs, and beer—chiefly to Great Britain. Without the markets and merchant fleet of Great Britain, the economic welfare of Eire would be gravely threatened. If political and religious strife could be done away with, Eire would probably become as prosperous a dairying region as Denmark. As the part of the British Isles with the brightest prospect for agricultural development, Eire could form economic ties with the industrial parts of the British Isles that would bring rich benefits to all.

Canada. Across the North Atlantic Ocean from Eire lies Canada. Though both are dominions of the British Commonwealth of Nations, they are strikingly different in most other regards. Eire is the smallest of the dominions in both area and population; Canada is the largest. Eire, though close to Great Britain, was not colonized by people from that island. Canada, though far away, was colonized in large part by Britons. Eire, though a neighbor of Great Britain, sought to be independent of it politically. Canada, though both a neighbor and a friend of the United States, has never cared to sever its ties with Great Britain.

At first glance the relationship between Canada and the United States seems much


James Sawders

Much of Canada's production of pulpwood, wood pulp, and paper goes to the United States.

more intimate than the relationship between Canada and the United Kingdom. Physically, Canada and the United States are parts of the same body. On the east the Appalachian Mountains, and on the west the Rockies and the Coast Ranges, link the two countries in defiance of the political boundary that separates them. In the interior the Great Plains sweep north and south over the international boundary, bringing common activities and interests to the people on both sides. Half of the approximately 12 million Canadians live within 100 miles of the United States border, and nearly all the rest live within 300 miles of it.

The union of Canada and the United States is just as intimate economically as it is physically. Both countries share the advantages of the Great Lakes–St. Lawrence River water routes, as we saw in Chapter XV. Each profits greatly by trading with the other. Canada buys more than half of all its imports from the United States. These include coal, iron, petroleum, sugar, woolen and cotton goods, and various kinds of machinery. Canada also sells a large percentage of its exports to the United States. These include paper, lumber, fish, asbestos, and nickel and other metals. Business between the two countries has been good, and good business makes good neighbors.

One of the strongest bonds between the peoples of Canada and the United States is that they have much the same cultural background. For the most part they are of the same blood and speak the same language. They have the same kind of laws, customs, and ideals, and many of the same social problems. They share the same dangers from the aggressive ambitions of Germany and Japan. All these things have helped to make Canada and the United States good neighbors and good friends. The 3000 miles of undefended boundary along which these countries touch is proof that nations can be close to one another and yet live in peace.

With Canada so intimately bound to the United States, what are its ties with the United Kingdom? Part of the answer to this question is simply a matter of dollars and cents. Canada's trade relations with the United States are many and close, but they are not sufficient by themselves to ensure Canadian prosperity. Canada cannot sell all its surplus commodities to the United States, because both countries have sur-

James Sawders

Much of Canada's production of wheat goes to the United Kingdom through the port of Montreal.

pluses of several of the same types of commodities. What surpluses Canada cannot sell to the United States it must sell to Europe if its people are to escape unemployment and bankruptcy. The United Kingdom is the best customer Canada has for its large surpluses of wheat and other food products.

Aside from purely economic advantages, Canada derives certain real but less easily measured advantage from the prestige of being part of the British Commonwealth of Nations. Its people for the most part are proud to be affiliated with the traditions and the affairs of the United Kingdom. This feeling, to be sure, is not unanimous among Canadians. Both economically and politically, Canada has developed a strong sense of its own individuality. This sense is stronger in many Canadians than their sense of allegiance to the Crown. Then, too, about 30 per cent of the people of Canada are of French descent and without any strong sentimental ties with the United Kingdom.

All in all, however, Canada has found it profitable and pleasant to keep its political status as a dominion of the British Commonwealth of Nations. As such, Canada is of great value to the mother country, not only as a rich storehouse of food and other needed commodities, but also as a link in the Northern Hemisphere between the United Kingdom and its colonies in the Far East. Canada also functions as a link in the friendship between the United Kingdom and the United States. This link grows more and more important as it becomes more and more clear that the United Kingdom cannot hope to continue to be a world power without the friendly coöperation of the United States.

Australia and New Zealand. Nearly halfway round the globe to the southwest of Canada lies Australia. Large enough to be described as a continent, Australia has an area which is nearly equal to that of the United States. It has a total population, on the other hand, which is somewhat less than that of New York City. It resembles its fellow dominion Canada in having a large percentage of wilderness land which is of little use to its people. In both these vast domains there is more than one third of a square mile of land for every human being. In both, however, most of the people are gathered into relatively small areas.

Whereas most Canadians live along the inland boundary between Canada and the United States, at least three fourths of all Australians are bunched together in the southeastern corner of their mighty land within 50 miles of the ocean. Earlier in this book we learned why this should be so. Most of the western half of Australia is made up of desert plateaus and semiarid steppes. Much of northern Australia is tropical savanna. Much of northeastern Australia is mountainous. Only the southeastern quarter of the continent has a climate that breeds a high degree of human energy, and the setting in which such energy can give rise to economic and political strength.

Australia is still a frontier country with a relatively short history. Dutch traders touched its shores early in the seventeenth century, but they were not tempted to stay. Not until after Captain Cook had visited the country more than a century and a half later did Australia begin to attract European settlers. The first British colony was established on the southeastern coast in 1788. Other British colonies followed on other sections of the long Australian coastline. In time these colonies gave rise to six political states, which gradually extended their influence over the entire continent. It was not until 1901, however, that these states united under one federal leadership.

A strong federal union of the British people in Australia has been opposed by the vast distances that separate them. Australia has no rich deposits of petroleum, and no elaborate system of automobile highways such as comes when gasoline is plentiful and cheap. Before the Second World War it had only one transcontinental railway, and that one clung to the eastern and southern coasts, where most of the people live. If you turn back to the map on page 275 you will see that the other railway systems of Australia serve chiefly to connect seaports with the country that lies immediately behind them. These railways do not all use the same gauge (width of track), and this makes it slow and expensive to transfer goods from one district to another.

Owen from Black Star

Much of the economic life of Australia centers round the great seaport of Sydney.

All this has held back both the economic and the political growth of Australia. The chief reason why its development has lagged, however, is its remoteness from the rest of the world. Sydney, Australia's largest city and seaport, is more than 1400 miles from Wellington, the capital of New Zealand. It is nearly 4000 miles by ship from Manila in the Philippine Islands, nearly 5000 miles from Tokyo, nearly 7000 miles from San Francisco, and more than 13,000 miles from London. These distances set up formidable obstacles to the colonization and the foreign trade on which the development of a frontier country largely depends.

In spite of this handicap, Australia has become much the greatest wool-exporting country in the world. It is also an important exporter of meat, hides, wheat, and dairy products. As such, Australia is valuable to the United Kingdom because these are things which the United Kingdom sorely needs. Australia, on her part, needs the manufactured goods of the United Kingdom. This need, however, has steadily lessened, especially since the beginning of the

Australian Publicity and Tourist Bureau

Australia exports more wool than any other country on earth.

The High Commissioner for New Zealand

New Zealand, like Australia, is an important stock-raising country.

Second World War, when Australia began vigorously to expand and diversify its own manufacturing industries.

Though the remoteness of Australia has tended to make Australians self-reliant and aware of their differences from people in other parts of the world, it has also emphasized one great advantage of belonging to the British Commonwealth of Nations. That advantage is the protection afforded by the naval strength of the mother country. Australia, with its handful of people, warships, and military equipment, cannot hope to defend its vast coastlines against invasion without help. The reliance which Australia had placed in British naval strength was evident in its alarm when the great British naval base at Singapore fell to the Japanese at the start of the Second World War.

Since that time Australia has looked more and more to the United States for naval and military aid. It will doubtless grow closer to the United States as time goes on, both politically and economically. But Australia has all the practical and sentimental reasons that Canada has for preserving its ties with the United Kingdom. There are no reasons for believing that it will soon break these ties.

Even farther away than Australia from the great centers of modern civilization are the twin islands of New Zealand. Though Australia and New Zealand are often thought of together, they are separate dominions of the British Commonwealth of Nations. They are also different from each other in several other ways. Whereas Australia is immense in area, New Zealand is only a little larger than Great Britain. Whereas Australia has fewer than three inhabitants to the square mile, New Zealand has more than fifteen. Whereas Australia has tens of thousands of square miles with highly unfavorable climate for human activities, all New Zealand has a healthful and stimulating climate.

Aside from these differences, the two British dominions of the Southwest Pacific have much in common. Both are relatively young countries with bright prospects for future development. In both, stock raising and farming are the outstanding occupations of the people. Though New Zealand, with its moist climate and green pastures, has come more and more to specialize in dairy products, it is also an important producer of wool and meat. Like Australia, New Zealand trades chiefly with the United Kingdom and the United States, and looks to those countries for help when aggressors threaten its shores.

British possessions in Africa. During the nineteenth century Africa was a happy hunting ground for the nations of Western Europe that were striving for empires overseas. The native peoples of Africa were for the most part backward and weak. Their lands contained resources that were highly desirable, though poorly developed. At the start of the Second World War there were only two nations in Africa which were completely governed by native Africans: Egypt and Liberia. Even these two independent nations had to act in such a way as not to displease the European nations that controlled all the rest of Africa, and were therefore independent more in name than in fact.

When Africa was carved up and appropriated by the nations of Western Europe, Great Britain got the lion's share. (See the map on pages 330–331.) Today the British lands in Africa, exclusive of the regions which came under British control during the Second World War, amount to more than one third of the entire continent. Of these lands the Union of South Africa is much the most important.

This region, on the southernmost tip of Africa, was a way station for Dutch traders on their voyages to India as early as the seventeenth century. By the end of the eighteenth century, Dutch farmers (Boers) had pushed well inland and had set up the colony of Dutch South Africa. After the Napoleonic Wars the British fell heir to this colony. In 1910, after a century of struggle with the land, the natives, and the Boers, the British colonists in South Africa formed the Union of South Africa out of four earlier British colonies and added a new dominion to the British Commonwealth of Nations.

With 472,550 square miles of territory and about 10 million inhabitants, the Union of South Africa is the third largest in area and the second largest in population of all the British dominions. Located for the most part in the middle latitudes of the Southern Hemisphere below the tropic of Capricorn, it has all the varieties of climate which such latitudes can offer. Its coastal climate, like that of Australia, is chiefly of the mediterranean type on the southwest and the wet subtropical type on the southeast. As in the case of Australia, semiarid steppes and deserts crowd down upon the coastlands from the north.

Just as Australia stands out as a grazing country, the Union of South Africa stands out as a mining country. With the world's

The Union of South Africa possesses the greatest diamond mines in the world.

Philip Gendreau, N. Y.

greatest diamond mines and gold fields, to say nothing of considerable deposits of coal, iron, and copper, the people of the Union live chiefly by their mineral wealth. Grazing and farming, however, are not neglected; wool, hides, corn, and fruit are regularly exported along with diamonds and gold. Just as in the case of Australia and New Zealand, the surplus products of the Union of South Africa are exchanged for manufactured goods which are made chiefly in the United Kingdom.

Because of its large numbers of Boers (60 per cent of the white population of 2,200,000) and colored natives (about 7,500,000), the sentimental ties that bind this dominion to the mother country fall far short of embracing all the inhabitants. When the United Kingdom declared war on Germany in 1939, the Union of South

Africa followed with a similar declaration. But whereas Canada rose to the aid of the mother country by an almost unanimous vote of Parliament, the vote in the South African House of Assembly was a not especially reassuring 80 to 67. After the declaration was made, however, the Union contributed its full share to the war effort.

The British holdings in Africa outside the Union of South Africa all fall in the general class of "dependencies." Dependencies, unlike dominions, are not completely self-governing. Their governments are controlled, in most cases, by the United Kingdom but in some cases by the dominions. British dependencies are variously called "mandates," "protectorates," "colonies," "territories," and "condominiums," depending on the type of political control to which they are subjected. A full description

Philip Gendreau, N. Y.

The Union of South Africa exports considerable quantities of cotton and other agricultural products.

of the legal status of the various British possessions the world around would fill a book, but it would not contain much geography.

Geographically, the most significant fact about the British dependencies in Africa is that they all lie within 30 degrees of the equator. This means that they all have climates which are more or less hostile to Europeans. In the nearly 3 million square miles of Africa which are occupied by the British dependencies on that continent, Europeans are few and far between. In Southern Rhodesia the European population accounts for only 4 per cent of the total population. All other African dependencies of the United Kingdom have still smaller European populations. Several have no permanent European settlements at all.

Whether lightly colonized or not colonized at all, the British dependencies in Africa all perform the same general service for the mother country and the dominions. They are all sources of tropical raw materials and foods which cannot be produced in the middle latitudes, where all the ruling states of the British Empire are located. Some possess great possibilities for future development. In return for these benefits the British perform a variety of services for the native peoples which on the whole tend greatly to raise their standards of living.

The policy of the United Kingdom has been to grant a dependency as much self-government as the native people seem capable of administering. Southern Rhodesia, for example, has the status of "semidominion," and its people are nearly as free politically as their neighbors in the Union of South Africa. Other dependencies, in which most of the people are in primitive stages of cultural development, are entirely controlled by the British. Such a system of governing the weaker and more backward peoples of the earth contains both good and bad elements. The social rights and wrongs of British "imperialism," however, lie outside the field of geography. The significant fact for the geographer in the exploitation of weak nations by strong nations is that regions which would otherwise lie beyond the margins of world civilization are brought within those margins by such exploitation.

British possessions in Asia. If you look at the map on pages 330–331, you will see that most of the dependencies of the British Empire make an arc round the Indian Ocean. Except for Arabia and the Netherlands Indies, this arc was practically unbroken all the way from South Africa to Australia at the time of the outbreak of the Second World War. With the Japanese conquest of over half a million square miles of British territory in Burma, the Malay Peninsula, Borneo, New Guinea, and neighboring islands, a great breach was made in this arc. This breach broke both the wall of British Empire defense and some of its important life lines of trade and transportation.

The bulk of the British Empire in Asia, however, was left intact because India remained under British control. With more than $1\frac{1}{2}$ million square miles of land and not far from 390 million people, India is much the largest British possession in Asia. With the exception of Canada and Australia, it is much the largest British possession anywhere. Without any exception it is much the most valuable possession. It is also much the most serious administrative problem.

Far back in the early days of European civilization, India was a land that fired the imagination of Europeans. It was a legendary land of almost unbelievable wealth, a land of silks, spices, and precious stones which the ladies of Europe very much desired. But India for centuries was also a faraway land that could be reached only by a long, slow caravan journey from the head of navigation at the eastern end of the Mediterranean Sea. As we all know, Columbus was looking for an easy all-water route to India when he discovered America. It was left for a Portuguese sailor to do, a few years later, what Columbus had failed to do. Vasco da Gama discovered the water route from Europe to India round the southern tip of Africa in 1498.

Then followed a race for the control of Indian trade. Though Portugal and the Netherlands were the chief contenders during the sixteenth century, Great Britain entered the race early in the seventeenth century and—with the help of its rapidly developing naval power—won it. What it won, however, was not clear profit. As its trade with India increased, the problem of protecting its traders also increased. As it extended its influence and power over the Indian peoples, it also extended its administrative responsibilities in India. In time the British lands and investments in India became vast enough to constitute an empire by themselves. The protection and development of these possessions constituted a task of comparable immensity.

India, like Eire, is a country of political discontent. The "Indian problem," like the "Irish problem," is more social than geographic. The Indian people are divided into many mutually unfriendly groups by differences in language, customs, and religion. When the British first came to India they found the native peoples organized in hundreds of political states that fought frequent wars with one another. The chief reason why Great Britain was able to become the ruler of this country of many times its own size was that no group of Indians objected to British rule nearly so much as it feared being ruled by other groups of Indians.

Not all that the British did in India is praiseworthy, but it must be said to their credit that they largely removed the curse of civil war from the Indian people. Within the structure of British control there was a great and increasing amount of self-government by native Indians. As time went on, however, the Hindu people became deeply discontented with British rule. During the Second World War the United Kingdom promised India complete independence after the threat of Japanese invasion had disappeared. Accordingly, on August 15, 1947, two new self-governing dominions were established on the peninsula of India. The Dominion of Pakistan,

Philip Gendreau, N. Y.

Cheap labor and plenty of raw materials have favored the development of textile industries in India.

where most of the Moslems (about one fourth of the population) live, is a divided state with its two chief parts in northeastern and northwestern India. The Dominion of India, where most of the Hindus (about two thirds of the population) live, accounts for the rest of the country, with the exception of some independent states.

We have seen that nations with irregular boundaries and those which are not all in one piece are likely to have administrative and defense problems. The basic political problem of the new Indian dominions, however, is rooted less in their shape than in the age-old hatred between Moslems and Hindus. Since the partition of India, millions of Moslems have moved from Hindu India into Moslem Pakistan, and millions of Hindus have moved from Pakistan to India. Only the future can tell whether this gigantic shuffling of politics and populations will bring a solution to the Indian problem.

The India of legend is a land of riches, but the India of reality is a poverty-stricken land with millions of its people never far from the danger of starvation. Most Indians are farmers, but their primitive methods, combined with the unreliability of the rainfall in many areas, make it a yearly gamble whether the crops will be sufficient to feed all the teeming hordes of people. Though the British have built irrigation projects to increase the amount of croplands, and railroads to shift food supplies from one region to another, terrible famines have occurred in India, one as recently as the autumn of 1943. Though they have built thousands of hospitals and have spent millions of dollars on public health and sanitation, the standard of living in India is still appallingly low and the death rate appallingly high.

India is the home of some of the oldest civilizations on earth, but it has lagged far behind North America and Europe in the development of modern manufacture. The first modern factories were located near Bombay, and were devoted to the manufacture of cotton cloth. Later other textile industries were established at Calcutta, and still later some heavy industries. With its vast resources of cheap labor, and its high-grade iron ore and other raw materials, eastern India, in the vicinity of Calcutta, forged ahead as a manufacturing center during the Second World War. There is no reason why manufacture in this area should not continue to expand in the future.

Though its great industrial resources and vast domestic markets promise well for the development of manufacture, wheat, rice, cotton, jute, tea, and the many other agricultural products that made India the most valuable of all the British possessions in the past will doubtless continue to rank among the leading elements which shape its future economic fate.

THE WEB OF BRITISH SEA POWER

The British Empire and the sea. Now that we have examined the chief lands and peoples of the British Empire, let us look a little more closely at the web that holds them together. We have already seen enough of this web to know that its strands are partly psychological and partly physical. Though both types of bonds are vital to the British Empire, the psychological bonds could not hold the empire together if the physical bonds were cut. The British Empire lives by trade. It can hold together only as long as that trade and the systems of transportation which make it possible are preserved.

If you look at the map on pages 330–331, you will see that nearly all the states of the British Empire are intimately related to the sea. Great Britain, Ireland, Australia, and New Zealand are islands entirely surrounded by the sea. South Africa and India are

About two thirds of all the people in India are Hindus.

Wide World Photos

© A.B.C. from Black Star

The Suez Canal, which makes possible a short route between the United Kingdom and its possessions on the shores of the Indian Ocean, saves the British a handsome fortune every year.

peninsulas, with the sea on all sides but one. Nearly all the minor British dependencies are either islands or peninsulas, or are located on or near the edges of continents. Only Canada among the states of the British Empire shares a long land boundary with a nation which is stronger than itself, but Canada also has thousands of miles of coastline boundaries on three oceans.

Because of these facts the sea has always played a role of tremendous importance in the affairs of the British Empire. It was over the sea in the first place that men from the mother country went forth to exploit, to colonize, and to annex the outlying domains. It was chiefly through trade and transportation which moved over the sea that these domains were built into the economic structure of the empire. Let us see if we can discover how this web of sea power was built in the past and what chances it has of surviving in the future.

Sea routes and sea bases. The very existence of the British Empire has depended on the sea routes which connect its various parts. As the empire grew, Great Britain naturally took steps to protect its long lines of seagoing trade and transportation. If you study the map on pages 330–331, you will see that these lines of overseas communication cross three oceans: the Atlantic, the Pacific, and the Indian. Notice that it is impossible for any sea route to pass from one ocean to another without either being squeezed into narrow passages between masses of land or coming close to projecting masses of land.

The control of such land areas early became of vital importance to the British Empire because such control also meant control of the shipping that moved close by. After a long struggle with rival sea powers (chiefly the Netherlands, France, Portugal, and Spain) Great Britain managed to get control of most of the land bottlenecks that constrict the major sea routes of the earth. It got control of all the most vital straits and of many islands and peninsulas that flank the seaways which lead into the Indian Ocean from the Atlantic and Pacific oceans. By establishing friendly relations with the United States and the other American republics, and by setting up sea bases in the West Indies and a land link by railway through Canada, Great Britain secured routes into the Pacific Ocean by way of the Atlantic Ocean.

Nearly 65 per cent of the land and more than 75 per cent of the people of the British

Empire either face the Indian Ocean or lie just beyond its margins. The sea routes between this ocean and the mother country are, accordingly, of supreme importance. The British Empire is fortunate in having the use of several such routes. Of these the long roundabout routes into the Indian Ocean by way of the Americas and the Pacific Ocean have been least important, partly because of their great length and partly because their control has been largely in non-British hands.

The shorter (but still very long) route round the Cape of Good Hope, on the southern tip of Africa, has been of much greater importance. This route was for many years the only all-water passage between the United Kingdom and its possessions in the Indian Ocean. It is still an extremely important route, in spite of its length, because of the growing importance of South Africa in both empire and world affairs.

The short route from the Atlantic Ocean through the Mediterranean and Red seas to the Indian Ocean is by far the most important link between the United Kingdom and its possessions. By cutting off the long journey round Africa this route has saved the British Empire billions of dollars in transportation costs. By gaining economic, political, and naval control of the bottlenecks at the entrance to the Mediterranean and Red seas, and of the Suez Canal which connects these seas, Britain has been able to control the traffic of all the nations that use this route.

The defense of the British Empire. In the past the defense of the British Empire has consisted chiefly in the defense of British sea routes. This defense has been made up of the following elements:

1. A system of coaling stations and repair bases on many islands and peninsulas along the sea routes.

2. A system of strong fortifications and garrisons on such islands and peninsulas as

Philip Gendreau, N. Y.

Gibraltar stands guard over the vital bottleneck between the Atlantic Ocean and the Mediterranean Sea.

Malta, Gibraltar, and Singapore, where the sea routes are squeezed between masses of land.

3. A system of alliances with such friendly powers as the United States and the Netherlands, which control sea routes and bases that British ships find it profitable to use.

4. A great fleet of warships to guard British shipping on the high seas and to help guard the vital bases where the ship routes come in contact with the land.

This fourfold system of defense has been severely menaced in recent years by the following threats:

1. The attempts by enemies with large land armies and land-based air power to break the vital strands in the web of British sea routes.

2. The rising commercial competition of airplanes and airways with ships and seaways.

3. The growing self-sufficiency of the member states of the British Empire and the lessening dependence of these states on the mother country.

Philip Gendreau, N.Y.

The merchant vessel has long been the symbol of British prosperity.

The future of the British Empire. History is full of examples of colonial empires that fell to pieces. Every nation of Western Europe with easy access to the Atlantic Ocean has had such an empire at some time in its past. The empires of Spain, Denmark, and Sweden collapsed so long ago that even the memory of their glory has grown dim. Yet these empires were once great; the Spanish Empire was one of the greatest that any nation has ever built.

Similarly, France lost much of its mighty empire in the eighteenth century and the rest of it in the twentieth century. Germany lost all its overseas colonies in the First World War; Italy and the Netherlands lost all theirs in the Second World War. Some of these nations have since attempted to regain their empires, but with little success. Will the United Kingdom, which has been able to keep much of its empire intact, be able to continue to do so?

Nobody surely knows the answer to that question. The history of two world wars would seem to indicate that the British Empire is able to withstand the military and naval blows of its enemies. It is doubtful that the United Kingdom will soon again offer its enemies so fine an opportunity to strip it of its possessions as it offered during the two decades that preceded the Second World War.

But nobody can predict the pattern of future wars. With all its great naval and economic power, the United Kingdom could not have survived the blows of its enemies during the Second World War without the naval, economic, and military assistance of its dominions and its friends among other nations. Though we hope that men of good will may prevent another world war, another one yet may come. If it does, the British Empire may not be so fortunate as it has been in the past.

There are reasons for believing, however, that of all the threats to the safety of the British Empire the threat of destruction by force may be the least dangerous. The threat of a commercial revolution brought on by the airplane seems to some people a greater and more immediate danger. If the airplane should ever be able to compete with the ship as a long-distance carrier of heavy freight (and some people believe that this will someday come to pass), the whole vast and elaborate web of British sea-borne trade might be seriously impaired. In several instances the shortest air routes between Britain and its far-flung possessions cross land rather than water. If the non-British nations that are located along these routes should refuse Britain the use of their skyways, much trade that was formerly monopolized by the United Kingdom might come under the control of other nations.

Here, again, it is too early to know exactly what is likely to happen. We can assume, however, that in the competition for air-borne commerce which the future will certainly bring, the British will not be asleep. Nevertheless, the fact remains that British world trade was founded on ships and coal. There is very little petroleum in the whole of the British Empire; to turn over to an economy which is based chiefly on airplanes and petroleum might well prove to be a very serious problem. On the other hand, it seems reasonably certain that not a few of the districts which have served as vital British sea bases in the past will serve as vital air bases in the future. With these bases to start with, and with no immediate threat on the part of the airplane to put the freighter entirely out of business, the United Kingdom may well find ways of keeping much of the foreign trade on which it lives.

Perhaps the gravest threat to the security of the British Empire lies within its own borders. As the member states become more and more industrialized, they will become less and less dependent on the mother country for manufactured goods. The British dominions in the middle latitudes have already gone far in this direction. As the economic strength of British possessions increases, their political strength will probably also increase; "allegiance to the Crown" will become more and more a matter of sentiment rather than of need. In time this process alone might strip the United Kingdom of all but its low latitude dependencies. It is possible that only where climate is hostile to the development of strong-minded industrial nations will the United Kingdom be able to maintain the economic and political domination which in the past it has held over one quarter of the lands and peoples of the earth.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. The British people are energetic, courageous, and united because they are all descended from the same racial stock, with little or no mixing of different kinds of people.

2. Great Britain is a great nation because it has great agricultural and mineral resources.

3. Great Britain must import most of its food, raw materials, and fuel.

4. The British dominions are entirely self-governing because their people do not like the people of the mother country.

5. Northern Ireland is a part of the United Kingdom rather than of Eire because the people in Northern Ireland are less energetic and progressive than the people in Eire.

6. During the Second World War every dominion of the Commonwealth of Nations declared war on Germany, Italy, and Japan.

7. Canada is the largest and richest state in the British Empire.

8. Because Australia has an area almost as great as that of the United States, it will doubtless sometime become one of the great powers of the world.

9. The Union of South Africa is a strong supporter of Great Britain because the people are largely of British origin and therefore are uniform in their ideas and feelings.

10. The African dependencies of the British Empire are of little value because most of them have climates which are not very good for white men.

11. Great Britain's administration of her colonies in Africa and Asia has permitted little self-government among the native peoples.

12. The rise of air transportation will undoubtedly someday destroy the web of British naval power and with it the British Empire.

QUESTIONS FOR DISCUSSION

1. If you were a farmer in Wales, what would your main activity probably be? What would be the climatic and other reasons for this?

2. The British are famous for their merchant fleet and their navy. What do you think would happen to the British people if they should suddenly lose these ships?

3. Do you think it would be better for the United States if Canada were part of it rather than a dominion of the British Commonwealth of Nations?

4. What events of the Second World War were caused by the location of Australia? Why were so many American soldiers and sailors sent to Australia?

5. In what chief ways do you think Great Britain has influenced the United States, and vice versa?

THINGS TO DO

1. Examine a map of the United Kingdom and get a clear picture of the boundaries of England, Wales, Scotland, and Northern Ireland. Then examine the map on page 320, showing the location of industry, and the location of coal and iron deposits, in the United Kingdom. Write a short report on the relative industrial importance of the four states of the United Kingdom.

2. During the Second World War hundreds of thousands of American soldiers were stationed in Great Britain. If you know any American who was stationed there, ask him how he liked the country. Ask him how he was treated by the British, how he liked the climate, how he liked the British food, and anything else you can think of. Try to find out whether he thinks the country superior or inferior to the United States in any respect.

3. Study the map on pages 330–331, which shows the countries of the British Empire, and make a list of the completely self-governing countries. Look at the map on page 300, which shows the distribution of human energy, and indicate in what human energy regions these independent countries lie. Make a second list of the countries which are not completely self-governing, and indicate their human energy regions. Now examine the map of climatic-vegetation regions on pages 70–71, and indicate after each country in both your lists the kinds of climate which prevail there.

4. Look up the area and population of Canada and of Australia and write them down on separate pieces of paper. Determine the number of people to the square mile in each country. Then study the map of population distribution on pages 18–19, and indicate where most of the people live in each country and which areas contain very few people. Now write down the reasons which you believe account for the fact that certain parts of these countries contain many people and other parts very few people.

5. See how many recent articles about India you can find. Watch the daily newspapers and also any magazines that come into your home. Cut out these articles on India or make a summary of them for your geography scrapbook.

BOOKS TO READ

1. For a more detailed account of the geography of the British Isles than this chapter contains, the chapters in *Europe*, by Samuel van Valkenburg and Ellsworth Huntington, which deal with this region are excellent. The chapters in *North America*, by J. Russell Smith and M. O. Phillips, which deal with Canada are equally excellent and extremely readable. *Asia*, by L. Dudley Stamp, and *Africa*, by Walter Fitzgerald, are standard works on the geography of these continents, which contain so much British territory, but they are not the easiest kind of reading. *Australian Frontier*, by Ernestine Hill, is a journalist's survey of the continent "down under" which contains much interesting human geography. *Focus on Africa*, by Richard Upjohn Light, is a superbly illustrated account of a trip from Capetown to Cairo by plane.

2. Rudyard Kipling did perhaps more than any other person to give the world a picture of the British in India. His stories of India are well worth reading, both for entertainment and for instruction. *Kim* is a story of an Indian boy which no boy in any country should miss reading.

3. The books which were recommended at the end of the last chapter contain up-to-date discussions of the broader geopolitical aspects of the British Empire. Files of *Foreign Affairs* and the *National Geographic Magazine* contain many informative and interesting articles on the lands, peoples, and political geography of this far-flung empire.

XVIII · NATIONS OF THE EUROPEAN PENINSULA

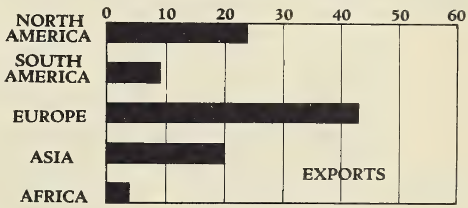
EUROPE AS A WHOLE

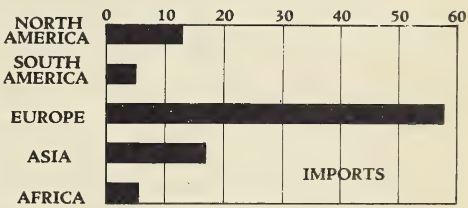
The family of European nations. If you should stand on the cliffs of Dover, England, on a sunny day and look to the southeast across the Strait of Dover, you would probably be able to see the mainland of Europe. You might well marvel that so narrow a strip of water should be able to act as a barrier between Britain and the rest of Europe. It is nevertheless true that not a little of what we learned about Britain in the preceding chapter was directly or indirectly the result of this barrier. It is also true that in spite of this barrier Britain is yet one of the family of European nations. Though each member of this family is sharply separated in one way or another from every other member, there is a certain family resemblance that marks them all.

If you should cross the water gap from Dover to Calais, you would probably be more impressed by the differences than by the similarities between England and France. French houses and towns look decidedly different from British houses and towns. French people dress, talk, and seem to think differently from British people. If you should land at Antwerp instead of Calais, you would doubtless be just as impressed by the differences between British and Belgian places and people. If you should land at Rotterdam in the Netherlands, you would notice even more striking differences. Not only that, but all three of the nations which lie so close to Britain on the mainland of Europe are almost as different from one another as each is different from Britain. Where, then, is their family resemblance?

The importance of Europe. One general characteristic of Europe to which most of its many nations contribute is its outstanding importance in the modern civilized world. It is difficult to exaggerate this importance, particularly in view of the fact that all the countries of Europe, exclusive of Russia, add up in area to less than two thirds the size of the United States. Though the population of Europe is only about half the population of Asia, Europe leads Asia by a very wide margin in all the productive activities of men. As a matter of fact, only the United States can rival Europe in the production of things which go by the name of "modern" in the world today. And even the modern civilization of the United States, like her people, came in large measure from Europe.

Per cent of total foreign trade (1938)





Commercially, Europe stands far ahead of any other region on earth. Before the Second World War, Europe's foreign trade was not only very much greater than the foreign trade of the United States; it was about three times as great as that of the entire North American continent. Similarly, it was about three and a half times as great as the foreign trade of Asia and about four times as great as the foreign trade of Africa, Australia, and South America combined. Much of the trade credited to Europe on the graph above, however, is carried on between the various countries of the continent and is comparable to interstate trade in the United States.

This is how Europe was divided before Germany commenced to change the boundaries in 1938.

Politically, Europe was equally outstanding at the start of the Second World War. It contained five of the seven major powers of the world. These five European powers ruled more than three fourths of all the people on the other continents of the globe, exclusive of the people of the United States, China, and Japan.

When we look for the causes of European importance in world affairs we find that several of the reasons for British leadership apply also to the other great European powers. All the nations of Europe, both great and not so great, share the general advantage of climates which on the whole are stimulating to men and favorable to agriculture. All share the negative advantage of a complete absence of such unfavorable wastelands as deserts and rain forests; all but Iceland, the Scandinavian nations, and Russia enjoy the complete absence of tundra and taiga. Many either possess or have access to such positive advantages as coal and iron deposits, water power, navigable rivers, fine railways, highways, airways, and harbors.

Nearly all the nations of Europe also share the general disadvantage of having more people than they can feed without help from other nations. If you turn back to the map on pages 18–19 you will see that Europe is one of the three most densely populated regions on earth. If you turn to the map on pages 162–163 you will see that more than half of Europe is mountainous. These two maps shed light on the chief reason why Europe cannot feed itself: there are too many mouths to be fed, and too many mountains where the production of food is either limited or entirely impossible. Oddly enough, this disadvantage was turned into an advantage by the nations of Europe. The great powers of the mainland, like the island kingdom of Britain, expanded commercially and politically in the attempt to get from foreign lands the necessities which the homelands could not supply.

The peninsula of Europe. Driven by the need of obtaining food and many raw materials overseas, Europe is blessed with fine opportunities for doing so. One of these opportunities comes from the peculiarities of its shape. Just as a bird is superbly shaped for flying, a horse for running, and a fish for swimming, Europe is superbly shaped for overseas trade. Though Europe is set off from Asia by deserts and mountains, it is called a continent chiefly because the people of earlier days did not know that Europe and Asia were connected by land. Europe is really only a peninsula at the western end of Eurasia. Much of the importance of Europe in the modern world comes from the fact that it is a peninsula.

If you imagine yourself as an aviator who is gifted with superhuman eyesight, and who is flying westward from a point high above the Ural Mountains, you can get an idea of the peninsular nature of Europe. The map on pages 344–345 shows how Europe would appear to such an aviator. Notice that the "continent" of Europe appears as a long and highly irregular neck of land which is squeezed between the Black and Mediterranean seas on the south and the Baltic and North seas on the north. The tip of this neck of land is made up of Spain and Portugal, which jut into the Atlantic Ocean far to the west.

Notice that in addition to being one great peninsula, Europe is also a collection of lesser peninsulas. On the south, Turkey, Greece, and Italy are almost surrounded by water. On the north, northwestern France,

L. Green from Gendreau, N.Y.

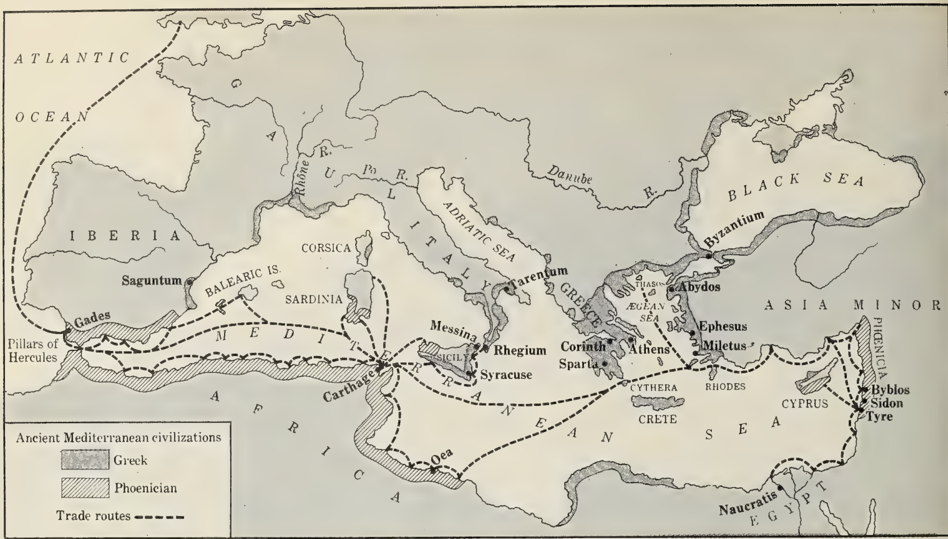
Such harbors as this abound along the deeply indented shores of Europe.

Denmark, Norway and Sweden, and Finland are peninsulas, which jut off from the main peninsula of Europe. And all these peninsulas, together with their connecting coastlines, are in turn indented in many places to make dozens of lesser peninsulas. The sea thus bores deeply into the heart of Europe, far more deeply than it does into any other land area of equal size on earth. By doing so it affords Europe an unparalleled opportunity for the foreign trade and empire building which help to feed its crowded peoples and to satisfy their ambitions.

The location of Europe. The relative location of Europe, no less than the natural location, has favored its development since the very beginning of its history. Its nearness to Asia and Africa has been one of the most important elements in its relative location. Europe was first settled by people from neighboring regions in Asia and Africa. The heart of ancient European civilization was located in the coastlands of the Mediterranean Sea, where Asia, Africa, and Europe come together. The peninsulas of Greece and Italy were ideally placed for an interchange of goods and ideas with other great


ALGERIA
MOROCCO
TUNISIA
LIBYA
Algiers
Barcelona
Marseille
Tunis
CORSICA
SARDINIA
SICILY
Mediterranean Sea
Rome
Naples
ITALY
Milan
Venice
Adriatic Sea
GREECE
ALBANIA
YUGOSLAVIA
Belgrade
Budapest
HUNGARY
CZECHOSLOVAKIA
Vienna
POLAND
Athens
CRETE
Aegean Sea
Sofia
BULGARIA
Bucharest
Danube R.
RUMANIA
Carpathian Mts.
Dniester R.
Istanbul
Odessa
TURKEY
Ankara
Black Sea
Kiev
Sevastopol
CRIMEA
Dnieper R.
Sea of Azov
U.S.
Kharkov
DONETS BASIN
Rostov
Don R.
Caucasus
Stalingrad
Volga R.

Europe from the East



In ancient times, the heart of European civilization was located in the region where Asia, Europe, and Africa come together.

centers of ancient civilization in nearby North Africa and Asia Minor.

As time went by and European civilization spread northward, Asia and Africa continued to be sources of new blood and new ideas. Still later, when Europe had grown economically and politically much stronger than Asia and Africa, these continents became convenient regions for European expansion. Though Europe is only the tail of the Eurasian dog so far as size and location are concerned, the tail came to wag the dog economically and politically. Today the energetic people of Europe control a large part of Asia and almost all of Africa.

We have seen how the discovery of America and the invention of the steamship gave Great Britain its greatest help in becoming a world power. Much the same opportunity was presented to nations on the mainland of Europe, and they seized it in much the same way. When George Washington was a boy, four European nations had staked their claims to practically all North and South America. (See the map on page 431.)

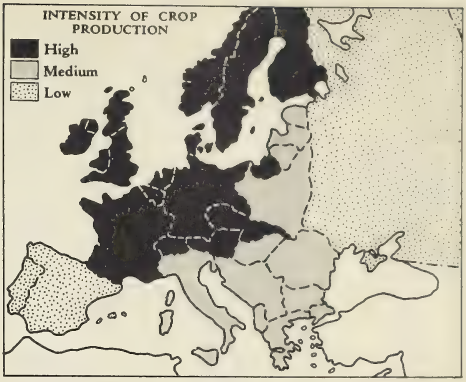
Though America has since thrown off most of the shackles of European economic and political control, it has vastly increased its voluntary economic and political ties with Europe. The relative location of America and Europe has played an important part in the creation of these ties. Thanks to the steady improvement of transportation by sea and air, the Atlantic Ocean is a less effective barrier between Europe and America today than was the Mediterranean Sea between Rome and Egypt two thousand years ago. Europe and America are now so close to each other in so many ways that what happens to the one has a profound effect on the other.

The heart of modern Europe. Though all Europe west of Russia has the advantage of being located not far from the center of the land masses of the earth, some areas are more favorably located than others. Some areas are more fortunate than others in combining the advantages of a favorable location with the other advantages that make for economic and political strength.

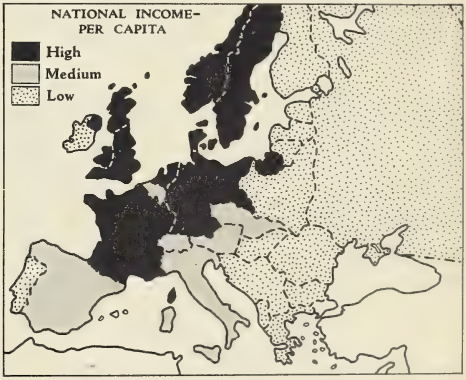
If you study the map on pages 344–345, you will see that Europe can be roughly divided into three east-west zones on the basis of relief. Europe can be likened to a sandwich, with mountainous and hilly country above and below and flatlands in between. As in a sandwich, the middle layer of Europe is the richest. You can see by the map that the flatlands of west-central Europe have exceptionally easy access to the open ocean and many fine harbors for the loading and unloading of ships. These flatlands also have easy access to the products of the rest of Europe through railroads, highways, canals, and navigable rivers. As trade with America became more and more important in the economic life of Europe, this region became more and more the center of that life.

The plain of west-central Europe is blessed with more than merely an ideal location for overseas trade. It is also blessed with the other ingredients of a highly developed civilization. The mild west-coast marine climate is at its best in this region for both men and crops, as the maps on this page will show. Well-developed agriculture and trade make the standards of living higher here than in most of the rest of Europe. Notice that all these maps present the same general pattern. All the elements that contribute to a highly developed modern civilization rather generally reach a peak in west-central Europe and decline away from that region. West-central Europe is the intellectual, economic, and political heart of the European peninsula.

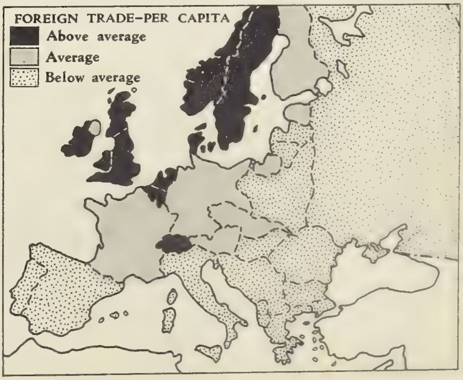
European manufacture. Though the people of the European peninsula live by all the major activities, they are first and foremost a manufacturing people: In Chapter XIV we saw that the European Manufacturing Belt of west-central Europe is the greatest manufacturing region on earth. In Chapter XVII we examined the part of

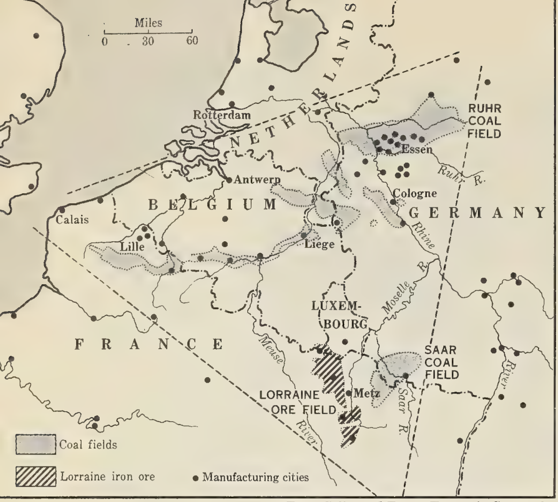


The map above shows that west-central Europe leads all Europe in the production of food.



West-central Europe leads all Europe in personal wealth (see the map above) largely because it leads in foreign trade (see the map below).





From Colby and Foster Economic Geography

The International Triangle is the industrial heart of continental Europe. Notice that most cities are on or near deposits of coal and iron.

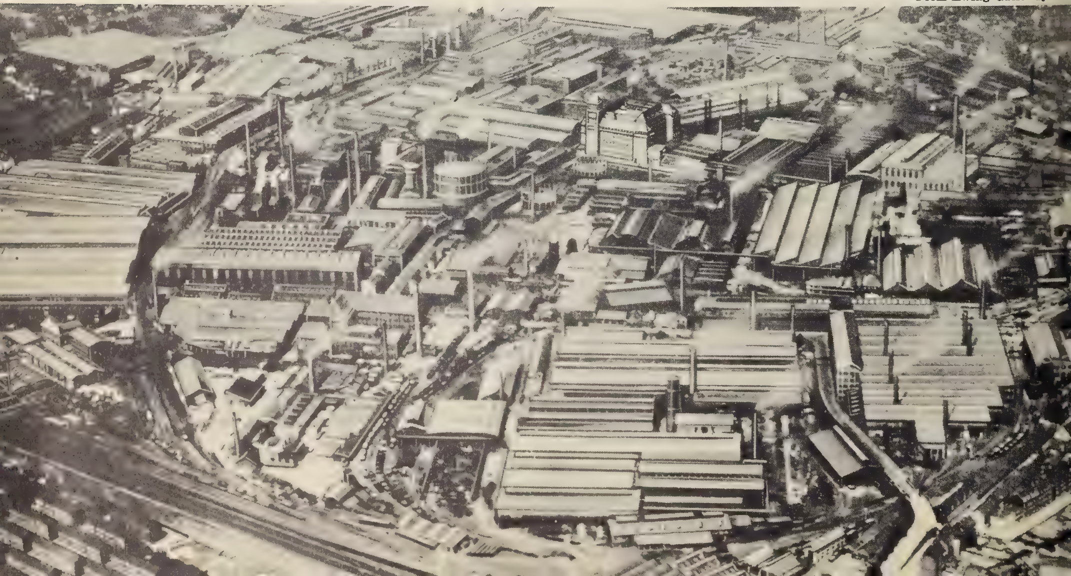
this belt which lies in the British Isles. Let us now examine the larger part that lies on the mainland of Europe, because there we shall find many of the reasons for Europe's leadership in the economic and political life of the world.

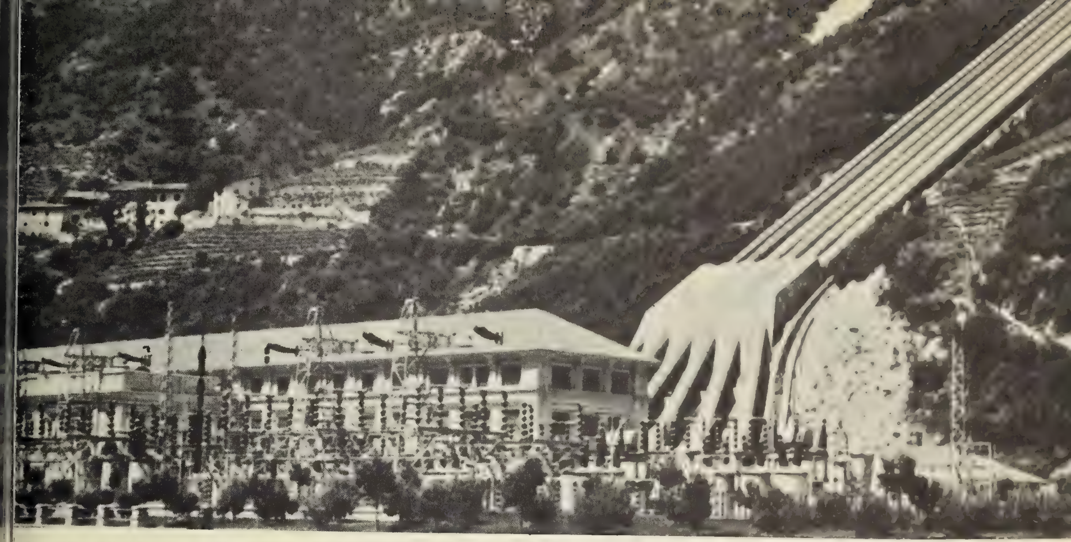
Most of the most highly developed centers of manufacture on continental Europe cling to the Rhine River and its tributaries in a triangular zone which is shared by five nations: France, Belgium, Luxembourg, the Netherlands, and Germany. In this so-called International Triangle the heavy industries are nearly all in cities which are located in the coal and iron-ore districts. Textile, chemical, and other light industries are more widely scattered. With its great concentration of skilled labor, its great home markets, and the two great seaports of Antwerp and Rotterdam, the International Triangle stands second to no other region on earth in manufacture and commerce. This region, however, is cursed with serious political problems. We saw something of these problems earlier in this book and we shall see more of them as we go on with this chapter.

East of the International Triangle, Germany and its varied chemical industries are dominant. The leadership of Germany in the chemical industries is based on the fact that large quantities of potash, salt, coal, and sulfur-bearing iron pyrite occur together in this region. Through these four resources Germany became the first nation to excel in the manufacture of dyes, fertil-

This plant at Essen, in the northeastern corner of the International Triangle, is one of the many heavy industries in a district which has contributed much to the industrial strength of Germany.

From Ewing Galloway





James Sawders

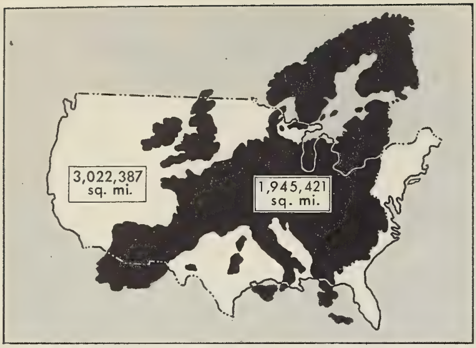
Northern Italy has made good use of its rich water-power resources.

izers, plastics, and other chemical products. Germany also produces optical instruments and other articles that require great skill and precision in manufacture. Besides these specialized light industries, Germany contains great textile industries and a variety of heavy metal industries. Similar manufacturing industries extend into neighboring districts in Poland and Czechoslovakia.

Outside the European Manufacturing Belt there are less extensive districts of manufacture in southwestern Europe. (See map on page 263.) The Lyon district in France, for example, is the leading center of silk manufacture in Europe. This district is intimately related to the Paris district, which is Europe's chief style and dressmaking center. Round the rugged Alps, with their great resources of water power, many light industries have developed. The Swiss district specializes in the manufacture of textiles, watches, clocks, aluminum, and a variety of dairy food products. The Po district in northern Italy specializes in textiles, chemicals, and other light commodities. Other great centers of manufacture, which we shall discuss in the next chapter, are located in the Soviet Union.

The Second World War made many changes in the picture of manufacture in Europe. Many British factories, for example, were moved from the cities to the country in order to escape the concentrated force of German bombing. Many Continental factories were moved eastward—in some cases as far as Poland and Czechoslovakia—to escape the ever-lengthening arm of the British and American air forces. Many Russian factories were moved into Siberia to escape the German invaders. It is still too early to know just what this will spell for future manufacture in Europe. But though the war greatly extended the distribution of factories in Europe, the districts that favored their development in the past will probably favor their continuance in the future.

The disunion of Europe. The industrial life of Europe, along with several other elements of its geography as a whole, tends to bind Europeans together in cooperative union. The community life of Europe, on the other hand, tends to divide Europeans into competing national groups. The people who make up these groups are for the most part energetic, ambitious, and proud; each group is both jealous and distrustful of the other groups. This disunion has given



Though Europe is small its troubles are great

rise to the strange spectacle of a region which has contributed greatly both to the creation and to the destruction of civilization.

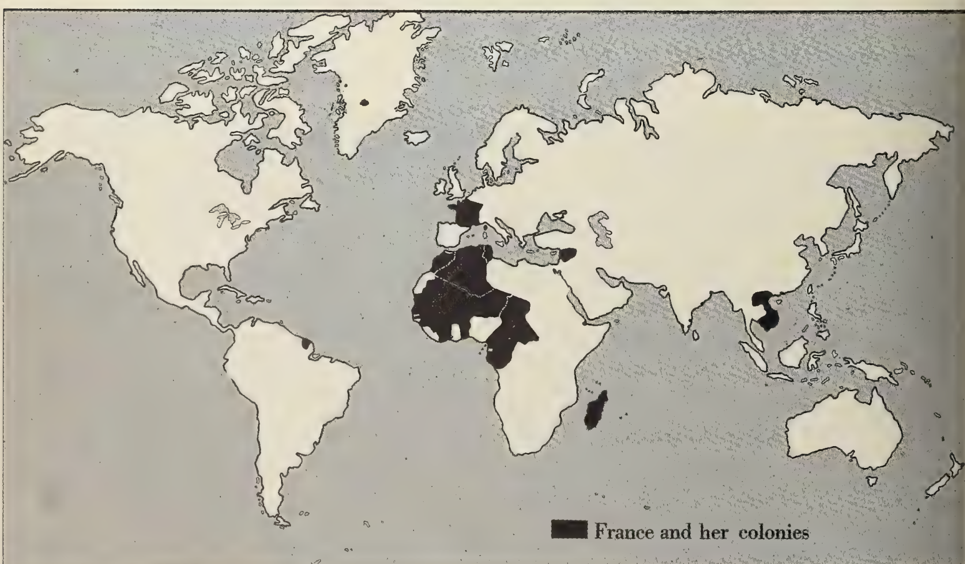
Why have the nations of Europe taken part in most of the wars we read about in the history books? What part has the geography of Europe played in causing these wars? What part can it play in making future European wars impossible? We shall spend much of the rest of this chapter in a search for the answers to these questions.

THE MAJOR POWERS

Growth of the French Colonial Empire. At the start of the Second World War four nations of continental Europe were far stronger than any of their neighbors. Of these four major powers—France, Germany, Italy, and Russia—France lies nearest to the United Kingdom and in several respects is most like it. Like the United Kingdom, France has a climate that makes men strong and energetic. It has easy access to the Atlantic Ocean, as well as to both the North Sea and the Mediterranean Sea, and fine harbors that make foreign trade easy and profitable. It has rich deposits of iron and coal for manufacture. At the start of the Second World War, France had built an empire across the seas which was second in size only to the British Empire.

Like the United Kingdom, France was faced on the east by strong nations which interfered with growth in that direction. After the discovery of America, Great Britain and France competed for colonies there,

At the start of the Second World War the French had built the second greatest empire on earth.



but Great Britain was the more successful. In the end, France gave up most of its American possessions. It later built up its modern empire, chiefly in Africa and Asia among weak nations which no other strong nations had yet come to control. The map on page 350 shows the French Colonial Empire at the start of the Second World War. Compare the size of this empire with that of the British Empire as shown on the map on pages 330–331.

Though France and the United Kingdom are alike in several ways, they are different in several other ways. With more than twice the area of the United Kingdom, France at the beginning of the Second World War contained about four million fewer people. Its climate and soil are fine for many crops. Before the war less than one tenth of the people of the United Kingdom were farmers. France, where one person out of every three was a farmer, was unique among the nations of Western Europe in being able to raise at home nearly all the food it needed. Its population has increased less rapidly than that of the United Kingdom, and there has been no uncomfortable crowding at home. Because of this, France has had much less need of a great colonial empire than Britain. It is a question whether the energy and wealth she paid out for her empire have been well spent.

The greatest interest, as well as the greatest problem, of France has always been on the continent of Europe. Britons have needed and cherished their colonies more than Frenchmen have needed and cherished theirs. For the Frenchman it has always been France rather than the French Empire that mattered most. All through its history France has tried to set up and protect what it thought were its proper boundaries on the continent of Europe. At the start of the Second World War it had a large army, whose only purpose was to keep enemies away.

Boundaries and the fate of France. If you look at the map on page 342, you will see that on the northwest and west, France has the definite frontiers of the English

The gleaming city of Algiers is a monument to French enterprise in Africa.

Channel and the Bay of Biscay. On the south it has the equally definite Pyrenees Mountains and the Mediterranean Sea. On the east it has the Alps, the Jura Mountains, and the Rhine River. The great weakness of France's location is that it has no natural frontiers on the northeast. Over the rolling lowlands of that region enemy armies can easily move—and have so moved more than once in the past, to the grief of France.

The lack of a natural boundary on the northeast is the military weakness which has made possible the many wars that France has fought with Germany. But what made those wars necessary? The answer to that question is simple. The wars were not necessary at all. They grew out of fear and jealousy and pride rather than need. Germany has always feared that a strong France would give that country control over all Europe. France has always feared that Germany would destroy it if it could. In spite of these feelings, France and Germany had done an increasing amount of business with each other in the years just before the war.

Both were among the leading manufacturing countries of the world. France produced large quantities of the so-called "luxury" goods: silk articles, jewelry, wine, and many similar things. Germany produced large quantities of chemicals, dyes, fertilizers, and a great many other articles which were not produced so abundantly in France, and which Frenchmen were glad to buy. Why, then, could not both these nations have lived peacefully side by side, as the United States and Canada live? The answer to this question lies chiefly in the nature of Germany.

The growth of Germany. During its early history Germany was not a united nation. It was a collection of hundreds of little independent states. It was not until 1871 that Bismarck reduced the number of these states to twenty-five and united them under one strong central government. At that time Germany contained about 40 million people, chiefly farmers. It raised enough food for itself and had some left over to export to other nations.

The Pyrenees Mountains make a perfect natural boundary between France and Spain.

By Ewing Galloway, N.Y.

Though in uniting Germany Bismarck had led his people into three wars, he was at heart a lover of peace. He believed that Germany had grown large enough in Europe. The industries which were springing up all over the land were bringing more and more trade with Germany's neighbors, and more and more prosperity to both its neighbors and itself. Though Europe was full of old jealousies, fears, and selfish desires, Bismarck believed that peace and good will were possible. He went a long way toward proving that he was right.

Germany under Bismarck grew into one of the great industrial nations of the world. For a long time it was too busy strengthening and developing its empire at home to do much about extending it away from home. But as time went on, Bismarck came to feel that Germany should have colonies which could supply raw materials for its factories. It was the style of the time for industrial nations to have colonies, whether they were worth the bother or not, and Germany was the only great industrial nation without any.

Unfortunately, Germany entered the race for colonies late. Most of the best land all over the world had come under the control of other strong nations. Germany got only such territory as these nations had not really wanted. The map below shows the German Empire at the beginning of the First World War.

After Bismarck resigned as Chancellor in 1890, Germany never again had so just and wise a leader. By 1900 its population had increased to 56 million people; it kept increasing until it reached 68 million people by the beginning of the First World War. Germany's territory in Europe, on the other hand, had increased very little since 1871. The German people felt more and more like prisoners in their own country. On land Germany was hemmed in on all sides by strong nations. Overseas there was no better chance of growth than at home. What could it do?

It might have done what Bismarck wanted it to do. *It might have grown stronger without growing larger—by peaceful trade with other na-*

The German Empire before the First World War included colonies of little value.

tions. Germany had become very great in industry, science, education, and art. It had plenty of coal and iron to run its factories, enough timber to build a large percentage of its homes, and enough farm lands to help at least in the feeding of its growing population. To the east and south lay the vast agricultural lands of Russia and the Balkans. The people of these lands needed the manufactured goods of Germany, and Germany needed their farm products.

Why, when Germany was so fortunately located to grow stronger and richer through peaceful trade, did it decide not to grow in that way? There are two reasons: (1) Germany feared that the nations which surrounded it would unite to destroy it. (2) Not content to be just one strong nation among other strong nations, Germany wanted to spread its control and its culture all over the earth. It became a proud military nation spoiling for a fight, a threat not only to the rest of Europe but to the entire world.

Germany and the First World War. The result of all this was the First World War of 1914–18. Though Germany's power and influence had steadily grown by peaceful methods, those methods were too slow and

The fortified city of Metz, in the disputed territory between France and Germany, has seen many a bloody battle.

By Burton Holmes from Ewing Galloway

dull for the soldiers who had secured control of the German government. The way of the aggressor seemed faster and easier. It might truly have been so if only France, Great Britain, and the United States had not stood in the way.

After four bitter years of fighting Germany failed to conquer the world. It succeeded only in losing much of what it had built up during the fifty years before the war. It lost, among other things, the rich industrial districts of Alsace and Lorraine, as well as other valuable territory in Europe. It lost its foreign colonies. It lost its navy and most of its army. It lost its prestige among the great nations of the world—but it did not lose its desire to rule the world.

When the First World War came to an end in 1918, an English geographer, Sir Halford Mackinder, gave a warning to his country which it did not choose to heed. He tried to show that Germany might be beaten only for the time being; that it was still in a position from which it might someday be able to conquer the world. He tried to make the leaders of Great Britain see Germany's strong position on the map of the world, but they refused to look. If they had been willing to study the lesson in geography which Mackinder had tried to teach them, there might never have been a Second World War. Instead, the Germans studied the lesson. From Mackinder's warning to Great Britain, they built a new plan for conquering the world.

Germany and the Second World War. The map on page 355 shows the earth as Mackinder saw it. He was struck by the fact that about two thirds of all the dry land on earth was in one nearly continuous mass. People had grown used to thinking of this great land mass as three separate continents: Europe, Asia, and Africa. Mackinder thought of it as one continent and he called it the World-Island. Round the World-Island were many smaller islands, including Great Britain and Japan. He called these the Offshore Islands.

Courtesy of *Life* ana Richard Edes Harrison, (C) *Time*, Inc., 1942

This is the world as Mackinder saw it at the close of the First World War.

Farther away were other islands, including Australia and America, which he called the Outer Islands.

Mackinder saw that the World-Island contained not only two thirds of all the dry land on earth but about seven eighths of all the people. He saw that most of these people lived on the edges of the World-Island, which he called the Coastlands. In these Coastlands, the river mouths of which were open to ships from the sea, nearly all the world's great civilizations had been born.

Behind the Coastlands were the vast central lowlands of the World-Island, which Mackinder called the Heartland. The rivers of the Heartland flowed on the north into the ice-choked Arctic Ocean, and on the south into seas which did not connect with the ocean. The Heartland had resisted the advance of civilization because it could not be reached by the ships which in the past had carried civilization from place to place.

Mackinder realized that Great Britain must do three things to keep its empire from collapsing: (1) It must preserve the British Isles as a home base for its fleet. (2) It must keep the sea lanes open to its colonies, which were scattered round the edge of the World-Island. (3) It must keep possession of the strong naval bases on the edges of the World-Island, which protected both its sea lanes and its colonies.

But what if some strong land power in eastern Europe should use the ever-improving means of land and air transportation to conquer the Heartland? The bases for sea power round the edges of the World-Island might then fall into the hands of land armies drawn from the hordes of people who live on the World-Island. The whole World-Island would then become a home base for sea power under control of the nation that controlled these armies. Great Britain's sea power would be broken and so would the sea power of all the nations which were located on the Offshore and Outer Islands.

Mackinder summed up his theory in geography in three sentences:

1. Who rules East Europe commands the Heartland.

2. Who rules the Heartland commands the World-Island.

3. Who rules the World-Island rules the World.

Nobody knows whether these sentences will ever be proved to be true. The history of the Second World War strongly suggests that control of the Coastlands rather than of the Heartland of the World-Island is the key to world power. Before the war, however, the German geographer Karl Haushofer believed that Germany could prove that Mackinder was right. He believed that Germany was in the best possible position to rule East Europe, the Heartland, and the world. Adolf Hitler was strongly influenced by Haushofer's ideas in formulating the plan by which he hoped that Germany could be established as the ruling world power. From 1933, when Hitler became ruler of Germany, until 1939, when Germany invaded Poland and set off the Second World War, the German government prepared to act on this plan.

We all know only too well what that decision has cost the rest of the world. It is still too early to know exactly what it will ultimately cost Germany. We know only that the United Kingdom was able to hold its home base and most of its Coastlands bases against the attacks of Germany and its allies. We know that the Soviet Union was able to hold the Heartland of Eurasia. We know that Germany failed in its second attempt to conquer the world. We suspect that its second failure will prove much costlier than the first.

The early growth of Italy. It has been said as a joke that the future of Italy is in the past. There is more truth than humor in this remark, for the Italian people at least. Certainly Italy can never hope to be as powerful in the future as it was at the close of the first century of the Christian Era. At that time the Italian Empire (then called the Roman Empire) had grown so large that all the lands round the Mediterranean Sea belonged to it. It even contained Great Britain (then called Britannia) on the north, and at one point it touched the Caspian Sea on the east. By means of trade, war, a strong central government, and many fine roads, Italy had brought much of the civilized world under its control.

Between that time and the end of the First World War, the Italian Empire did not grow. It shrank. Strong nations on all sides whittled away the once proud empire until only the Italian peninsula, a few nearby islands, and a few poor desert colonies in Africa were left. For many centuries after the fall of the Roman Empire, Italy had no strong central government and no feeling of union among its people. It was many times abused and robbed by neighboring nations. At times, to be sure, certain Italian cities rose to great power, but Italy as a nation did not rise with them. Italy as a nation not only did not grow for many centuries; it did not really exist.

The modern growth of Italy. Though Italy was on the winning side in the First World War, it suffered almost as much as if it had lost. It came out of the war poor, discontented, and discouraged. It felt that its allies had not given it enough of the fruits of victory. When the Fascist government rose to power under Mussolini in 1922, conditions inside Italy began to improve. Mussolini made the Italian people feel that Italy would again have a place among the great nations of the world.

Mussolini believed that Italy's position on the map of Europe gave it a natural right, as well as a great opportunity, to control the Mediterranean Sea. But Italy could never have this control so long as the United Kingdom controlled the gateways of Gibraltar and the Suez Canal, and France the rich colonies of Morocco, Algeria, and Tunisia. This fact made the Fascist government very jealous of Italy's old allies, and led to a partnership with Germany, its old enemy. Like Germany, modern Italy had been able to get control of only such colonies as other strong nations had not really wanted. The map below shows the Italian Empire as it was when Italy entered the Second World War on the side of Germany in 1940.

Many of the reasons why Italy entered the war can be found in the geography of that country. Italy, like Germany, felt cramped. Germany felt imprisoned on land; Italy felt bottled up in the Mediterranean Sea. Again as with Germany, Italy could not produce enough food for its rapidly increasing population. It had to depend on trade with other nations for many of the necessities of life.

The Italian Empire, like the German Empire, was made up of second-rate colonies.

By Burton Holmes from Ewing Galloway

Though highly productive, the farms of northern Italy fall far short of satisfying the food requirements of the Italian people.

Ewing Galloway, N.Y.

These freighters in an Italian port are symbols of the wheat, coal, cotton, and wool which Italy needs but cannot itself produce.

The greatest geographic weakness of Italy is that it is poor in mineral resources. It has no really good deposits of coal and no oil fields. Northern Italy, where the climate makes the people energetic, has developed some great industries, but the fuel to run the factories must be brought in from Great Britain by boat or from Germany by rail. Italy's lack of large deposits of iron ore and its lack of cotton and high-grade wool have also slowed down its progress as a manufacturing nation. Though Italy has abundant water power resources, water power is not suitable for the manufacture of ships, airplanes, and heavy armament, which are so important for a nation with military ambitions.

Mussolini decided to throw Italy into the Second World War on Germany's side for the following reasons:

1. When France fell, Mussolini thought that Germany had all but won the war. He thought that Italy could enjoy the fruits of victory without having to do any of the heavy fighting.

2. He hoped that Hitler would turn over to Italy the rich French colonies of Morocco, Algeria, and Tunisia in Africa.

3. He thought that with Germany in control of Europe, and Italy an ally of Germany, Italy would be able to get more easily the wheat, coal, cotton, and wool which it had to import in such large quantities.

The future of Italy. The tragedy of Italy is that Mussolini guessed wrong on all three points. Much heavy fighting was left to be done. Italy soon lost many men, much of its fleet, and all its African colonies. It lost all hope of gaining control over the French colonies in Africa when the United States conquered North Africa. When later its government fell and its homeland was invaded, it all but ceased to exist as an independent nation.

Italy's future prospects are not bright. When it entered the war it was exporting considerable quantities and varieties of cloth, fruit, yarn, machinery, and automobiles. By developing the water power of its mountain streams, it was giving promise of becoming less and less dependent on other nations for fuel to run its factories. By making farms out of swamps and improving its methods of agriculture, it was giving promise of becoming less and less dependent on other nations for food. Italy lost all these gains when it entered the Second World War. The road back will be a hard one for the Italian people. But the Italian people have risen above misfortune in the past. They should be able to do so again.

THE LESSER POWERS

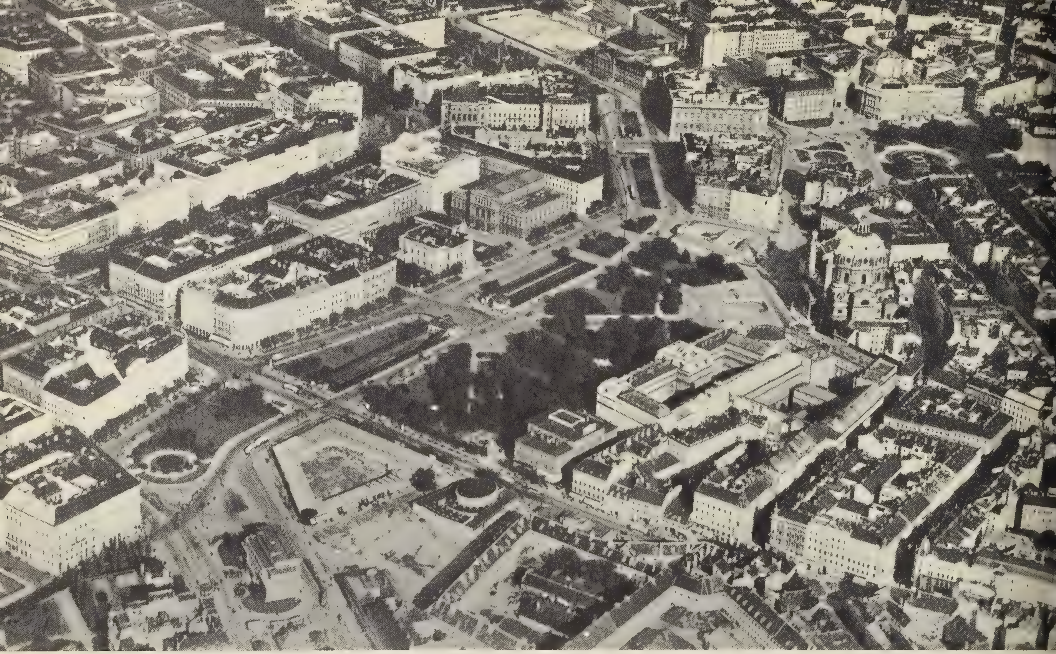
The doctrine of living space. In Chapter XVI we saw something of the problems which the less powerful nations of the earth must face. Nowhere are such nations more numerous or more sorely vexed by problems than in Europe. A much larger book than this could be written about these nations and their problems. Since you have doubtless studied the general geography of the nations of Europe in elementary school, we shall not repeat that study here. Let us rather try to discover how geography affects the relationships between the weaker and stronger nations of that region, because through these relationships the fate of the weaker nations is decided.

We have seen that before the Second World War the weaker nations of Europe were tied to their stronger neighbors by the peaceful bonds of trade and treaties. When Germany decided to change the economic and political structure of Europe, its spokesmen advanced a variety of reasons for doing so. Most of these reasons had little to do with geography, but they were not infrequently made to sound geographic. The German spokesmen talked at great length about the union of man and his physical environment. They built up a doctrine of *Lebensraum* ("living space") on their interpretation of what this union should be. They found in what they considered the right of the German people to living space a justification for every economic, political, and military move that Germany made against the other nations of Europe.

It is difficult to define the German doctrine of living space because it was frequently changed to meet the political needs of the moment. When it took a form that was designed to meet the approval of Germany's neighbors, it held that a people in a continental location should control enough land and resources to guarantee economic security. It held that nations in such a location should unite to achieve this end; that only by doing so could the people of such nations protect themselves from a maritime nation with the power of cutting them off from sources of necessary raw materials. In theory, this doctrine promised the weaker nations of Europe protection from the economic strangulation by the British Empire which Germany had long feared would be its own fate. In fact, the doctrine was only a cloak for Germany's desire to get complete economic and political control of neighboring nations on the continent of Europe.

All through this book we have had evidence of the fact that all the people and all the nations of the modern world are intimately related in many ways. No nation or group of nations in any region can become entirely independent of the nations in other regions. A doctrine of living space that promises such independence has no basis in sound geopolitics. Such a doctrine, however, in one form or another, has come to be a standard part of the procedure of aggression. Italy's theory of *Mare Nostrum* ("our sea") was a doctrine of living space that cloaked its desire to dominate its neighbors on the shores of the Mediterranean Sea. Japan's theory of a New Order in Greater East Asia was a doctrine of living space that cloaked its desire to control its neighbors in southeastern Asia. All these varieties of the doctrine of living space have the purpose of disguising (or, if that does not work, of justifying) the intentions of nations to grow larger and richer by force.

The doctrine of living space in action. How the false geopolitical doctrine of living space can be used as part of the technique of aggression was thoroughly demonstrated by Germany in the early years of the Second World War. Not all the people of German blood live within the boundaries of prewar Germany. Many of them live in the adjoining nations of Austria, Czechoslovakia, and Poland. Among the early rumblings of the war was the argument of German leaders that a proper living space for the German nation should include all areas adjacent to


Austrian Federal Railways

Beautiful Vienna, capital of Austria, was the first of several European capitals which the Germans seized at the beginning of the Second World War.

Germany which contained any considerable number of Germans. The war really began when Germany began to act along the line of this argument—when by a combination of threats and promises it took over Austria in 1938 and the Czechoslovakian provinces of Bohemia and Moravia in 1939.

These bloodless conquests placed most of the German people in Europe under one government. They gave Germany the living space it had demanded but not all the living space it wanted. Poland was the next nation to receive German threats and promises. According to the German concept of living space, it was geographically and morally wrong that a piece of Poland should be allowed to lie between Germany and East Prussia. (See the map on page 342.) Poland, which had its own ideas about living space, refused to yield to the German demands.

With England and France pledged to the support of Poland, the German drive for living space entered its military phase. This phase was inevitable because sooner or later Germany's conception of living space was bound to clash with the conceptions of living space which the other strong nations of Europe held. Germany was bound to have to wage war against the nations which it could not win over by other means. So it was that Germany's conception of living space turned Europe into a region which could be more accurately described as a dying space.

Location and the fate of weaker nations

Whenever great European nations go to war with one another their little neighbors suffer merely because they happen to be in the way. To destroy Great Britain, Germany would have to control the coasts of Europe which lay nearest to that island. Only from these coasts could an invasion of Great Britain take off. In April, 1940, Germany seized Denmark and Norway, which lay nearest to Great Britain on the northeast. In May of that year the German armies began to move against France. The little nations of Luxembourg, the Netherlands, and Belgium had the bad luck to lie between Germany and France's weak northeastern boundary. They were in the way of the

German armies on their march toward France and they had to be crushed. They, like Denmark and Norway, were the victims of their location.

When Germany invaded Denmark and Norway it got more than bases from which it could attack Great Britain. If you look at the map on page 342 you can see that it also got control of the Kattegat and Skagerrak straits at the western end of the Baltic Sea. By doing so it was able to control the ships which entered and left that sea. Since these ships carried much of the trade by which the nations of northeastern Europe lived, Germany was able to control the actions of these nations.

By blocking the outlet of the Baltic Sea, Germany was able to close Russia's best port, Leningrad, and to use all the lesser nations along the shores of the Baltic for its own selfish purposes. It did not have to invade Sweden and Finland after Norway and Denmark surrendered, because these nations had to coöperate with Germany or die of economic starvation. Its armies had already conquered Poland, the only Baltic nation that dared to resist it. Lithuania, Latvia, and Estonia were invaded because they lay along the path of the German invasion of Russia. These little nations were victims of their location in northeastern Europe, just as the Netherlands, Belgium, and Luxembourg were victims in northwestern Europe.

The small nations of southeastern Europe are called the Balkans. The First World War began in the Balkan nations, and the Second World War quickly spread into them. Rumania lies between Germany and Russia, and had to be controlled by Germany when that nation decided to attack Russia. Bulgaria, Greece, Albania, and Yugoslavia have boundaries on the Mediterranean Sea. Germany and its ally Italy had to control these coastlines so that they could strike at the Suez Canal, and at the British Empire's water routes through the Mediterranean and Red seas. Thus it was that because of their location all the Balkan nations except Turkey became victims or none too willing allies of Germany before the summer of 1941.

The beautiful and productive city of Prague in Czechoslovakia was one of Germany's bloodless conquests at the start of the Second World War.

By Ewing Galloway, N.Y.

Essential Facts about the Nations of the European Peninsula at the Start of the Second World War

COUNTRY	AREA IN SQUARE MILES	POPULATION	PRINCIPAL EXPORTS	PRINCIPAL IMPORTS
Albania	10,629	1,003,124	Wool, hides, and furs	Cotton and cotton textiles
Austria	32,341	6,755,000	Iron and steel; paper pulp and paper; wood	Coal and coke; swine; textile fabrics
Belgium	11,754	8,386,553	Iron and steel; precious stones; coal and coke; woven fabrics	Metal ores; wool; machinery; wheat
Bulgaria	39,825	6,272,900	Tobacco; fruits and nuts	Machinery; iron and steel
Czechoslovakia	54,244	15,263,400	Iron and steel; textile fabrics; glass and glassware	Raw cotton; wool; machinery
Denmark	16,575	3,805,000	Butter; bacon; eggs	Coal and coke; iron and steel; oil-cake and meal
Eire	26,601	2,944,000	Cattle; bacon and ham; butter	Coal; machinery; wheat
Estonia	18,359	1,133,940	Butter; wood pulp; swine	Iron and steel; machinery; raw cotton
Finland	134,547	3,863,753	Wood pulp; lumber; newsprint and other paper products	Machinery; iron and steel; textile manufactures
France	212,722	41,980,000	Textile fabrics; iron and steel; chemicals; wines and spirits	Coal and coke; petroleum and products; wines
Germany	181,677	68,072,000	Machinery; iron and steel; chemicals	Fruits and nuts; nonferrous metals; iron ore; petroleum and products
Greece	50,270	7,201,092	Tobacco; currants and raisins; olive oil and olives	Wheat; machinery; iron and steel
Hungary	35,935	8,688,319	Wheat; machinery; swine	Chemicals; machinery; nonferrous metals
Italy	110,600	42,444,588	Textile fabrics; fruits and nuts; machinery	Coal and coke; raw cotton; iron and steel; petroleum and products
Latvia	25,402	1,950,502	Lumber and timber products; butter; flax and tow	Machinery; iron and steel; coal and coke
Lithuania	21,473	2,575,363	Butter; bacon; flax and tow; swine	Machinery; textile fabrics; iron and steel
Netherlands	13,515	8,722,000	Dairy products; vegetable oils; radio apparatus	Iron and steel and manufactures; machinery; wood and cork; coal and coke
Norway	124,587	2,921,000	Fish and shellfish; wood pulp; paper and newsprint	Machinery; iron and steel manufactures; coal and coke; textile fabrics
Poland	149,957	34,500,000	Coal; wood and manufactures; metals and manufactures	Machinery; metals and manufactures; raw cotton; wool
Portugal	34,386	7,380,906	Wines; sardines; cork and cork products	Machinery; coal and coke; iron and steel
Rumania	60,643	19,750,004	Petroleum and products; wheat	Iron and steel; machinery
Soviet Union	2,315,828	170,467,186[1]	Wood and manufactures; wheat; furs	Machinery; nonferrous metals; iron and steel
Spain	192,364	25,241,000	Fruits and nuts; olive oil; wines; iron ore and pyrites	Raw cotton; machinery; fertilizers
Sweden	173,341	6,341,303	Wood pulp; lumber and timber; iron and steel; iron ore	Machinery; coal and coke; iron and steel
Switzerland	15,944	4,183,200	Machinery; watches and clocks; textiles	Iron and steel; coal and coke; machinery; wheat
United Kingdom	93,982	46,075,102	U.K. { Textiles and manufactures; machinery; iron and steel and manufactures	U.K. { Butter; wood and manufactures; petroleum and products; meat (fresh, chilled, or frozen)
England	50,874	37,794,003		
Northern Ireland	5,237	1,279,745		
Scotland	30,405	4,842,980		
Wales	7,466	2,158,374		
Yugoslavia	95,576	15,919,000	Wood for building; corn; copper; swine	Machinery; yarn and thread; iron and steel; textiles

[1] Population figure for both European and Asiatic parts of the Soviet Union.

The reconstruction of Europe. The weak neighbors of Germany were more than merely in the way of its marching armies. Many of them were rich. Austria had factories, forests, and iron mines. Czechoslovakia had fine farms and many fine industries. Poland had farms, forests, and some of the richest lead, zinc, and iron mines in Europe. Denmark had some of the best dairy herds in the world, Norway some of the most productive fisheries. The Netherlands had good factories, farm lands, and excellent harbors; Belgium, rich deposits of iron and coal, as well as many different kinds of manufacturing industries. Even little Luxembourg had valuable iron ore, which the Germans could use. And every one of these nations had the most valuable of all natural resources, human energy, which Germany hoped to be able to use for the sole benefit of itself.

Two things made this hope impossible to realize: (1) the military resistance of the British Commonwealth of Nations, the Soviet Union, and the United States; (2) the refusal of the people whom Germany had conquered to coöperate with it. The Second World War proved that no political union of people which threatens the welfare of other political unions of people can stand in a world where all people are related. It proved that a union which is not desired by most of the people who are members of it cannot hope to become an efficient social, economic, and political organization.

Does this mean that the people of Europe can never form a political union which will be beneficial to themselves and not harmful to the people in the rest of the world? Does it mean that a United States of Europe will never bring to Europeans the peace and prosperity which the United States of America has brought to Americans? The answers to these questions are secrets of the future, but some of the elements that will shape the answers are clear. We know that the Second World War has not only greatly changed the structure of nations all over the world, but also has changed our ideas about what that structure should be. The nations of tomorrow will doubtless be different in many ways from the nations of today.

Nearly all the nations of today began as small groups of people which were separated from one another by such physical and economic barriers as mountains, oceans, deserts, poor transportation facilities, and restricted areas of trade. Under such circumstances all sorts of social differences —differences in language, religion, law, and government—developed between the groups. As increasingly efficient means of transportation and communication were established, the physical and economic barriers between national groups were greatly weakened. The social barriers, on the other hand, remained strong.

Europe is the best illustration on earth of this lack of harmony between the economic and the social development of a region. Economically, the people of Europe are more intimately and vitally related to one another than are the people of any other region of equal size on earth. They are at the same time more decidedly divided into antagonistic social groups. It is hard for an American to realize the great differences which mark these groups, or the strong feelings which keep the differences alive.

In the Balkans, for example, some 47 million people occupy a space which is about the size of Texas and Louisiana. These people belong to several different races, speak several different languages, profess several different religions, and are divided into several different nations. Though nearly all Balkan peoples are farmers, and as such have common interests, they have never been able to unite on the basis of these interests. Their social differences have kept them continually quarreling among themselves.

Much the same thing applies to the people of Western Europe, where manufacture and commerce are the outstanding activities. No activities work more effectively than these for a coöperative union of the people who practice them. There are few geographic reasons why the people of France, Belgium, the Netherlands, and Germany should not be helpful partners in the business of living. It is chiefly their social differences which have kept them so long out of sympathy with one another. It is chiefly the social differences between the nations of Europe as a whole which make it impossible to predict their political future.

One thing, however, is certain. Social differences are getting more and more expensive in terms of every phase of human welfare. Man's adjustment to the earth is no longer a local affair. The physical and economic framework of modern civilization embraces the entire globe. Unless men can create a political framework which is equally broad, their civilization will continue to be shaken and possibly shattered by war.

The broadening of the political framework of European civilization might someday come to mean the disappearance of many political dividing lines. More than a score of sovereign states, all pulling in different directions, might someday come to be intolerable to the residents of these states. If the right of making war should someday come to be valued less highly than the hope of preserving peace, the crowded nations of Europe might create by common desire the political union of Europe which no nation has ever been able to create by force.

With war hatreds still smoldering in Europe, such an achievement might seem to some to be utterly impossible. Stronger, however, than those hatreds is the newly won political power of the Soviet Union, the United States, and the United Kingdom. The fate of Europe depends very largely on how wisely and unselfishly these master nations will use their power for the reconstruction of that war-torn region. It will depend very largely on how successfully these nations can broaden the political and social pattern of Europe to harmonize with the broad economic pattern that already exists there.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. Before the Second World War the foreign trade of Europe was greater than that of any other region except the United States.

2. Europe contained five of the seven great powers and three fourths of the world's population at the start of the Second World War.

3. Europe is always on the verge of starvation because of its dense population and large percentage of wasteland.

4. The United States severed its ties with Europe at the time of the American Revolution and has managed to keep isolated from Europe ever since.

5. France and Germany have fought wars with each other because the physical boundaries which separate them have kept their people from understanding and liking each other.

6. France is a relatively weak nation because it lacks raw materials and access to countries which have them.

7. France, like Great Britain, is utterly dependent on its colonial empire.

8. Germany has had to fight wars of aggression because its people have not been able to live through their own natural resources and industries.

9. It is absolutely necessary for strong nations to control the governments of the regions which supply the raw materials for their industries.

10. Italy is a strong world power because of its abundant resources and manufacture.

11. The industries of northern Italy are based on the country's possession of extensive deposits of coal, as is true in most of the other European countries.

12. Germany overran many small nations of Europe during the Second World War because the people in these nations were its natural enemies.

13. The nations of Europe probably can never get along together without fighting because the economic ties for a peaceful union are very weak.

QUESTIONS FOR DISCUSSION

1. What would you say are the most important reasons why Europe before the Second World War outranked all other regions in the value of its foreign trade?

2. Debate the proposition, "France would be better off if it had no colonial empire."

3. Do you think that changes in the boundaries between the countries of Europe would help to prevent future wars? If so, what boundary changes do you consider most important?

4. Do you think it would be beneficial to the peace of Europe if the industries in the crowded International Triangle were more widely scattered?

5. In view of the history of the Second World War, do you believe that control of the Heartland of Eurasia is the key to the control of the entire world?

6. Do you think that there are any purely geographic reasons why the nations of the European Peninsula should not form a United States of Europe? If so, what are the reasons?

THINGS TO DO

1. Study the distribution of the climates of the countries of the European Peninsula on the map on pages 70–71. Make a list of the European countries where climate is in general most favorable to the pursuits of modern men. Make another list of the European countries where climate is in general least favorable.

2. Examine a map of Europe and make a list of the various peninsulas, the countries which occupy them, and the seas which surround them.

3. Make a list of the ways in which the position of Europe on the map of the world has given it economic and political advantages over Asia and Africa. Make a second list of the ways in which the shape of Europe has given it such advantages.

4. In the past, Belgium has had serious disagreements with its powerful neighbor Germany. Read up in the library on the relationships between these two nations. Write a report on the history of these relationships, stressing the geographic reasons for disagreement and how they might best be handled for the future peace of Europe. Do the same for Greece and Italy, where somewhat similar disagreements have occurred in the past.

BOOKS TO READ

1. *France*, by Pierre Maillaud, is an excellent up-to-date analysis of the tragic geopolitical problems of France, but it is thoughtful and rather difficult reading. A more readable book by a Frenchman (and with a Frenchman's point of view) is *The Making of Tomorrow*, by R. de R. de Sales. There is no better book than the latter to give you an idea of the tangle of geographic and social forces which lies beneath the turmoil of modern Europe.

2. *German Strategy of World Conquest*, by Derwent Whittlesey, is an interesting analysis of the deceitful use which modern Germany has made of geographical facts in its struggle for world power. *The World of General Haushofer*, by Andrews Dorpalen, is an analysis of German geographical writings and their effect on the behavior of modern Germany. *Generals and Geographers*, by Hans W. Weigert (an Oxford professor), is an emotional treatment of the German ideas and leaders which have formed the spearhead of German aggression.

3. *Polish Countrysides*, by Louise A. Boyd, is an instructive photographic account of the land and people in what is perhaps the most tragic of all the weak nations of Europe.

4. The general works listed earlier in this unit apply in large part to the nations of the European Peninsula, where geopolitical power has so frequently run amuck.

XIX · THE SOVIET UNION

THE BACK YARD OF EUROPE

Russia, giant of Europe. Eastward the peninsula of Europe widens and merges with the great main body of the Eurasian continent. Where Europe ends and Asia begins is more a matter of opinion than of geography. The Ural Mountains and the Caspian Sea make up the traditional boundary of Europe on the east. The largest nation of Europe, however, crosses this boundary just as if it did not exist, and reaches all the way across Asia to the Pacific Ocean.

Before the Second World War we in America knew little of this nation, which is larger in area than the entire continent of South America. It was in the back yard of Europe and in the back yard of our thinking. Time, however, has moved it into the front yard of everyone's thinking. For this nation, which for many years was known as Russia, does not merely control about one sixth of all the dry land on the globe and nearly one tenth of all the people. It has come to have a tremendous influence on the fate of the world as a whole.

The growth of Russia. Russia grew large by land much as the British Empire grew large by sea. Russia as a nation began in the neighborhood of Moscow, where the climate is severe but not severe enough to kill the energy and ambition of the people. From Moscow, flatlands stretch away for hundreds of miles to the north, west, and south, and for thousands of miles to the east. These lands were rich in natural resources and poor in strongly governed peoples. They invited Russia to grow, just as the sea invited Great Britain to grow.

Just as British traders sought business across the water, Russian traders sought business across the land. Just as the British government stepped in to protect its people and their interests away from home, the Russian government stepped in to protect its people and their interests away from home. Russia, however, was less fortunate than Great Britain in building an empire. The Russian Empire never became so strong as the British Empire for many reasons. The temperament of the Russian people, combined with the policies of their leaders, long acted as a drag on political progress. To these social handicaps were added the following geographic handicaps:

1. At the time of Russia's greatest growth, land transportation and communication were poorly developed. For many years the only bonds that held the Russian Empire together were boats moving slowly along the rivers and sleighs driven over the snowy plains. At the same time, transportation by sea, through which the British Empire was being welded together, was rapidly becoming more and more efficient. It was partly because of these facts that the widely scattered British Empire became more strongly unified than did the vast solid block of the Russian Empire.

2. The abundance of coal and iron which occur within a relatively small area in Great Britain helped that country to grow rapidly into a great manufacturing nation. Though coal, iron, and many other valuable minerals are found in Russia, the deposits are widely scattered and some of them are far from western Russia, where most of the people live. For centuries most Russians were poor and uneducated, and their government had little interest in improving them or developing their great rich land. Though the present government of Russia had done much to develop the industries of the country, about one half of all Russians were farmers at the start of the Second World War. This is one of the chief reasons why the people of other European nations considered Russia a backward, as well as a back yard, nation.


Sovfoto

The ice-free harbor of Murmansk is vital to the defense of Russia.

These shortcomings have held back the development of Russia, but perhaps the greatest geographic weakness of all is the lack of good outlets to the sea routes of the world.

The weakness of Russia's location. Though Russia has a longer coastline than any other country in the world, most of its harbors are choked with ice from one fourth to one half of each year. Not only that, but its sea routes to other nations are dangerously open to enemy attack. If you look at the map on pages 370–371, you will see that Leningrad, Russia's best port, lies at the eastern edge of the Baltic Sea. In both the First World War and the Second World War, Germany was able to close this port to overseas trade by blocking the straits into the open ocean at the western end of the Baltic. On the east, Russia is just as weak. Japan can easily cut off Vladivostok, Russia's best port on the Pacific Ocean. On the south, Turkey and Iran control Russia's only possible outlets to the ocean in that direction.

Being bottled up in this way is a weakness in peacetime because it makes trade with other nations difficult. In wartime it is a serious danger. One of Russia's great military problems in the Second World War was to keep possession of the port of Murmansk on the Arctic Ocean. Murmansk has the only year-round ice-free harbor in all Russia which its enemies cannot easily block. Many of the war materials which Russia had to get from its allies had to enter Russia through this port. The remainder had to come in from the south through Iran, or from the east through ports which are closed by ice in the winter and which can be closed by the Japanese at any time.

The lack of good harbors is not Russia's only military weakness. Like France, Russia lacks strong natural frontiers where it most needs them. Its whole western boundary from the Arctic Ocean to the Black Sea lies in flat or rolling country which is open to invasion by enemy armies. Wars have broken, restored, and again broken this boundary many times in Russian history.

Several of Russia's neighbors on the west were once wholly or partly in Russia—and are well on the way to becoming so again.

The strength of Russia. The strength of Russia lies in the growing union of its people under one strong government, which is known as the Union of Soviet Socialist Republics (U.S.S.R.). It lies in Russia's great wealth of natural resources, which modern machinery and modern transportation are helping to develop. It lies in the great armies which Russia trained to fight the Germans, who, it feared for many years, would someday try to destroy it. Russia's strength lies in all these things—and in the fear which this strength has instilled in Russia's neighbors.

At the beginning of the Second World War, no nation realized how strong the Soviet Union had grown—except possibly the Soviet Union. The German leaders still thought of it as a backward nation, large but weak. This was their biggest mistake in their plan to conquer Europe. The mighty German lawn-mower, which easily rolled over the front yard nations of the European peninsula, stalled and grew dull in the rocks of the back yard. Let us now look in more detail at these rocks and see if we can discover exactly what they are.

INSIDE SOVIET RUSSIA

People of the Soviet Union. No nation can be stronger than the people who compose it. The Second World War woke up the world to two striking facts about the people of the Soviet Union: (1) their great numbers and (2) their great courage and intelligence in defending their homelands. The world still has only a vague idea about another striking characteristic of these people: the great diversity of their racial and cultural backgrounds.

Russia and Germany differ from one another in many ways, but in no way more conspicuously than in their official attitude toward the different races of mankind. The leaders of Nazi Germany believed that the blond, blue-eyed people who are numerous in Germany and other parts of northwestern Europe make up a "master" race which is superior in every way to other races. There is no evidence that this so-called Nordic race is a race at all, or that Nordics are necessarily superior to any other type of human beings. The leaders of Nazi Germany, however, used their belief in Nordic superiority to explain and to justify their persecution of peoples who belong to other racial types.

The Soviet leaders, on the other hand, claim to believe that no one race is necessarily superior to any other race; that the people of many races can live and work together in a coöperative and peaceful union, if all have a decent standard of living. Unfortunately, this tolerance of the Soviet leaders for racial differences is offset by intolerance for ideas on economics and government which differ from their own. In opposing such ideas, the leaders of the Soviet Union have persecuted and debased millions of their own people as well as millions of people in neighboring countries.

The more than 170 million people who live within the far-flung boundaries of the Soviet Union belong to nearly 200 different racial types. Most of these people, however, belong to the broad and indefinite racial type which goes by the name of Slav. Most Slavs live west of the Ural Mountains, in European Russia. Though there are many blonds among the Slavs, most are rather dark-eyed, dark-haired people. The Slavonic people of the Soviet Union number about 150 million; millions of other Slavonic people live in Poland, Czechoslovakia, and the Balkans. Though most Slavs are roughly similar in having medium to dark complexions, there are many different racial and cultural groups among them. They differ widely among themselves in looks, language, religious belief, and traditions.

The outstanding racial group in the Soviet Union is made up of people who are

This map shows the location and relative size of some of the chief racial groups in the Soviet Union.

called Great Russians and who account for more than half (about 99 million) of the citizens of that nation. Great Russians are Slavonic people of generally medium complexion who live in the central part of European Russia. The next most numerous racial group is made up of darker Slavonic people, the Little Russians, or Ukrainians, of southwestern Russia (about 28 million). Next in numerical importance are the White Russians (about 5 million), who live in the forested country of western Russia near the Polish frontier, and who are blond, blue-eyed people of decidedly Nordic appearance. In addition to these, there are many Poles, Finns, and Germans in European Russia. (See the map on this page.)

The people of Asiatic Russia are much less numerous than those of European Russia, but much more varied in race and culture. Not a few of these people are decidedly oriental in blood and appearance; not a few are still little changed by modern civilization. The pictures on pages 374–375 will give you an idea of some of the different peoples who live in the Soviet Union.

Though Great Russian is the chief language of the Soviet Union as a whole, and is taught in all the schools, the Soviet government has tried to preserve many of the different native languages of its people. Not only are more than 150 languages spoken in modern Russia, but people who never had even an alphabet until a few decades ago are now able to read books in their native tongue. When the present government of Russia came into power, only one Russian in three could read and write; today only one in five cannot read or write. By thus reducing illiteracy (even though the purpose was to spread propaganda rather than light) the Soviet Union went far toward uniting diverse peoples into a strong national union.

NORTH POLE
GREENWICH MERIDIAN
Floating Pack Ice
60°
45°
30°
15°
0°
15°
30°
45°
60° E
80° N
75°
90°
GREENLAND
ICELAND
Spitzbergen
Arctic Ocean
Atlantic Ocean
NOVAYA ZEMLYA
Port Dickson
70° N
60° N
50° N
40° N
Murmansk
Khabarovo
Kara
NORWAY
SWEDEN
FINLAND
Baltic Sea
Archangel
Ob R.
Leningrad
Riga
Moscow
Gorki
Kazan
Sverdlovsk
Chelyabinsk
Ural Mountains
Warsaw
POLAND
Kuibyshev
Magnitogorsk
Kiev
Kharkov
Saratov
Volga R.
Ural R.
UKRAINE
HUNGARY
RUMANIA
DONETS BASIN
Stalingrad
Odessa
Dnieper R.
Don R.
Rostov
Kirghiz
Sevastopol
Krasnodar
Astrakhan
Black Sea
Aral Sea
Istanbul
Caspian Sea
Batum
Tiflis
Kungrad
Nukos
TURKEY
Baku
Krasnovodsk
IRAN

U.S.S.R. from the South

The farm and range lands of the Soviet Union are wide and rich.

Soviet farm and range lands. If you turn back to the map on pages 70–71, you will see that the general east-west banding of climatic regions which we observed in Chapter II is especially pronounced in the territory of the Soviet Union. This banding is reflected in the native vegetation, which grades from tundra along the arctic coastlands through a broad belt of taiga evergreen forests and a narrower belt of mixed middle latitude forests, and then into belts of prairie, steppe, and desert in the south.

Agriculture in the Soviet Union conforms to this pattern. It is held for the most part between the vast regions on the north which are too cold for farming and the vast regions on the south which are too dry. It is also held for the most part to western Russia, where most of the people live. But even so limited, Russian farm and range lands are immensely wide and productive. They are rivaled only by the farm and range lands of the United States.

When the present government of Russia came into power, agricultural methods in that country were very primitive and most of the people were poorly nourished. A system of collective farms was established, which has greatly increased the output of food. At the beginning of the Second World War nearly 20 million families were operating some 250,000 collective farms in the Soviet Union. Each family on such a farm is allowed to own its own house, garden plot, orchard, and livestock, but the government gets most of the produce. The land as a whole belongs to the farm as a whole; plows, tractors, and threshing machines are rented from the state. The members of a collective farm elect a board of managers to divide the farm produce among the members and to turn over a required percentage (65% in 1943) of each year's crop to the national government.

Through collective farming (combined with a system of huge state farms which hire workers, just as Russian factories do), the Soviet Union had become self-sufficient in food production before the German invasion of 1941. It had doubled its agricultural output in less than fifteen years, and at the same time had reduced its farm population from about four fifths to about one half of the total population. In 1938 the Soviet Union led the world in the production of wheat, oats, rye, and sugar beets. It also raised large quantities of cotton and flax. The grasslands of southern Russia produced large quantities of wool and meat. The map on page 372 shows the distribution of the chief agricultural and grazing belts of the Soviet Union. As more and more people colonize the relatively empty spaces of Asiatic Russia, the pattern of this map will become less and less one-sided. With all its considerable achievements of the past few decades, the Soviet Union has only begun to tap the agricultural and grazing wealth of Russia.

Mineral resources and manufacture. The Soviet Union is also richly supplied with mineral resources, as the map on this page will show. Its coal reserves are probably second in value only to those of the United States; its petroleum reserves are probably even more valuable than those of the United States. Russia's iron production, as well as its production of copper, nickel, aluminum, lead, zinc, tin, and many other mineral materials, was steadily rising at the start of the Second World War.

One of the most interesting stories in the history of world manufacture is the story of the rise of modern manufacture in Russia. Though the largest country on earth, and possibly also the richest in natural resources, Russia was industrially undeveloped through most of its history. But under the determined leadership of the Soviet government, and through the hard-driven efforts of the Russian people, Russia has become (since the inauguration of the First Five Year Plan in 1928) one of the important manufacturing nations of the world. (See the map on page 376.)

Before the rise of the Soviet government, Russian manufacture was chiefly grouped round two centers in European Russia: Moscow and Leningrad (the latter then known as St. Petersburg). The Moscow district is close to extensive lignite deposits, but it lacks coal of the quality necessary for the large-scale manufacture of steel. It began early to specialize in light industries that could utilize the reservoir of skilled labor which the district held, and the network of

The mineral deposits of the Soviet Union are both valuable and varied.

Sovfoto

This blonde White Russian girl lives in the forested country of west-central Russia.

These girls live in the Tadjik Republic of southern Russia.

Sovfoto


Sovfoto

These expert brocade-makers live in Uzbek Republic of southern Russia east of the Caspian Sea.

These hunters are selling their pelts at a State fur station in eastern Siberia.

Sovfoto

The map above shows the location and relative importance of the chief manufacturing districts of the Soviet Union.

The map below shows the location of the chief railroads of the Soviet Union.

railways and markets that surrounded it. This district is still the area of most varied manufacture in all Russia. Though it still specializes in textiles and a variety of other light products, it is attracting more and more heavy industries as it develops its own power resources and those of neighboring districts.

Leningrad, second greatest pre-Soviet center of Russian manufacture, is far from the best sources of raw materials and fuels. It has considerable water power, however, and it is one of the few good seaports that Russia possesses. Leningrad is still a great manufacturing center, but chiefly because of its highly favorable location with reference to the large market areas that cling to the shores of the Baltic Sea. Leningrad will probably become increasingly important as a commercial center. As a manufacturing center, however, its greatness is more a heritage from the past than a promise for the future.

The southern Ukraine district, with Kharkov, Rostov, Krivoi Rog, and Dniepropetrovsk as major urban centers, was the chief area of heavy manufacture in the Soviet Union before the Second World War. The Soviet government had done much to develop the extremely rich resources of this district, with its wealth of iron ore, manganese, high-grade coal, and water power. Much of what was achieved in the development of this district—as in the development of the other industrial districts of European Russia—was destroyed by the war. One of the chief problems of the Soviet Union is to rebuild these districts.

Just as Leningrad symbolizes the past in Russian manufacture, the Ural Mountains district and the South Central Siberian district symbolize the future. Before the war these districts were among the chief centers of the metal industries in the Soviet Union, having produced in 1937 about 28 per cent of the national output of steel. It was chiefly these districts (plus aid from the United States) that sustained the Russian war effort when the districts of heavy industry in European Russia fell to the Axis armies.

Soviet transportation. None of the achievements of the Soviet government which we have just described would have been possible without facilities of transportation for uniting the various districts. As you can see by the map on page 376, Soviet railroad lines are most numerous in northwestern Russia where people, industries, cities, and markets are also most numerous. And just as the other elements of modern civilization thin out toward the east, so also do the railways.

Though the Soviet government has greatly enlarged the railway systems which it took over from the government of the Czars, Russia today, with almost three times the area of the United States, has only about one fourth the amount of railroad track. As you can see by the map, vast regions in Asiatic Russia have not yet been penetrated by railways. These regions, however, are not entirely cut off from the rest of Russia, thanks to the great navigable rivers that flow through them.

The Trans-Siberian Railroad, now double-tracked all the way from Moscow to Vladivostok, is the most vital link in the chain that connects European and Asiatic Russia. Observe on the map that all the great rivers of Russia flow in a general northerly direction, that the Trans-Siberian Railroad crosses these rivers as it passes through Siberia. Observe that wherever it crosses a great river, a large city has developed. These cities (particularly Omsk on the Irtish River, Novosibirsk on the Ob, Krasnoyarsk on the Yenisei, Irkutsk on the Angara, and Khabarovsk on the Amur) are ports for the boats that move over the river highways into the depths of the Soviet domain. The mileage of navigable rivers which is used for transportation in Russia is much greater than that of any other country in the world.

In European Russia too waterways are of great importance. Many canals have been


By Ewing Galloway, N.Y

The Trans-Siberian Railroad is the only railroad that spans Russia in an east-west direction.

dug to connect rivers and lakes, and thus to make continuous water routes between important places. The Stalin Canal, for example, joins Leningrad and Murmansk by way of the White Sea, thus eliminating the long sea route between these two vital ports. Similarly, Moscow is connected through elaborate hookups of rivers and canals with the White, Baltic, and Caspian seas. Though these various waterways are frozen for several months each year, they are vital links in the chain of Soviet transportation.

The Soviet government has paid much more attention to railways and waterways than to automobile highways, but it has not neglected airways. Before the Second World War, air routes paralleled all the major rail and inland water routes in both European and Asiatic Russia, and were rapidly expanding. Even the frozen seas of Russia's arctic borders had been turned to the service of transportation. With the help of ice-breaking ships and a string of weather observation stations, summer sea routes were established all along the Russian coasts from Archangel on the northwest to Vladivostok, some 5300 sea miles away to the southeast.

In spite of these accomplishments, Russian sea communications are decidedly restricted by ice and by Russia's continental location. This natural limitation has played an extremely important part in the relationship of Russia to the rest of the world—and will doubtless continue to do so.

THE SOVIET UNION AND THE REST OF THE WORLD

The government of modern Russia. Though the body of Russia sprawls over one sixth of the land area of the earth, its heart is a highly centralized government. Though the country is divided into sixteen separate republics for the purpose of administration, the governments of these republics can operate only within the limits which the central government sets. There is only one political party—the Communist party—in all Russia, and only a very small percentage of all Russians belong to it. Though people who are not members of this party are elected to governmental positions, Communist Party leaders shape all the important political policies of the nation as a whole and direct all the important economic activities. Among these leaders one man, Joseph Stalin, has stood out for more than two decades as the supreme ruler of modern Russia.

Such a government would not appeal to the people of our country; because we like to run our government and our business in our own way and do not care to run the risk of having our country fall into the hands of unscrupulous or unwise leaders. But though the leaders of the Soviet Union allow their people very little personal freedom, and though they use secret police and rigid control of the press to beat down opposition, it is generally accepted that they have elevated the standard of living in Russia. They have been able to develop the dormant strength of Russia chiefly because they can act swiftly and forcefully along any line they choose.

Similarly, the leaders of the Soviet Union can act swiftly and forcefully in directing that nation's relationships with other nations. They can act with a singleness of purpose with which the leaders of few other nations can act. For these reasons the present government of Russia has not only become a great power at home but a great power in the world at large.

Russia and its neighbors on the peninsula of Europe. Though conditions inside Russia have profoundly changed in the last few decades, the major problems of Russia's relationship to the rest of the world have remained very largely unchanged. First among these problems, as conceived by the present leaders of Russia, is the problem of protecting the Russian empire against the crowded peoples to the west.

We have already seen that Russia has no good natural defenses along its western border. The traditional Russian policy of defense has included the creation and preser-

In 1936, these workers in a Leningrad factory resolved to punish the enemies of the Communist Party in the Soviet Union. Such resolutions made complete rule by that party possible.

Wide World Photos

vation of "buffer areas" along these borders. Such areas, according to Russian thinking, not only might reduce friction between Russia and the strong nations of Central and Western Europe, but also might retard and weaken a military invasion from the west. Acting on this belief in the late eighteenth and early nineteenth centuries, Russia brought Finland, Estonia, Latvia, Lithuania, and a large part of Poland under its control. These regions gave Russia not only buffer areas between itself and the other strong countries of continental Europe, but also outlets to the open ocean through warm-water ports on the Baltic Sea which it very much needed for the development of its foreign trade.

After Russia fell to the German armies in 1918, it lost by the treaty of Brest-Litovsk most of the buffer areas along its western border. When Germany was later defeated by the Allies, these areas became once again the independent nations of Finland, Estonia, Latvia, Lithuania, and Poland. Most of the naval and commercial bases on the Baltic were again under the control of other nations. Though defeated, Germany was again in a position to menace Russia by extending its influence into the weak Baltic and Balkan nations. This, as we know, is exactly what Germany did. By doing so, it once again raised the vexing question of where the western boundaries of Russia should be located. It also laid the foundation for another war with that nation.

With the outbreak of the Second World War, in 1939, Russia seized most of the territory which it had lost as a result of the First World War. It once more established buffer areas along its western borders, but it made bitter enemies of many people in those areas. When Germany invaded Russia in 1941, Finland and Rumania became military allies of Germany largely because of their resentment of what Russia had done to them.

Russia became one of the major battlefields of the Second World War for various reasons. Among these reasons three stand out as the most important:

1. In 1941, when Germany attacked Russia, the Russian armies were the only thing that stood in the way of complete German control of continental Europe. Having decided not to share this control with Russia, Hitler had to try to destroy the Russian armies.

2. Germany badly needed the grain and oil of Russia to carry on its war for the control of the world.

3. Control of Russia would give Germany land routes to the riches of the Middle East and the Far East. It would give Germany the means of striking at British possessions in these regions without interference from the British blockade at sea. It would give land connections between the European members of the Axis and their partner, Japan.

Unfortunately for Axis hopes, the Russian defenses were stronger than anyone not a Russian had ever dreamed they could be. The strategy of modern Russian defense is a modification of the old strategy of buffer areas and is known as "defense in depth." It is based on the probability that the farther an invading army moves away from its source of supplies, the weaker it will become; that though a country of great size invites military invasion, great size is also a natural obstacle to the success of such an invasion.

By presenting as many additional obstacles to invading armies as is possible without risking the destruction of its own armies, a large nation can "sell space to gain time." With the time thus gained the defenders can harbor their strength while the invaders are losing theirs. As the invaders drive deeper and deeper and grow weaker and weaker, the time will come when the defenders can stop retreating and begin to attack. Even though the defending armies were weaker

Vladivostok is the best Russian port on the Pacific Ocean, but even it is closed by ice in winter.

in striking power at the start of the invasion, the balance of power will now have swung to their side.

The history of the Second World War proves that the Russian strategy of defense in depth is a sound policy for a nation with the man power and determination to put it into practice. By effecting a combination of skillful stands and retreats; by destroying everything which might have been useful to the invaders (the "scorched earth" policy); by harassing the invaders when they were already being harassed by Russian cold and mud; by moving their industries eastward as the invaders swarmed in from the west; by getting supplies from their allies in Great Britain and the United States, the Russian armies were able to stop and turn the German tide.

With the close of the military phase of the war the Soviet Union began the political refortification of its weak western boundary. Through a combination of persuasion, threat, and force backed by its huge armies and by administrators trained in Russia, the Soviet Union established governments friendly to itself not only in the traditional buffer areas but also in Yugoslavia, Hungary, and Czechoslovakia. It built an "iron curtain" of secrecy between these states and the rest of Europe. In short, it strengthened itself against aggression by means which looked very much like aggression to many people in Europe and America. It proved that the war had only increased the fears, suspicions, and jealousies which are the root of Europe's problems.

Russia and its neighbors in the Far East. The geopolitical problems of eastern and western Russia are much the same. Just as Germany has been a menace to Russia on the west, Japan has been a menace on the east. Japan, like Germany, has been a crowded militaristic nation; the German policy of *Drang nach Osten* ("drive to the east") has been matched by the Japanese policy of a drive to the west. Russia for its part has long desired warm-water ports on the Pacific Ocean. Though the harbors of Petropavlovsk, Sovietskaya Gavan, and Vladivostok are free from ice in summer, they are closed to navigation in winter. The nearest year-round ports to eastern Russia are in Manchuria.

Acme Photo

For Russia, large area has demanded large armies to protect it.

With these causes for ill will between Russia and Japan, it is not surprising that the relationship between these two countries has been marked by frequent quarrels. These quarrels led to the Russo-Japanese War of 1904–1905, which resulted in the expulsion of Russian interests from what is now Manchuria, Korea, and the southern part of the island of Sakhalin. (See the map on pages 390–391.) Since that time Russia and Japan have had literally thousands of disputes over fishing rights and boundaries, some of which rose to the proportions of undeclared wars.

Japanese spokesmen made it clear that the policy of Japan was to push the boundary of the Japanese Empire westward on the mainland of Asia as far as Lake Baikal in south-central Siberia. The gaining strength of the Soviet Union, however, stood in the way of this ambition. A state of armed compromise came to exist in the regions where the interests of these two nations clashed. Japan established control over Manchuria and Inner Mongolia, the Soviet Union over Outer Mongolia and Sinkiang.

These enormous areas of the surface of the earth are traditionally parts of China, but China has been too weak to protect the outlying portions of its vast domain against aggression. In extending its influence into Chinese territory, the Soviet Union has shown no respect for the sovereignty of China, but it has kept the friendship of many Chinese who live in the affected regions. Japan, on the other hand, treated the Chinese people with the utmost brutality. By doing so, as we shall see in the next chapter, it paved the way for its ultimate downfall as the master of the Far East.

Russia and the British Empire. Just as Russian interests clash with German interests on the west and with Japanese interests on the east, they clash with British interests on the south. Just as Russia has striven for outlets to the ocean through the Baltic and Yellow seas, it has striven for outlets to the ocean through the Mediterranean Sea and the Persian Gulf. Britain, fearful of this threat to the supremacy of its sea power, has long opposed these ambitions. Though British and Russian territory do not actually touch at any place, Britain, with the help of its allies in the Middle East, has been able to keep Russia landlocked on the south.

The straits that connect the Black and Mediterranean seas have long been the storm center of rivalry between Russia and Great Britain. Though Turkey owns the land that flanks these vital waterways, and has fought with Russia more than once to protect them, Russia would doubtless have had them long ago had it not been for Britain's opposition. Great Britain, like Russia, has an interest in the rich oil fields of the lands round the Persian Gulf. Great Britain fears that unless these regions and their ports are in the hands of friendly powers a serious threat to its sea power will arise. It fears the danger of Russia's acquiring this territory or an influence over it. If you remember that Iran, Iraq, and Arabia form an area about half the size of the United States, you can better understand Great Britain's point of view. The problem of Russian outlets to the open ocean is one of many vexing problems which the Soviet Union, the United Kingdom, and the United States will have to solve in the future.

Russia and the United States. Russia and America almost touch along the narrow Bering Strait, which separates Asia and North America. In the late eighteenth and early nineteenth centuries, Russian colonists established settlements along the Pacific coast of North America as far south as northern California. The Russians who built these settlements were interested chiefly in collecting the extremely valuable pelts of sea otters. A serious clash between Russia and the United States could have developed had not ruthless hunting quickly reduced the sea otter to the verge of extinction, which lessened Russia's interest in America. Finally, in 1867, Russia sold its colony of Alaska to the United States for $7,200,000—less than 2 cents an acre.

Though the relationships between Russia and the United States have been for the most part friendly since that time, they have not been perfectly serene. The United States disapproves and distrusts government by dictatorship; the Soviet Union has the same attitude toward government by democratic procedures. Though they were allied against a common enemy in two world wars, the United States and the Soviet Union have clashed in the handling of postwar problems in both Europe and the Far East. The germs of such conflict thrive in Eurasia.

Opposition by the Soviet Union to the Marshall Plan for European recovery, along with the seizure of the government of Czechoslovakia early in 1948 by a Soviet-inspired communist minority, filled the freedom-loving peoples of the world with indignation and fear. It seemed to many people that the Soviet Union had gone much further than was necessary to protect its borders against another invasion. It seemed that the Soviet Union was exploit-

The Teheran conference of Stalin, Roosevelt, and Churchill symbolizes the union of the three great nations on which the peace of the world depends.

Keystone View Company

ing the postwar weaknesses of democratic nations with the object of bringing them all eventually under Soviet control.

The United States has made clear its disapproval of Soviet foreign policy. It is inconceivable that these two great nations should carry their differences to the point of war, yet war is always a possibility when suspicion and fear guide the relationships between nations.

The future of Russia. We come to the end of this chapter with many questions still unanswered. Inwardly and outwardly, Russia is in the process of geopolitical development. The Second World War might be called the growing pains of this development, as Russia passed from the mere largeness of her geopolitical youth to the strength of her geopolitical maturity. What Russia will do with this strength in the future, the future alone can tell.

There is no doubt that the Soviet Union has already become the dominating geopolitical power over all the Eurasian heartland. There is little doubt that the Soviet Union and the United States are the two greatest land powers on the globe. There is little doubt that the Soviet Union, the United States, and possibly the United Kingdom will stand out as much the most powerful nations on earth. As long as they can settle their differences peaceably, there will be no possibility of another world war. If, however, they cannot do so, another world war can come.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. Russia is a large, rich nation with little political influence except on the nations which are close to Russia.

2. Great Britain and Russia grew strong in the same way and at the same time.

3. Soviet Russia has few good harbors because it is a land-bound country with very little coastline.

4. Russia successfully defended itself during the Second World War because it has many natural barriers to military invasion.

5. The Soviet Union was able to repel the invasion of the German armies during the Second World War because the Russian people are all more or less alike in race and traditions, and united in their desires and aims.

6. The Soviet government controls its people by giving them a great amount of freedom.

7. The Soviet Union is so large that there is a great surplus of food produced every year.

8. Russia did not have any industrial development prior to the present Soviet dictatorship.

9. The transportation system of the Soviet Union is well developed, every part of the country being well served by highways and railroads.

10. The various republics of the Soviet Union have separate governments, which are independent of the central government.

11. The Russian desire to control Albania, Poland, Lithuania, Latvia, Estonia, Bulgaria, Hungary, Rumania, Czechoslovakia, Yugoslavia, and parts of Austria, Germany, Korea, Mongolia, and Manchuria is due to Russia's desire to protect people's liberty.

12. The quarrels between the Soviet Union and Japan are due to poor diplomacy rather than to geographic reasons.

13. Both Russia and Japan have been unselfish neighbors of China.

14. Great Britain, the United States, and the Soviet Union have always been allies in time of war and friends in time of peace.

QUESTIONS FOR DISCUSSION

1. From what you have read here and elsewhere about the history of Russia, what would you say were the chief reasons why Russia lagged behind Great Britain in becoming a major power?

2. Do you think that there are any geographic weaknesses in Russia which a peaceful people and government cannot eliminate? If so, what are these weaknesses?

3. What do you think of the Soviet attitude toward economies and governments that differ

from their own? How does it compare with your own attitude and that of your friends?

4. What are the chief weaknesses of the land transportation system of the Soviet Union, and what would you do to eliminate them?

5. What would you say are the chief reasons why the Soviet Union and the United States should strive to be friends in the future? What would you say are the strongest geographic reasons why such friendship is possible?

THINGS TO DO

1. Study the distribution of the various climates of Russia on the climatic-vegetation map on pages 70–71. Make a list of the different kinds of climate which occur in that country and estimate the approximate percentage of the total area of Russia which is taken up by each area of different climate. On the basis of this analysis of Russian climate, write a report on the agricultural possibilities of Russia.

2. With the help of an encyclopedia and maps, make a list of Soviet seaports and estimate what parts of the country each port serves. Briefly note the advantages and disadvantages of each port. Write a report on Russian seaport facilities, comparing them with the seaport facilities of Great Britain. Write a report comparing the land of Russia and Great Britain suited to agriculture.

3. Go to the library and make short summaries of such magazine articles and books as you can find about the Soviet Union, and place them in your geography scrapbook. Arrange the summaries under the following headings: (1) internal government regulations; (2) manufacture and trade; (3) mineral resources and their development; (4) agriculture; (5) transportation; (6) education; (7) world relations.

When you read these articles and books try to explain their substance with geographic reasons. If you do not know what the geographic reasons are, perhaps your teacher can help you.

4. Make a list of the ten largest cities of the Soviet Union and look up their population in a world almanac or a recent encyclopedia or atlas. After the name of each city write the main activities of its people.

5. Find out what steps must be taken to enter Russia, and then plan a trip through the Soviet Union. Plan to see all the most important cities, all the main areas of mountains and plains, and all the major climatic areas. Plan your methods of transportation and the season of year of your visit to each region. Estimate the probable distances you would have to travel and the probable length of time that each journey would take.

BOOKS TO READ

1. Until relatively recently Russia was a comparatively unknown land. Today it is much better known, but the strict censorship and other regulations of the Soviet government have limited the observations and writings of both residents and visitors. Among the geographic writings of native Soviet authors which have been translated into English, the books of Max Ilin are perhaps the most readable. Though they contain much that must be described as propaganda, they also contain considerable authentic information on the geography of modern Russia.

2. *40,000 against the Arctic*, by HARRY P. SMOLKA, tells the story of the achievements of the Soviet government in the vast reaches of Russian land that lie above the arctic circle. *Behind the Urals*, by JOHN SCOTT, tells the story of the achievements of the Soviet government in developing the industrial possibilities of Siberia.

3. A great many books about modern Russia have been written by professional travelers, journalists, and diplomats. Though many of these books reflect the sympathies and prejudices of their authors more than they reflect the geography of Russia, some are both readable and reliable. *The Traveler's Russia*, by BURTON HOLMES, will give you a picture of the surface appearance of Russia before the Second World War. *Broken Earth*, by MAURICE HINDUS, is a similar book on the people and villages of Russia as seen through the eyes of a Russian-born American. *Inside Europe* and *Inside Asia*, by JOHN GUNTHER, will give you an American journalist's impressions of the political forces which were working beneath the surface of Eurasia at the start of the war.

4. The entire issue of *Life* for March 29, 1943, was devoted to an instructive and illustrated survey of the Soviet Union, which should interest all students of geography.

XX · NATIONS OF THE FAR EAST

THE NATURE OF CHINA

China, giant of southeastern Asia. China is the largest country on earth in population and the second largest in area. It adjoins Russia, the third largest country in population and the largest in area. Though these two giants adjoin physically, they are far apart in many other respects. Whereas Russia is, in some respects, one of the progressive countries of the world, China is one of the backward. Whereas Russia is one of the strong powers of the earth politically and economically, China is one of the weak.

The human history of China began many centuries before the birth of Christ. During the course of its long history China has had several periods of geopolitical strength. It was a united and forceful nation under the Han Dynasty at the beginning of the Christian Era, under the Tang Dynasty in the seventh century, and again under the Sung Dynasty during the twelfth and thirteenth centuries. It later had long periods of strong centralized government under Mongol, Ming, and Manchu leadership up to the early years of the twentieth century. Between these periods of geopolitical strength, however, Chinese history is marked by long periods of geopolitical weakness.

Before the Chinese armies under Chiang Kai-shek put up so stout a defense against invading Japanese armies during the Second World War, China had come to be a symbol of political chaos. Its history had come to be one chiefly of civil war and aggression. Chinese "war lords" had repeatedly fought one another with private armies for control over this or that piece of China. The armies, diplomats, and merchants of other nations had repeatedly striven for control over Chinese territory, institutions, and trade. Though much of China is now united under the Kuomintang government of Chiang Kai-shek, it is still all but impossible to answer the question "Just what is Chinese territory and who controls it?"

When we spoke of China as the second largest country on earth, we referred to the roughly $4\frac{1}{4}$ million square miles of southeastern Asia which has traditionally been considered Chinese territory, and which is inhabited by people who can be broadly described as Chinese. Some geographers refer to this region as Greater China. The *Foreign Commerce Yearbook* of 1930, using the most accurate available surveys and estimates, lists the following divisions of Greater China:

China Proper (including Manchuria)	1,897,000 square miles
Mongolia (Inner and Outer)	1,370,000 square miles
Sinkiang (formerly Chinese Turkestan)	550,000 square miles
Tibet	465,000 square miles
Total	4,282,000 square miles

Manchuria and certain adjacent territory in northern China (containing about 500,000 square miles of land and about 43 million people) were taken over by Japan in 1932 and returned in 1945. Mongolia, with some 3 million people, has never been more than loosely united with China Proper. Today that part of Mongolia known as Outer Mongolia and much of Manchuria are more under the influence of the Soviet Union than of China Proper. The same thing is true of the remote desert territory of Sinkiang, with its $1\frac{1}{2}$ million people. The even more remote high plateau territory of Tibet, with less than 4 million people, is practically independent. It is the most isolated and least known inhabited region on earth. (See map, p. 180.)

Even without its outer territories, China is a giant. Though much smaller than Russia in area, China Proper contains about twice as many people. Nobody knows exactly how many people China or its outer territories contain, because no accurate cen-

Bosshard from Black Star

These peasants live in the fertile province of Shantung in North China.

James Sawders

These merchants do business in Hong Kong, off the coast of South China.

sus has ever been taken. Modern estimates of the population of China Proper vary from 300 to nearly 500 million people. We know that the only country which can rival China in population is India. China and India together contain about one third of all the people on earth.

The people of China. The key to the understanding of China lies in the nature of its people. Chinese civilization is one of the oldest civilizations in the world. Centuries before the birth of Christ and centuries before people in most other parts of the earth had risen above barbarism, the Chinese people had invented printing, gunpowder, and the compass. They had domesticated the silkworm and had made priceless contributions to the fine arts. Little, however, is known about the earlier Chinese cultures. Definite records go back as far as 2357 B.C., when Yao the Great was the emperor of China. Since then China was ruled by a long succession of emperors until 1912, when it became a republic with a democratic form of government.

China has suffered innumerable military invasions in the course of its long history, with the result that the blood and culture of the Chinese people are mixtures of various elements. If you look at the map on pages 390–391, you will see that three great rivers cross China from west to east: the Hwang, or Yellow River, the Yangtze, and the Si River. The drainage basins of these three master rivers are frequently referred to as North, Central, and South China respectively. Many historians believe that the earliest inhabitants of China Proper came in from the west and north, and settled chiefly in the basin of the Hwang. There is little doubt that the people who came to live along the lower reaches of this river were the source of many of the racial and cultural characteristics which distinguish the Chinese people of today.

These people can be separated into two somewhat different physical types. The so-called Northern Chinese live north of the divide between the Yangtze and Yellow River basins; the Southern Chinese live south of this divide. The Northern Chinese are somewhat taller and larger-boned than the Southern Chinese. Both types have the fold of skin round the eyes which gives them the slant-eyed appearance that distinguishes them from Western peoples. Both types have skin which is generally light yellow in color, though the Southern

James Sawders

The family is the most sacred of all Chinese institutions.

Chinese are somewhat darker than the Northern. Both types generally have dark straight hair, though light wavy-haired individuals testify to the mingling of racial characteristics which has taken place during the long history of these people. (See the photographs on page 387.)

It is the mental and spiritual rather than the physical characteristics of the Chinese people which have shaped their destiny through the ages. The traditional basis of Chinese society is the family. It is difficult for people who are not Chinese to realize how closely united and highly organized the Chinese family is, and how deep is the family loyalty of each member. In China the family is more than a social institution; it is also a religion. The man who stands at the head of a Chinese home is responsible not only for his wife and unmarried children, but also for his married sons and their wives and children (who normally live with him). The Chinese "house father" is also both morally and legally responsible for any other dependents and for all the servants who live in his house.

This kind of family organization has spread far beyond what we in America consider the limits of the family. Government officials in China have long been considered the parents of the people they serve. The emperors of China have been considered the parents of the people as a whole, and responsible to heaven for their welfare. This reverence for family ties has led to ancestor worship, through which the dead have become very important elements in the Chinese social structure. The head of a house is always the head of the house, whether alive or dead. When dead, his descendants venerate the ground on which he lived and in which he is buried.

It is difficult to overestimate the geographic importance of ancestor worship in China. People refuse to move away from places which are sacred to their ancestors. This has led to severe crowding in many districts; the population of some rural districts approaches the prodigious figure of 4000 people to the square mile. Many Chinese people are as unwilling to depart from the ways as from the lands of their ancestors. It is this attitude toward ancestors more than any other factor which accounts for the economic and political weakness of China.

The food supply of China. The people of China would have heavy burdens to carry, even without the burden of their ancestors. In earlier chapters of this book we caught glimpses of the Chinese landscape. The map on pages 390–391 will give you an idea of this landscape as a whole. Notice that behind China the heart of the continent of Asia is made up chiefly of a series of high plateaus. China Proper lies to the east of these plateaus in the region which is drained by the three great rivers that have been mentioned. Notice that though extensive plains exist in North and Central China, much of this country is mountainous. Though the area of China embraces nearly every type of climate and natural vegetation that we studied in Unit II, most of the people are crowded into regions with the humid continental and humid subtropical types of climate. (See the map on pages 70–71.)

Though about three fourths of the people of China are farmers, China is far from being a first-class agricultural country, because of its many mountain ranges and the infertility of the soil in many districts. The greatest problem of the Chinese people is to produce enough food merely to keep alive. In Chapter VII we saw that the Chinese farmers work very hard and live very poorly. On their tiny farms and by the most primitive methods these people raise the rice, wheat, and millet on which for the most part the Chinese people live.

Some authorities believe that the Chinese may be increasing by as much as 35 million people every ten years. With most of the good agricultural lands of China already intensively cultivated, this steadily mounting population is a terrible threat for the future. Unless the Chinese birth rate declines, unless modern agricultural methods are put into wide use, and unless new food-producing areas are developed, want and famine will increase rather than decrease in China.

The mineral wealth of China. Until relatively recently in the history of man, China was as remote a land as people in other lands could possibly imagine. Walled away from the rest of the world by plateaus, mountains, deserts, jungles, and the vast Pacific Ocean, China for centuries stood alone—a world by itself. For centuries the Chinese people made few attempts to break

Three fourths of the people of China are farmers.

Press Association, Inc.

Southeastern Asia

acific
Ocean
MARIANAS ISLANDS
Guam
CAROLINE ISLANDS
150°E
140°
130°
120°
110°
100°E
20°
10°N
N
E
S
W
FORMOSA
Amoy
PHILIPPINE IS.
Manila
NEW GUINEA
HONG KONG
Canton
South China Sea
Celebes Sea
CELEBES
HAINAN
Hanoi
FRENCH INDO-CHINA
Mekong R.
Saigon
BORNEO
(British)
(Dutch)
Strait of Macassar
SIAM
Bangkok
Gulf of Siam
BRITISH MALAYA
EQUATOR
Singapore
JAVA
Batavia
Rangoon
Strait of Malacca
SUMATRA
of Bengal

down this natural isolation; on the contrary, they did what they could to increase it. They built their Great Wall along some 2000 miles of their northern frontier between the ocean and Tibet, where the outside world was most likely to intrude upon their peace and privacy. For centuries they were content to live like clams within these barriers.

Though people from the outside world repeatedly cracked the shell of Chinese isolation with military and commercial advances, the shell repeatedly healed again. Europeans gained little accurate knowledge of China until late in the nineteenth century. Ignorance of a country almost always endows it with great riches. Since the earliest days of caravan travel between Europe and the Orient, China has been widely considered a land of enormous wealth because of its silk, porcelain, jade, and other luxury products. Not until the seacoasts of China were opened to world trade, however, did the outside world begin to get a true idea of China's resources as a whole. Not until after 1912, when the republican government of modern China invited the help of outsiders in appraising and developing these resources, did China itself begin to know the extent of its possessions.

We have already seen the general result of these studies as they apply to the agricultural resources of China. In mineral resources China is both rich and poor. Its coal reserves are tremendous, but they contain little of the coking coal which is needed in the manufacture of iron and steel. They are widely distributed, though many of the best deposits are far from the great centers of population and from well-developed lines of transportation. China also has tremendous reserves of water power in its countless mountain streams, which must be listed among the assets of the future. China has rich deposits of tungsten and antimony, perhaps the richest on earth. It has considerable deposits of mercury and manganese, and not a little copper and tin. But with

Scarcity of good iron ore and coking coal makes such steel plants as this one in Manchuria extremely rare in China as a whole.

Keystone View Company

Philip Gendreau, N.Y.

Transportation is still primitive over most of China.

all this wealth, China is poor in two of the chief mineral elements of industrial strength: iron ore and petroleum.

Transportation in China. The weakness of China lies less in the shortcomings of its resources than in the scarcity of its roads. Next to the ancestor worship of the people, lack of good transportation facilities has been the chief cause of China's lag in economic development. For centuries, both the economic and the political unification of the Chinese people suffered from the lack of avenues of communication. Even today most travel in China is done on foot, or by mule, cart, or boat. Most goods are carried from place to place by the muscles of men and beasts. Though the modern Chinese government has done much to improve transportation in its enormous domain, China Proper before the Second World War had only some 7000 miles of railroads. It had only one river, the Yangtze, which was navigable for any great distance by large ships. Its automobile highways were negligible.

The future of China. In addition to all these drawbacks, China has long had that of Japan. For over half a century China has been the object of exploitation by many nations, but by no nation so much as by Japan. Japan, whose people are as aggressive and ambitious as the Chinese people are peaceful and content, has long considered China its private hunting ground. Japan began its economic, political, and military penetration of China long before the Second World War got under way. By 1942, when Japan invaded the lands to the south of China, it had already brought much of the most valuable part of China under its control. (See the map on page 394.)

Since then a notable development of West China has taken place, begun under the stress of war conditions. Now that peace has come to China the western portions of that

This map shows the Chinese territory which Japan controlled before the 1942 invasion of countries to the south of China.

far-flung land will doubtless play an important part in the industrial and agricultural development of the country as a whole. Some authorities even predict that because of its great agricultural, forest, and mineral resources West China may someday become the most important part of China, provided that it is linked up effectively with railroads and motor roads to the Indian Ocean.

The future of China as a whole depends in large measure on the behavior of Japan and Russia. It seems likely that the outside world will do all it can to make China the dominant power in southeastern Asia, which Japan has aspired to be. It also seems likely that Russia will attempt to influence the political and economic structure of this power. China's prospect for geopolitical strength, however, does not depend wholly on the behavior of Japan and Russia. Even if China's political and economic freedom were guaranteed by the good will of the United States, Britain, and the Soviet Union, China would still have to overcome its internal weaknesses if it were to play the role of leader in southeastern Asia.

In many ways the Chinese are a great people. Their contributions to art, literature, religion, philosophy, and science are among the richest treasures of world civilization. Unfortunately, geopolitical strength is based on other things—on modern agricultural methods, mills, factories, transport, and world trade. Though China has made a start toward the development of these fundamental elements of national power, it has made only a start. The leaders of modern China have made only a start in the heavy task of loosening the hold of the past on the thoughts and customs of the people. China has a long way to travel before it can reach the economic and political level of a major power. There is little likelihood that it will reach that level soon.

THE NATURE OF JAPAN

"**Britain of the East.**" When we turn to the detailed study of Japan, the first thing we notice is the similarity between the main islands of Japan and the British Isles. If you compare the location of these two groups of islands, as shown on the maps on pages 390–391 and 344–345, you will see that the islands of Japan are related to the mainland of East Asia much as the British Isles are related to the mainland of Western Europe. Notice that the Sea of Japan corresponds to the North Sea, Korea Strait to the English Channel, and the peninsula of Korea to the peninsula of northeastern France. Notice that the Japanese islands block Russia's outlet to the Pacific Ocean much as the British Isles block Germany's outlet to the Atlantic Ocean.

The similarity between Japan and Britain goes well beyond a mere similarity in location. Both countries are heavily populated and unable to feed their people adequately on home-grown food. Both are great industrial and trading countries which have expanded economically and politically overseas. For these and other related reasons, Japan has been aptly called the "Britain of the East."

This comparison, however, can be carried too far. In many ways Japan is very different from Britain; in some ways it is much more like Germany and Italy. Like Germany, Japan began looking for colonies after much of the best territory had come under the control of other nations. Like Italy, Japan lacks enough fuel and iron to feed its factories. Like both Germany and Italy, Japan decided to get by force the colonies and the raw materials it wanted.

The early history of Japan. Nobody knows exactly where the Japanese people came from, nor when Japan as a nation began. It would seem that, early in the history of Japan, tribes from several parts of the mainland of Asia invaded the Japanese islands. The people of modern Japan seem to be descended from these mixed tribes. There is a legend that these tribes were produced by the gods, and some Japanese people still believe it. The emperor of Japan is called *tenshi*, which means "son of heaven." The emperors were traditionally thought to be directly descended from the gods that made the Japanese people, and therefore to be gods themselves.

Though the emperors of Japan were thought to be gods, they never have been the real rulers of the Japanese people. Until 1869 Japan was divided into several states, each one with its own laws and ruled by its own chieftain. These chieftains ruled the people with an iron hand and told them nothing about the outside world.

During much of its history, Japan, like China, was almost completely cut off from the outside world. Few Japanese people knew even that there was such a world, and those who did know were afraid of it. When Commodore Perry of the United States paid a visit to Japan in 1853 to try to get that country to trade with the rest of the world, his ships filled the people with terror. The emperor ordered the people to beg the gods to destroy the visitors.

Perry's visit, however, bore fruit. The climate of much of Japan is stimulating, and the Japanese people are full of vigor and ambition. Japan became a modern nation almost overnight. It united under one strong government with the emperor at the head, but the kind of men who used to be chieftains still controlled the people. Japan made peace and trade treaties with foreign nations, and quickly became one of the leading agricultural and industrial nations of the world. It built up a great fleet of merchant and fishing vessels, and a great navy of warships.

With this sudden burst of geopolitical activity, Japan began to look for new territory which might supply raw materials for its growing industries, and new homelands for some of its crowded peoples. It looked longingly at the mainland of Asia which China and Russia controlled. Like Germany in Europe, Japan became an aggressor nation, a grave menace to all its neighbors and in time to the entire world.

The home islands of Japan. Just as in the case of Germany, the aggressive spirit of Japan is rooted in geography. If you look at the map on page 400, you will see that the heart of Japan lies in four large islands: Kyushu, Shikoku, Honshu, and Hokkaido. These islands form a curving line off the mainland of East Asia between 30° and 45° north latitude. They thus occupy the same latitudes as the east coast of North America between Jacksonville, Florida, and Eastport, Maine. Just as on the east coast of North America, the climate of Japan is humid subtropical in the south and humid continental in the north.

Associated with the four large islands of Japan Proper are some 1700 smaller ones. All this territory together, however, is somewhat smaller than the state of California. At the beginning of the Second World War it contained more than half as many people as lived in the United States as a whole, and its population was increasing at the rate of nearly a million people a year. Not only that, but about 80 per cent of Japan is too mountainous for farming, which places a terrific pressure on the food-producing capabilities of the flatlands. Japan, in

Natori from Black Star

This photograph will give you an idea of how intensively the Japanese landscape is cultivated.

short, is one of the most crowded countries on earth. It is this fact which forms the basis for both its great economic and its great military ventures.

The food supply of Japan. Most people in occidental countries believe that most people in oriental countries live almost entirely on rice. In North China, however, there are millions of people on thousands of square miles of land who not only do not live on rice but have never even tasted it. Japan, on the other hand, comes much closer than China to deserving its rice-eating reputation. In Japan rice is much the most important food product. More than half the cultivated land in that country is given over to that cereal.

In Chapter VII we saw that the rice plant will produce more food on less ground than any other plant in the world. The Japanese have increased the natural productivity of the rice plant through the use of chemical fertilizers and modern agricultural methods. The history of Japan has been in one sense a race between the ability of the Japanese people to increase their numbers and their ability to increase their output of food on their rice paddies. Though even in modern industrialized Japan about half the people are farmers, and though Japanese rice fields are today more productive than they have ever been before, the fertility of the people has outrun the fertility of the rice. Even though the present low standard of living should continue, Japan would be unable to feed its people entirely on home-grown food.

In addition to rice, the lowland districts of Japan produce considerable quantities of barley, beans, and peas. The hilly country produces a variety of grains, vegetables, and fruits. Because of religious opposition to meat-eating, and because little land can be spared for pasturage or the production of fodder crops, animals are raised in Japan (as in most other oriental countries) for power rather than for food. The fisheries of Japan, on the other hand, are among the greatest in the world. They do much to supplement the yield of the farm lands, but

P. L. from Black Star

Japanese fisheries do much to help the serious food shortage of Japan.

they do not relieve the Japanese people from the need of looking to other countries for many of the elements of an adequate diet.

Japanese manufacture and foreign trade. Japan lacks the first two essentials for heavy manufacture: extensive deposits of coal and iron. It is also extremely poor in petroleum. The rapid growth of manufacture which has distinguished the recent history of Japan has been almost entirely in the field of light manufacture. Though not well endowed with many of the raw materials for light manufacture either, Japan at the start of the Second World War was producing most of the world's supply of silk and much of its rayon, vegetable oil, cotton cloth, and paper.

For decades before the outbreak of the war, the leaders of Japan realized that their land was poor in nearly all the elements of geopolitical strength except human energy and ambition. They realized that as people, manufacture, and foreign trade increased, Japan would become more and more dependent on the raw materials of other countries. They feared that Japan would not be able to meet the competition for these materials which richer nations with more capital to invest would create.

Though the foreign trade of Japan was steadily increasing, and the Japanese standard of living steadily, if slowly, rising, the leaders of Japan became desperate in their determination to control the sources of the raw materials on which the very existence of Japan depended. In short, they launched their ambitious military program of conquering all East Asia. As we all know, the Japanese were remarkably successful in achieving most of their ambitions in a remarkably short period of time. But they achieved them at the cost of war with the British Empire and the United States and certain, eventual defeat.

Before the Second World War, Japan produced most of the world's supply of silk thread.

James Sawders

Philip Gendreau, N.Y.

The prosperity of these Japanese people depends chiefly on foreign trade.

GEOPOLITICS OF THE FAR EAST

Japanese philosophy of aggression. Through its acts of aggression Japan brought war to eastern Eurasia, just as Germany brought war to western Eurasia. Underneath the actions of these two nations lay essentially the same philosophy for explaining and justifying their actions. Indeed, there are good reasons for believing that Germany took some of the major principles of its philosophy of aggression from Japan.

Japanese aggression, like German aggression, was rooted in a belief in racial superiority. Many Germans, as we have seen, came to believe that they belong to a master race with a natural right to rule over their neighbors in Western Europe. Many Japanese came to believe that they were the direct descendants of the Sun Goddess (whose emblem is on the flag of Japan), with a divine "mission" to rule over their neighbors in East Asia. These similar lofty beliefs were similarly used by Germany and Japan to cloak the less lofty desire to steal the possessions and to destroy the independence of their neighbors.

Most Americans were not aware of the dangerous nature of the Japanese philosophy of aggression until it struck them in the form of bombs on Pearl Harbor in 1941. Other peoples, however, had been feeling its sting ever since 1875, when Japan first began to push its boundaries beyond its native islands. By 1904–1905, when Japan fought Russia in its first determined bid for territory on the mainland of East Asia, the Japanese philosophy of aggression had been formulated in essentially its mature form. Though this philosophy has been known at different times as the "Japanese Monroe Doctrine," the "New Order in East Asia," the "New Order in Greater East Asia," and simply as the "Mission," it has always contained the following essential elements:

1. *The doctrine of "Asia for the Asiatics."* Just as Germany came to believe that all the Germans of Europe should be united under

one political leadership, Japan came to believe that all Asiatics should be so united. In attempting to enforce this belief, Japan, like Germany, had been for the most part unsuccessful. Most of the people of Asia had long realized that the Japanese doctrine of "Asia for the Asiatics" is really a doctrine of "Asia for Japan," and that a tyrant is a tyrant, regardless of race or residence.

2. *The doctrine of defense.* Just as Germany felt that its neighbors were a threat to its economic and political security, so did Japan. Just as Germany's aggressions against such weak nations as Czechoslovakia and Poland were committed in the name of national security, so were Japan's aggressions against such weak nations as China and Korea. Just as in time the possession of all Europe came to be considered essential to the defense of Germany, the possession of all the lands in and around the Southwest Pacific came to be considered essential to the defense of Japan.

3. *The Japanese doctrine of living space.* The Japanese doctrine of living space in Asia was practically identical with the German doctrine of living space in Europe. As both these nations became more and more highly industrialized, both came to feel that they should have complete economic and political control over the sources of the raw materials which made their industries possible. Just as the German conception of a proper living space grew larger and larger as Germany brought more and more of its neighbors' territory under its control, so did the Japanese concept of living space grow. And just as the doctrine of living space led Germany to inevitable war with other nations in Europe, it led Japan to war with other nations in Southeast Asia.

The course of Japanese aggression. On the basis of the philosophy outlined above, Japan expanded its original small island kingdom until it became one of the greatest empires on earth. This empire of some 3 million square miles and some 435 million people was created in the relatively brief space of time between 1875 and 1942. If you look at the map on page 400, you will see that the original Japanese islands are part of a vast scalloped fringe of islands which stretches all the way from the Alaska Peninsula to Australia. The earliest expansion of Japan was peaceful and involved the islands nearest to the Japanese home islands: the Bonin and Ryukyu Islands on the south and the Kurile Islands on the north. Aside from giving Japan valuable new fishing grounds, these islands greatly increased the arc of Japanese naval control over the waters of the western Pacific Ocean.

Japan's first important military conquest was the large Chinese island of Formosa (later named Taiwan) in 1895. This island, far to the south of the Japanese home islands, was not only a rich source of tropical raw materials but an excellent base for further aggression in South China and the other countries of the Southwest Pacific. Though Japan continued to add islands to its empire, it did not invade the mainland of Asia until 1904. After its military victory over Russia in the following year, it won its first mainland foothold: the Kwantung Peninsula in southern Manchuria. In 1910 Japan took over the adjoining peninsula of Korea (later renamed Chosen), with its agricultural and mineral resources and its valuable ice-free harbors.

With the First World War, Japan's territorial ambitions became of world-wide significance, though much of the world was either blind or indifferent to the fact. As an ally of Britain, Japan did little to affect the outcome of that war. At the peace table, however, it did much to lay the foundation for the next world war. It got control of about 1400 more islands (the Marianas, Marshalls, and Carolines) and with them the means of extending its naval control over the whole of the western Pacific Ocean. During the war it got another foothold on the mainland of Asia in the former German

JAPANESE EMPIRE
AREA CONTROLLED IN 1942
Japan Proper
Outlying territory
SOVIET UNION
Sea of Okhotsk
SAKHALIN ISLAND
KARAFUTO
KURILE ISLANDS
PARAMU
OUTER MONGOLIA
Amur R.
MANCHUKUO
Harbin
Vladivostok
HOKKAIDO
INNER MONGOLIA
Mukden
Peiping
Hwang Ho
KWANTUNG PEN
Tsingtao
Yellow Sea
CHOSEN
Chosen Channel
Sea of Japan
JAPAN
HONSHU
Tokyo
Osaka
SHIKOKU
KYUSHU
CHINA
Yangtze Kiang
Hankow
Shanghai
Chungking
East China Sea
RYUKYU ISLANDS
BONIN IS.
BURMA ROAD
INDIA
Irrawaddy R.
Mandalay
BURMA
Si Kiang
Canton
Hong Kong
TAIWAN
TROPIC OF CANCER
MARCUS IS
PACIFIC OCEAN
HAINAN
FRENCH INDO-CHINA
THAILAND
Mekong R.
Rangoon
Bangkok
Saigon
South China Sea
Manila
PHILIPPINE ISLANDS
MARIANAS ISLANDS
SAIPAN
GUAM
YAP IS.
PALAU IS.
CAROLINE ISLANDS
TRUK IS.
MALAY PENINSULA
Singapore
SUMATRA
BORNEO
CELEBES
EQUATOR
BISMARCK ARCH.
Rabaul
BOUGAINV
NEW GUINEA
Port Moresby
GUADALCANA
Batavia
JAVA
NETHERLANDS INDIES
TIMOR
INDIAN OCEAN
Darwin
Coral Sea
AUSTRALIA
20°
10°
0°
10°
90°
100°
110°
120°
150°

district round Tsingtao. Here, about midway between the large Chinese cities of Peiping and Shanghai, Japan was in a position to strike at the heart of China.

In 1932 Japan formed a puppet government over all Manchuria and thereby gained its richest loot of raw material in sixty years of continuous aggression. By political and economic penetration it annexed more and more territory in northeastern China. Finally, in 1937, China took up arms against the nation that was obviously determined to destroy it.

While carrying on the Sino-Japanese War with one hand, Japan laid the groundwork for aggression elsewhere with the other hand. By a combination of political and economic expansion it crept down the coast of Southwest Asia, annexing Hainan and other islands of strategic importance in 1939. With the outbreak of the Second World War in Europe Japan was ready to go after the really big game of the Pacific. By the summer of 1941 it had Indo-China and Thailand in its net. By the summer of the next year it had wrested the Philippine Islands from the United States, the Malay Peninsula and Burma from the British, and the extremely rich East Indies from the Dutch. Through aggression Japan had achieved one of the greatest empires in the history of man.

The end of Japanese aggression. Through aggression Japan achieved its mighty empire and through aggression it set the stage for its ultimate collapse. There were three good reasons why Japan has since been reduced to the status of a minor power; why the Japanese Empire has been hacked away until little is left of it but the original four islands of 1874. The seeds of geopolitical doom for Japan germinated in the following conditions:

1. *Resistance of exploited peoples.* The divine right of Japan to rule over East Asia was never admitted by the vast majority of people who had been forced to submit to that rule. Though it is true that Japan had less opposition than did Germany from its subject peoples, it is also true that the Japanese policy was one of ruthless exploitation of these peoples. No nation can build a strong and lasting empire on such a foundation. Even the most docile people resent enslavement and will express their resentment in revolt when the opportunity comes. Though it is true that many Asiatics distrust the democratic principle of coöperation among different people for the good of all, great numbers of Chinese have believed in it sufficiently to die for it. Chinese resistance to Japanese tyranny was the core of the power that destroyed Japan.

2. *Resistance of occidental powers.* More obvious than the resistance of the weak peoples of the East was the resistance of the strong peoples of the West. The vast undeveloped regions and peoples of East Asia are the richest source of raw materials and the most promising future markets for manufactured materials in the world. Prior to the Second World War occidental nations, particularly Britain, the Soviet Union, the Netherlands, France, and the United States, had invested much time and money in commercial ventures in the Far East. They had drawn up treaties with one another and with the nations of the Far East which were designed to guarantee the rights of all concerned.

Though Japan signed these treaties, it never appeared that Japan had any intention of honoring them. The Japanese plan has always been clear for those who cared to see it: to drive the occidental powers out of East Asia and to reduce China and the other native nations to the condition of vassal states. With such a policy it was only a matter of time before Japan would have to face a military reckoning with the occidental powers that stood in its way.

No nation was more clearly aware of this fact than Japan. For decades before it struck, it had been building up its strength to strike. Japan, alone among the nations of the earth, knew how strong it was when the day of decision came. Unfortunately for its imperialistic ambitions, it did not also know how weak it was. It made the worst mistake that can possibly be made in warfare: it underestimated the strength of its enemies. It did not realize that behind their temporary weakness in the western Pacific Ocean, Britain and the United States had resources which were greater than its own, and which in time would bring it to defeat.

3. *The military weakness of Japan.* At the beginning of 1942, when Japan had naval and military control of nearly every strategic location in the Far East, its chances of keeping its ill-gotten empire must have seemed very good to it. It had an almost complete monopoly of the world supply of tin and natural rubber. It had control of vast supplies of petroleum, coal, iron, and food. It had a great navy and merchant fleet, and great armies and air forces.

By capturing the British naval base at Singapore, Japan not only had removed the immediate threat of British sea power, but had put Britain on the defensive by laying open the lands of the Indian Ocean to possible invasion. By wrecking the American naval base at Pearl Harbor, Japan had removed the immediate threat of American sea power. It had a position from which it could strike with great force in any direction, and one in which it could not be effectively struck by its enemies on any side. It had time in which to consolidate its gains while its enemies were fighting Germany in the West and nursing their wounds in the East.

Underneath this apparent strength, however, were grave weaknesses. Raw materials necessary for the defense of the Japanese Empire were scattered over wide areas of sea, and held together by ship lanes which were open to naval attack. The heart of Japan lay in crowded industrial cities which were particularly vulnerable to air attack, once its enemies had won bases from which air attacks could be launched. After the summer of 1942 it became increasingly clear that Japan could not defend its far-flung empire against the combined productive power and military might of Britain and the United States.

Just what the military collapse of Japan will mean for the future of the Far East is still not clear. Under the brilliant administration of General Douglas MacArthur, and with the surprisingly full coöperation of the Japanese people, Japan has effectively faced the heavy tasks of economic and political reorganization. It is doubtful, however, that Japan will ever regain its former power. China, with the backing of Britain and the United States, is more likely to achieve the geopolitical position in the Far East that Japan has so desperately desired.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. China is about twice as large as Russia.

2. China is a relatively weak nation because the Chinese people are not very intelligent.

3. The Chinese people are a pure race which has received almost no mixture of blood from other races in the last several centuries.

4. The Chinese conception of family life is the foundation on which the future of China must be built.

5. Since most Chinese are farmers, China has plenty of food for everyone.

6. Though China has made little use of its mineral deposits; it has large supplies of all the minerals which are necessary for industrial development.

7. Though Chinese roads are old-fashioned, they fully satisfy the needs of the Chinese people.

8. Japan is called the "Britain of the East" because it built a great colonial empire early in its history.

9. Japan is a stronger nation than China because it has had contact with the Western world for a longer time.

10. The large population of Japan is due to the fact that all Jap nese lands are well suited to the cultivation of rice.

11. All Asiatic peoples live almost entirely on rice.

12. Japan is the leading manufacturing country in East Asia because it has rich coal and iron deposits.

13. Formosa (Taiwan) is the largest and richest of the original four islands of the Japanese Empire.

14. The Japanese are the logical rulers of East Asia because they are more intelligent and humane than any other people in that region.

QUESTIONS FOR DISCUSSION

1. If you were to be president of China during the next ten years, how would you set out to strengthen your country economically and politically?

2. If you were to build three trunk highways across China, where would you build them? Why would you locate them there?

3. Do you think that China can ever become important in the field of modern manufacture? If so, what must be done to reach this goal?

4. What would you say are the chief reasons why Japan, a nation with a population of less than 75 million, was able to become the strongest nation in the Far East?

5. How do you think the boundaries of the Japanese Empire and the behavior of the Japanese people should be changed to ensure the peace and prosperity of East Asia?

THINGS TO DO

1. On an outline map of China mark the boundaries of China Proper, Inner and Outer Mongolia, Sinkiang, and Tibet. Locate and name the chief rivers, mountain ranges, and cities.

2. Read up and report on the possibilities for the future economic development of Chungking and neighboring districts in West China. Compare the economic prospects of this area with those of the area round Shanghai in East China.

3. List the geographic strong points and weaknesses of Japan, and write a report on how in your opinion Japan should adjust itself to its geographic surroundings in the future.

4. Before the Second World War most of the world supply of tea, silk, rubber, and tin came from the lands of the Far East. Write a report on what you consider will be the future importance of the Far East in the world production of these commodities, considering the steps which other regions took during the war to become independent of the Far Eastern supply.

BOOKS TO READ

1. Interesting books about the Far East are legion, but sound books on its geography are relatively rare. *China: Land of Famine*, by WALTER H. MALLORY, is an excellent review of the geography of one of China's greatest problems. *Asia's Lands and Peoples*, by GEORGE B. CRESSEY, is an up-to-date and authoritative survey of Asia by an American geographer. *Japan's Industrial Strength*, by KATE L. MITCHELL, is an analysis of the industrial strength of Japan, based on research done by the Institute of Pacific Relations.

2. Some of the best books on the geographic conditions in China have been written by laymen. *My Country and My People*, by LIN YUTANG, is a charming account of China and the Chinese by a man who thoroughly knows both his subject and how to write interestingly about it. *House of Exile*, by NORA WALN, is an equally charming book on the experiences of a foreigner in a Chinese household. *The Chinese Are Like That*, by CARL CROW, is an informative and entertaining book about China just before the Japanese invasion of 1937.

3. *Children of the Rising Sun* and *Japan Rides the Tiger* are interesting books on the nature of modern Japan and the Japanese, by WILLARD PRICE, a man who had unusual opportunities to observe them. *Ten Years in Japan*, by JOSEPH C. GREW, United States ambassador to Japan at the time of the outbreak of the Second World War, is an important book on the geopolitical history of modern Japan and its unfortunate neighbors.

XXI · THE SOUTH AMERICAN REPUBLICS

LATIN AMERICA AND THE UNITED STATES

America's place in the world. Moving from Eurasia to America is in many respects like moving from one world into another. It was the difference between these two worlds which first tempted people in the one world to colonize the other. Through most of the four and a half centuries which have passed since that colonization began, the people of the New World have been on the whole far more aware of the differences than of the similarities between the New World and the Old.

Though the early colonists of North America sought chiefly homes, whereas those of South America sought chiefly wealth, they all found in America a land of fresh opportunity. They found a land that was free from the age-old fears, jealousies, and hatreds of Europe, Asia, and Africa. They found a land that was rich in resources and poor in population. They found, in short, a land where freedom could flower; where men and nations could grow economically and politically without interference from custom or competition.

Through most of their history most Americans have lived in an environment of opportunity and freedom which has no parallel in Old World lands. Through most of their history most Americans have felt a remoteness from those lands. The outstanding fact in the recent history of America is that the reasons for this traditional feeling of isolation have ceased to exist. With the tremendous recent improvement in sea and air transportation, and the tremendous growth in international trade, America is no longer an island outpost of civilization. It lies at the heart of the modern world and it functions as the heart of modern civilization. Americans cannot escape the consequences of their location and function.

Latin America's place in America. Just as Americans can no longer cut themselves off from the rest of the world, they can no longer cut themselves off from one another. By the time the United States had won its independence it had become the location of the greatest concentration of geopolitical strength in the New World. Today the United States is still the greatest geopolitical power in the New World. Though its power has never before been so great either in America or in the world at large, it has never before been so vitally affected by the conduct and attitude of its less powerful neighbors.

The people of the United States have only recently come to realize this fact. They have only recently begun to take their neighbors seriously. Below the southern border of the United States lie Mexico, the West Indies, and the several republics of Central and South America. The European people who settled in these countries came chiefly from Spain and Portugal. Spanish and Portuguese are the chief languages spoken there today. These languages grew out of the old Latin language, and for that reason all America south of the United States is known as Latin America.

Besides the people who are descended from early Spanish and Portuguese colonists there are many Indians in Latin America. There are many people who are part Indian and part white. There are also some Negroes, some people with a mixture of white and Negro blood, some with a mixture of Indian and Negro blood. There are not a few people who were born in Germany, Italy, Japan, and several other countries, who came in recent years to live in Latin America.

In the past, certain things have stood in the way of friendship and understanding between these people of Latin America and the people of the United States.

From The Evening Star Newspaper Company, Washington

The President of the United States greets the President of Mexico in a spirit of good will and coöperation.

1. The culture of the mixed people of Latin America is very different from the culture of the people of the United States. Differences in language, customs, and beliefs have bred suspicion and distrust. In many ways Latin America is more like Europe than like the rest of America. As a result of this fact, many Latin Americans have felt more friendly to Europe than to the United States.

2. Until recently, the great distances which separate them and the lack of good rail, automobile, and air connections have made it hard for the people of the two regions to get to know one another.

3. Most Latin American people have found it more profitable to trade with Europe than with the United States for reasons which will appear as we go on with this chapter.

4. Where trade relations have existed between the people of Latin America and the people of the United States, the former have felt in many cases (and in some cases with justification) that they were being unfairly exploited by the latter.

In spite of these things, the governments of most American nations have come to believe that real friendship and coöperation among Americans as a whole are possible. Nothing can make friends faster than a common danger. As the Second World War drew closer and closer to America, the governments of nearly all the American nations began to realize that America as a whole was threatened. It became clearer and clearer that *all* America must unite for defense against the Axis if *any* of America was to save its independence. The Good Neighbor Policy, which resulted from this realization, was sound geography—both in the face of immediate danger from war and in the hope of future prosperity from peace.

The Good Neighbor Policy. Though the foundations of the Good Neighbor Policy were laid several years before Americans were generally aware of the Axis threat, the policy was not definitely formulated until the summer of 1940. At that time the nations of Western Europe had begun to fall before the Axis aggressors. France, the

Netherlands, and Denmark were fallen nations that had colonies in the Western Hemisphere. American nations feared that the Axis might try to take over these colonies.

The representatives of the American republics who met in the Pan-American Conference at Havana during the summer of 1940 agreed to meet the danger in the following ways:

1. They agreed to forbid the transfer of any colony of a fallen European nation to any other nation outside America. They agreed that all American nations should act together to prevent such a move if it were ever attempted.

2. Long before the conference at Havana took place, Germans and Italians had been working to bring the Latin American republics under the control of Germany and Italy. Latin America was the one great region left on earth with nations that were both rich and weak. It was the one region where Germany and Italy could hope to expand without the heavy cost of war. Axis spies and businessmen had secretly done everything they dared do to get control of the business firms and the governments of the Latin American nations. The Pan-American Conference decided to work out plans for checking the activities of these enemies within the gates.

3. As more and more European nations fell into the hands of the Axis, more and more markets for the sale of Latin American products would be cut off by the British blockade. The Pan-American Conference agreed to work out ways of developing new markets inside America for the sale of American products. It agreed to work out ways of lending money to the governments and business firms of Latin America so that they could get on without the European money which had helped them in the past.

As a result of the Pan-American Conference, and largely because of it, the nations of America made great progress in co-operation. Under the leadership of the United States, the military defenses of the Western Hemisphere were greatly strengthened. After the United States declared war on the Axis, all the Latin American republics either declared war, too, or broke off diplomatic relations with the Axis nations (though certain of the republics did so only after considerable delay and with decided reluctance). Axis sympathizers, spies, and saboteurs were hunted in nearly all the American nations and thrown out. Commerce between the United States and Latin America immediately increased. But the finest result of the Good Neighbor Policy was a new feeling of friendship and trust throughout America as a whole, a feeling which has outlived the war emergency.

Subdivisions of Latin America. If you examine the map of the Americas on page 407, you will see that the Latin American countries spread over nearly 90 degrees of latitude in the Northern and Southern hemispheres. Within this vast expanse nearly all the major climates of the earth are represented, and practically all the varieties of human occupation. Within this vast expanse there are twenty independent nations and several dependent states.

We can divide this immense and complicated region into three broadly different areas:

1. The lands and seas which mark the transition from North America to South America.

2. The predominantly tropical lands, which occupy the broad northern portion of South America.

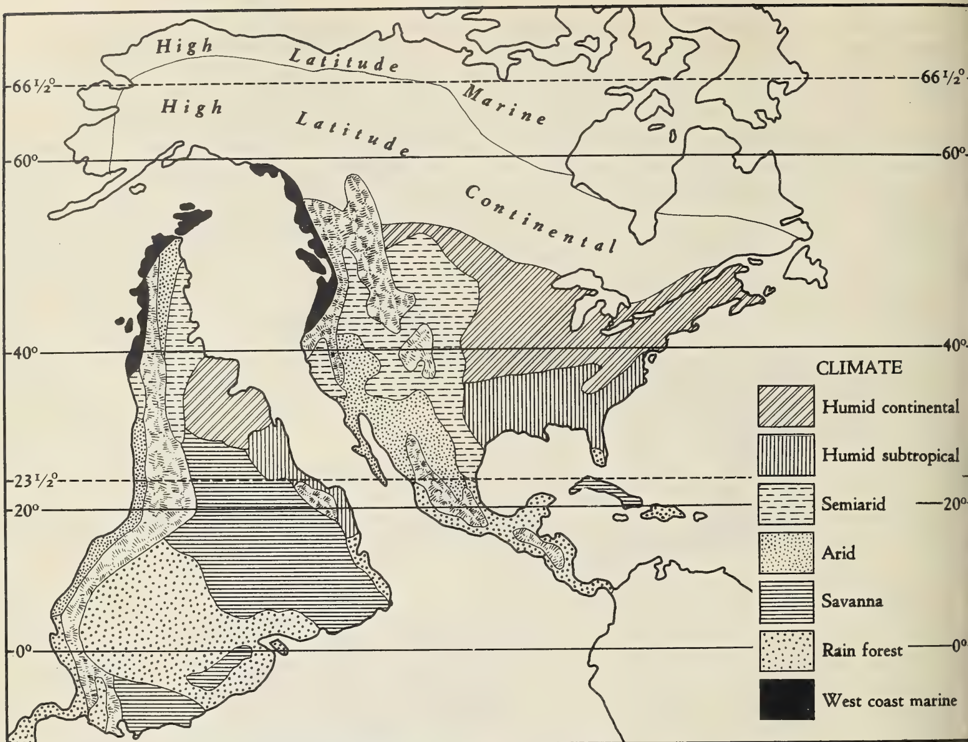
3. The predominantly "temperate" lands, which occupy the narrow southern portion of South America.

Notice that in this classification of Latin American lands, each subdivision contains one country which is larger than all the neighboring countries combined. Mexico is the giant of the northern area, Brazil of the central area, and Argentina of the southern area. These three countries are not merely vastly larger than their neighbors; they are also vastly stronger both economically and politically. Far stronger, however, than any of them is the United States. The influence of the United States is great in every Latin American nation, and decisive in the nations which lie within the vital strategic zone of transition between North and South America.

SOUTHERN SOUTH AMERICA

Argentina and the United States. Of all the Latin American republics, Argentina is farthest from the United States in both miles and sympathy. During the early years of the Second World War we heard much about the differences between Argentina and the United States on the vital matter of hemisphere defense. We heard less about the similarities between Argentina and the

From north to south the Latin American countries span about one fourth the circumference of the globe.



Rearrangement of the map of the Americas brings out the striking similarities in the climatic regions of the two continents.

United States. Yet it is at least partly the geographic similarities between these two countries which have caused their political differences.

In some ways Argentina is a Southern Hemisphere counterpart of the United States. Earlier in this book we saw how the climatic pattern of the Southern Hemisphere tends to repeat in reverse order the climatic pattern of the Northern Hemisphere. This fact is strikingly demonstrated in a comparison of the climatic regions of North and South America. Study the map on this page, in which South America is inverted and placed beside North America in the same latitudes in the Northern Hemisphere which it occupies in the Southern Hemisphere. Notice that each important climatic region of the United States is matched by a similar region in a corresponding location in Argentina and the neighboring countries of southern South America.

The similarity in climate between the United States and Argentina is accompanied, as we shall presently see, by similarities in the use of land for agriculture and stock-raising. Here, however, the similarities end and the far more significant differences begin.

The Pampa, heart of Argentina. Though Argentina contains over a million square miles of territory and extends some 2300 miles between its northern and southern boundaries, it has fewer than 14 million inhabitants. Most of these people live in the region of humid continental climate behind the broad Rio de la Plata estuary in the east-central part of the country. The flat plains, or pampas, of this region are known collectively as the Pampa. Equal to the combined areas of Ohio, Indiana, Illinois, Iowa, and Nebraska, the Pampa contains some of the richest agricultural lands in all South America. These lands are the economic heart of Argentina.

The amazing fact about the Pampa, aside from its richness, is the tardiness with which its development was begun. For many decades the early Spanish colonists of South America neglected this region because Spain insisted that all Argentine imports and exports should pass through Peru. It was not until 1776 that this handicap to the development of the Pampa was removed. It was not until after the middle of the nineteenth century that the wealth of the Pampa began to be developed on any very large scale.

In spite of the lateness of their development, the plains of east-central Argentina have taken a leading place among the world's great producers of meat and grain. Before the outbreak of the Second World War, Argentina was producing—largely on these plains—more than three fourths of the entire world's exports of flaxseed (linseed), more than half of the world's exports of corn and beef, about one third of the world's exports of hides, and about one fifth of the world's exports of wheat. Only Australia exceeded Argentina in the exportation of wool, and only Australia and New Zealand in the exportation of mutton. Most of these exports were shipped to northwestern Europe, chiefly to the United Kingdom. During the war Argentina's foreign markets were restricted by the blockade of sea-going trade to continental Europe. But thanks to Britain's need for food and to the willingness of the United States to pay for it, Argentina continued to prosper in spite of the war.

Other regions of Argentina. Though the Pampa is the heart of Argentina's wealth, the rest of the country is by no means unproductive. Notice on the map on page 411 that two great rivers, the Paraná and the Uruguay, enter the La Plata estuary above the capital city of Buenos Aires. These rivers are navigable and they lead into a country which is called the *Argentine Mesopotamia* because it lies (like the Old World Mesopotamia) between two rivers. The northern part of this region of subtropical vegetation is still only poorly developed. The southern part belongs to the great Argentine corn and flax belt, and it produces more flaxseed than does

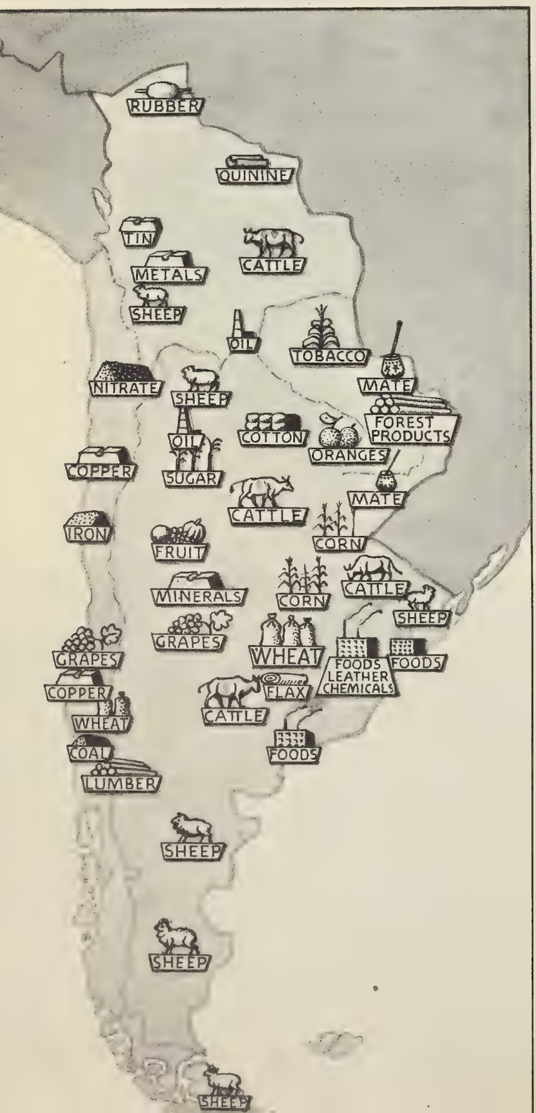
The vast plains of the Pampa in east-central Argentina are among the richest agricultural lands on earth.

Pan American Grace Airways

the Pampa portion of that belt. This area also has a well-developed sheep industry, which contributes a goodly quota of wool to the exports of Argentina as a whole.

West of the Paraná River in north-central Argentina and adjoining areas in Bolivia and Paraguay lies the little known *Gran Chaco* region. Much of this land of subtropical swamps is still the home of wild Indian tribes and even wilder insect species, which bow to no law but their own. A good start has nevertheless been made in the development of this region. It is the world's only source of quebracho wood, from which tannic acid is extracted for a variety of industrial purposes. It also produces considerable amounts of cotton and hides, and a little beef. It will doubtless yield more of these products as the population of Argentina increases.

This map shows the location of the chief resources and products of southern South America.



The Gran Chaco region of extreme northern Argentina shares with *Patagonia*, in the extreme southern part of the country, the double disadvantage of isolation and disagreeable climate. Patagonia is, on the whole, the least productive region in all Argentina. Its desert plateaus and mountains, however, yield about three fourths of all the petroleum that Argentina as a whole produces, about one half of all the wool that Argentina exports, and considerable quantities of mutton.

Western Argentina, like western United States, is made up of dry flatlands and towering mountains. The Andes cut off the moist westerly winds from the Pacific Ocean much as do the Sierras farther north. Most of Western Argentina is thus made unfit for the grazing of cattle, but a great many goats are raised there. On land which can be irrigated by streams from the Andes, extremely productive mixed farm lands have developed. Sugar cane and grapes are among the leading agricultural products of these oases. All the larger cities have important food-processing industries and in recent years have developed a variety of manufacturing industries. Mining and the production of petroleum are locally important. It was on the oases of Western Argentina that the first colonial settlements of Argentina were built. Today the culture of these garden spots outranks that of Buenos Aires itself.

The future of Argentina. The similarity between Argentina and the United States ceases when we turn from climate and

DRAWN BY RICHARD EDES HARRISON 1944 OBLIQUE CONIC CONFORMAL PROJECTION COURTESY OF AMERICAN GEOGRAPHICAL SOCIETY

By Ewing Galloway, N.Y.

Meat-packing stands high in importance among the industries of Argentina.

agriculture to manufacture and transportation. Argentina, like many other Latin American countries, is devoted largely to stock-raising and farming. Its progress in manufacture has been severely restricted by small domestic supplies of mineral fuels and other raw materials, by poorly developed transportation facilities outside the Pampa, and by remoteness from the great market areas of the world.

Perhaps the most serious handicap to the development of Argentine manufacture has been social rather than geographic. It has been the determination of the landed aristocracy to keep Argentina essentially a producer of the primary products of forest, farm, and mine, from which the landed aristocracy benefited, and a purchaser of the manufactured products of other lands. But in spite of all these handicaps Argentina had become the leading manufacturing country of South America prior to the Second World War.

At least one fifth of all the people of Argentina live in the capital city of Buenos Aires. Nearly all the 25,000 miles of railroad which the country contains lies within a few hundred miles of this city. Much of the manufacture which Argentina has developed is located in Buenos Aires and neighboring cities, and in the other port cities of Rosario and Bahía Blanca. This manufacture is exclusively of the light variety, with emphasis on meat-packing, flour-milling, leather-tanning, and textile-weaving. Partly through the products of these industries but chiefly through its much more valuable agricultural raw materials, Argentina built up a foreign trade which in the last few years before the Second World War was over half again as great as that of its nearest South American rival, Brazil.

The economic prospects of Argentina are bright, but they have certain definite limitations. The agricultural resources of Argentina are great and capable of much fuller development, but its forest resources are meager, it has little coal worth mining, and no iron ore at all. The lack of coal and iron, which are necessary for heavy industry and complete industrialization, is a very serious handicap. It seems likely that this handicap will keep Argentina largely a producer of primary commodities, with an edging of light industries to supply many of the demands of the domestic markets.

The greatest cloud on the economic horizon of Argentina is the United States. Though in the past the United States has bought considerable quantities of Argentine flaxseed, quebracho, hides, wool, and canned meats, the agricultural surpluses of these two countries are for the most part similar and therefore in competition with each other. Argentina must preserve the European markets for its agricultural surpluses if it is to preserve its prosperity.

This geographic necessity underlay the political policy of Argentina during the Second World War. Though most of its people were doubtless in sympathy with the cause of the United Nations, its government was consistently reluctant to take steps which might hurt its trade relations with Germany after the war. Through this policy, Argentina did far less than it might have done to help win the victory to which all other American nations contributed heavily. Through this policy it lost much of the respect and trust of these nations. It gave Brazil a golden opportunity to replace it as the economic and political leader of Latin America.

Uruguay. Much that we have written about Argentina applies to its little neighbor Uruguay. Like Argentina, Uruguay is a prosperous country whose two million people are energetic, ambitious, and largely of European descent. Like Argentina, Uruguay's prosperity is built chiefly on its soil and climate (though in Uruguay, livestock products far outrank agricultural products). Like Argentina, Uruguay is dependent on foreign markets for the sale of its surplus pastoral and agricultural commodities and for the purchase of most of the manufactured commodities which it requires.

Unlike Argentina, Uruguay was one of the first Latin American nations to break off relations with the Axis powers during the Second World War. Unlike Argentina, which has some mineral fuels of its own, Uruguay has practically none. It is entirely dependent on other countries not only for coal and petroleum, but for wood and metals as well. Because of the submarine menace and the lack of ships, Uruguay was unable to get many of the imports which its people needed during the Second World War, with the result that their standard of living declined. By taking a stand stanchly on the side of the United Nations, Uruguay lost many material advantages and placed

Montevideo, the capital of Uruguay, has a large export trade in livestock.

Ewing Galloway, N.Y.

a clear moral obligation on the United Nations to repair these losses in the future.

Paraguay. Whereas Uruguay is the smallest South American republic in area, Paraguay is the smallest in population. At least 90 per cent of Paraguay's one million people are "mestizos" of mixed Indian and Spanish descent. Paraguay is the most backward of all the Latin American republics except Ecuador, partly because of its sparse population, its rather enervating subtropical climate, and its limited transportation facilities.

The chief causes of Paraguay's backwardness, however, are historical rather than geographic. Foremost among these causes are the repeated wars which have bled Paraguay of its man power and its financial resources. Distrust of the people for neighboring Argentinians (who consider Paraguay within their sphere of geopolitical influence and who would like to invest money in Paraguay) has been another reason for the slow progress of Paraguay.

Though Paraguay has no mineral resources worth mentioning, its other resources are considerable. With improvement in its water, rail, and air transportation, and in its agricultural methods, Paraguay might well come to rival Uruguay as a productive country. Undeveloped though it is, Paraguay produces enough food to support its own people. Its cotton, forest products, and tobacco have found their way into foreign markets. For immigrants with energy, imagination, capital, and good will, Paraguay will doubtless be a land of opportunity in the future.

These children of Paraguay are interested more in puppies than politics.

Ewing Galloway, N.Y.

Bolivia. Sharing with Argentina and Paraguay the subtropical Chaco on the south and with Brazil the tropical savannas of the Madeira River on the north, Bolivia marks the transition from southern to northern South America. More than half of its $3\frac{1}{2}$ million people are pure-blooded Indians, and nearly one third of the remainder are mestizos, of mixed blood. Like Paraguay, Bolivia is landlocked, and its development has been held back by the backwardness of the people and by poor transportation facilities. Unlike Paraguay, Bolivia has one great resource which is well developed: its mineral deposits.

About four fifths of the people of Bolivia live on the plateaus and among the lofty mountains along the western edge of the country. For four centuries these highlands have been the center of Bolivian life because here are the mines which for four centuries have almost completely dominated that life. Though some of these mines produce copper, lead, silver, zinc, and antimony, the tin mines are much the most valuable. When Japan seized the rich tin deposits of British Malaya and the Netherlands Indies during the Second World War, Bolivian tin deposits became of tremendous strategic importance to the United Nations.

The mineral wealth of Bolivia is offset by the poverty of its agriculture. Though the vast majority of Bolivians are farmers, they cannot raise enough food to support themselves. Their equipment is poor and their farming methods primitive, and there are few areas where good climate, good soil, and good transportation facilities combine to favor agriculture. Most of Bolivia's imports accordingly consist of foodstuffs.

This country also suffers from a social system which has done little to raise the standards of the people as a whole. Many of the valuable mines are owned by British and United States companies, which in the past have been interested more in the exploitation than in the development of the country. Though Argentina considers Bolivia to lie within its sphere of geopolitical influence, and has at times exerted considerable influence on the government of that nation, the future welfare of Bolivia is largely in the hands of the great manufacturing countries that consume its mineral products.

Chile. Running down the back of Bolivia and Argentina like a spine, Chile is one of the most oddly shaped countries on earth. From Arica on the north to Cape Horn on the south, a distance of some 2600 miles, the climatic-vegetation regions of Chile range from tropical desert to tundra. In all this range, however, not a spot is farther than 250 miles from the ocean. Not a spot is out of sight of a mountain range. The Andes and the Coast Ranges, which run the entire length of Chile, occupy about 70 per cent of its surface.

In addition to being extremely mountainous, about 40 per cent of Chile is extremely dry; more than 30 per cent is too cold and rainy for crops and men. Though this country has one of the longest coastlines of any country on earth, it lay isolated from the rest of the world for centuries by the barrier of the Andes and the stormy waters of the South Atlantic Ocean. Even today, with the Panama Canal, and the Transandine Railway between Valparaiso and Buenos Aires, affording access to the avenues of world trade, Chile is still a remote and lonely land.

At this great plant in the highlands of Bolivia, tin ore is prepared for smelting.

James Sawders


Ewing Galloway, N.Y.

These twin volcanoes rise from the stormy crest line of southern Chile.

The nitrate deposits of northern Chile are one of the desert's richest gifts to man.

Fenno Jacobs from Three Lions

In spite of these handicaps, Chile is second in importance only to Argentina among the nations of southern South America. It is second in importance to no other nation on the west coast of that continent as a whole. About 85 per cent of the 5 million Chileans live in the central part of the country, where the climate is stimulating and the soil productive. They are for the most part intelligent, energetic, and progressive people. Though Chile exports considerable quantities of wool, mutton, and sheepskins, and a variety of agricultural products, its outstanding resources come from the mineral kingdom.

In Chapter XIII we saw that Chile possesses the only large deposits of natural nitrates on earth. Nitrates are of great importance in the manufacture of fertilizers and explosives, and Chile's supply of them is enormous. During the First World War a process for making nitrates from air almost wrecked the Chilean nitrate business. During the Second World War, however, the demand for natural nitrates rose again and with it rose Chilean prosperity. But since most of the world's nitrate needs are and will be supplied by manufactured nitrates, the people of Chile realize that they cannot anchor their hope for future prosperity in this resource alone.

Fortunately, they have other resources. Their great northern deserts contain rich deposits of iodine and borax, as well as nitrates. They contain some of the most extensive copper deposits on earth and no small amounts of iron, gold, and silver. Elsewhere in Chile are good coal deposits and vast reserves of water power. Though many of Chile's mines are owned by foreign interests, Chile gets a share of the profits. Though its mineral resources account for most of its present wealth, it is rapidly developing its pastoral and agricultural resources and has made a start in manufacture. As its isolation dissolves with the progress of transportation, Chile will doubtless increase in geopolitical power.

Like the United States of America, the United States of Brazil is a union of several states.

NORTHERN SOUTH AMERICA

Brazil, giant of Latin America. Just as Argentina overshadows all the rest of southern South America in size and importance, Brazil overshadows all the rest of northern South America. Brazil, as a matter of fact, is nearly as large as all the rest of South America combined. With its $3\frac{1}{2}$ million square miles it is larger than the United States, larger, in fact, than any other country on earth except Russia, Canada, and China. With a population of more than 45 million, Brazil contains considerably more than twice as many people as Mexico and more than three times as many as Argentina.

About three quarters of all Brazilians live within 100 miles of the seacoast; nearly three quarters of all Brazil is practically uninhabited. Like Canada, with its vast wilderness of tundra and taiga, and Australia, with its vast wilderness of desert, Brazil contains a vast wilderness of tropical rain forests, which are hostile to men. This region of low productivity accounts for about half the country. Much of the land outside the rain forest region is almost equally unfavorable to human occupation and almost equally undeveloped. Only about $3\frac{1}{2}$ per cent of the surface of Brazil as a whole is cultivated. Because of these drawbacks the economic and political strength of Brazil falls far short of matching its size.

The inner wilderness of Brazil. Like Argentina, Brazil has a highly varied geography. The most romantic but least valuable part of Brazil is the immense basin of the Amazon River and its tributaries. This region, known as *Amazonia*, is some 2500 miles wide from east to west and some 1800 miles long from north to south. Here the tropical rain forests, jungles, and wet savannas have set up their barriers of humid heat, disease, and tangled vegetation against the advance of civilization. This whole tremendous region yields little in the way of cultivated crops and livestock; its only important products to date have been such wild forest products as rubber and Brazil nuts. Though Amazonia has many untapped riches, they lie beyond obstacles which on the whole are still too difficult for men to overcome.

South of Amazonia in west-central Brazil is another immense and little used wilderness region. Known as the *Campos*, it consists very largely of tropical grasslands. Though millions of cattle are produced in the Campos round the headwater streams of the Paraguay River, the region as a whole is so remote from even the nearest South American markets that it will doubtless be among the last regions of Brazil to undergo intensive development.

Southern Brazil. Politically, Brazil is divided into several states. (Though it is seldom used, the official name of Brazil is The United States of Brazil.) If you look at the map on page 417, you will see that Brazil is shaped very much like the con-

These bales of rubber are the product of wild rubber trees in the inner wilderness of Brazil.

Wide World Photos

tinent of South America as a whole. Notice that it narrows rapidly from north to south between the large state of Minas Gerais and the small state of Rio Grande do Sul. It is in these states of the narrow southern end of Brazil that most of the economic and political strength of the country lies.

The three southernmost states of Brazil (Rio Grande do Sul, Santa Catarina, and Paraná) make up a region which is known as *South Brazil.* This region consists largely of a rolling, tree-covered plateau with an average elevation of about 2000 feet, and with a healthful subtropical climate. It is the center of Brazil's most promising livestock industries. It also contains rich forest resources, which are as yet only partly developed. The people of this region are largely of Portuguese, German, and Italian stock. Portuguese cattlemen early settled in this region, but vigorous colonization of South Brazil by Europeans did not begin until long after the colonization of regions farther north. The present inhabitants of South Brazil are energetic and intelligent, and they will doubtless develop the rich resources of their frontier lands to the full.

By Ewing Galloway, N.Y.

Barns and silos are unnecessary on this dairy farm in South Brazil because the pastures are always green.

The Central Plateau. Just as the Pampa is the economic and political heart of Argentina, the states of São Paulo, Rio de Janeiro, Espírito Santo, Minas Gerais, and southern Goiaz are the economic and political heart of Brazil. Sometimes referred to as the *Central Plateau of Eastern Brazil*, this region contains half again as many people as all Argentina. These people include many Indians, Negroes (whom the original Portuguese colonists imported from Africa as slaves), and various racial mixtures. People of European stock, however, dominate the life of the region. Portuguese people and the Portuguese language are supreme in this and most other parts of Brazil. This fact sets Brazil apart from all other Latin American lands, where the Spanish influence predominates.

As its name implies, the Central Plateau of Eastern Brazil is largely a rolling upland, about 3000 feet on the average above the sea Except for the hot, wet lowlands along its seaward edge, it has one of the most pleasant and productive climates on earth. Here are the rich coffee plantations which we described in Chapter XIV. These plantations occupy about 40 per cent of the cultivated land of Brazil as a whole and supply the world with about 60 per cent of its coffee.

Though coffee is the outstanding product of the Central Plateau, it is only one of the many rich resources of the region. Corn, cotton, beans, rice, sugar, cassava, and potatoes are all important crops, and considerable numbers of cattle and swine are raised. The Plateau contains the greatest undeveloped deposits of iron ore on earth, and valuable deposits of manganese and other minerals. In its cities are some of the most highly developed manufacturing industries in all South America, though, as

C.I.A.A. Photo

The Volta Redonda steel plant is one of the pioneer heavy industries of South America. On the Central Plateau of Eastern Brazil, it is close to one of the world's largest deposits of iron ore.

in most other parts of South America, these industries are severely handicapped by a shortage of mineral fuels. All told, this region exceeds even the rich Pampa of Argentina in natural wealth and in the promise of future development.

The upper maritime regions of Brazil. Though today the Central Plateau of Eastern Brazil overshadows all other regions of Brazil in economic and political importance, yesterday it was the state of *Baía*, to the northeast, which had that distinction. Two hundred years ago this region was the heart of the Portuguese colonization of Brazil, and sugar was long its chief agricultural product. Today cacao leads, though a large variety of other crops are produced under the warm, humid climate. Chromite and manganese are also important products of modern Baía. Though its relative importance in the economic and political life of Brazil is not what it once was, the actual importance of Baía is still great.

Like Baía, the coastal states of *Northeast Brazil* had more relative economic importance in the past than they have now. These lands, which lie within 10 degrees of the equator, are for the most part hot, humid, and enervating. They are poor in resources when compared with the lands of the Central Plateau. Cotton, sugar, and goats are the chief products; lack of transportation facilities, the chief handicap to their development.

The chief significance of Northeast Brazil lies in facts which are strategic rather than economic, and which had no importance until the airplane and the Second World War gave them the utmost importance. With the war Americans suddenly realized how close they were to the Old World. They realized, among other things, that the whole of South America lies east of Jacksonville, Florida. They realized that Natal, on the eastward bulge of Brazil, is only 1870 miles from Dakar, on the westward bulge of Africa—an easy hop for an Old World invasion of America. These facts have had tremendous influence on the recent history of Brazil—and of America as a whole.

The future of Brazil. Brazil, like Argentina, is a large, rich country which is only partly developed. Like Argentina, Brazil is destined to undergo large developments in the future. In spite of its vast wilderness areas, which are essentially unfit for human habitation, and in spite of the primitive condition of a large percentage of its people, Brazil has more of the elements of geopolitical strength than any other Latin American country.

Brazil, like China, contains several great regions which lack transportation facilities for their development. Like China, Brazil places much of the burden of its trade and transportation on its rivers. The chart on page 422 shows the extent and the limitations of water, rail, and air transportation in modern Brazil. Notice that the Amazon River is navigable nearly all the way from the Atlantic Ocean to the Andes. Unfortunately, this best of Brazilian transportation systems lies in the wilds of Amazonia, where it has the least possibility of being used to advantage. The Paraguay, Parana, and Uruguay rivers of southern Brazil, on

This map shows the location of the chief resources and products of northern South America.

This chart of transportation facilities in Brazil shows that the development of that vast rich country has only begun.

the other hand, flow through better and more thickly populated country. They are important strands in the network of Brazilian commerce.

Notice that the railroads of Brazil do not penetrate very far inland. Most of them link up the range and coffee lands of southern Brazil with the coast. The highways of Brazil are similarly restricted. Only the airways, as you can see on the chart, make a connected and well-developed pattern, but even this pattern is largely confined to the southern and eastern parts of the country. Nevertheless, Brazilian airways are playing a vital role in the development of this far-flung empire, and will doubtless continue to do so in the future.

The development of any country depends chiefly on the quality of the people and their leadership. Since Brazil broke away from the political domination of Portugal in 1822, it has suffered many political revolutions and attempted revolutions. Since 1930 Brazil has had a strong government, which has done much to develop the resources of the country and to raise the standard of living of the people. This government, however, is not democratic, though it may well move in the direction of democracy with time and under the influence of the United States.

The relationship between the United States and northern South America has always been closer than the relationship between the United States and southern South America. Northern South America is closer than southern South America to the United States, and thus within easier trading distance. Unlike southern South America, the climate of which is agriculturally much the same as that of the United States, northern South America produces many tropical products which find ready markets in the United States. To these long-standing commercial bonds between the United States and northern South America have recently been added the political and military bonds which were forged to meet a common danger. All these bonds between the United States and northern South America are anchored chiefly in Brazil.

No nation has responded more wholeheartedly than Brazil to the Good Neighbor Policy of an America united for defense in war and for prosperity in peace. The threat of invasion which we mentioned above doubtless strongly influenced the

Brazilian government to join the United States in declaring war on the Axis in 1942. But even after that threat was removed through the seizure of North Africa by forces of the United Nations, Brazil continued to coöperate with the United States in furthering plans for the military, economic, and spiritual union of the American nations.

It is difficult to overestimate Brazil's contributions to the achievement of this goal. More than any other nation, Brazil was responsible for persuading other South American nations to abandon their old fears and jealousies and to join the United States and Canada in solid opposition to Axis penetration. Brazil had no easy task in lining up its own people on the side of the United Nations. Most recent immigrants to Brazil have come from Germany, Italy, Spain, and Japan. At the start of the Second World War these people owned and operated many of Brazil's important industries and many of its airlines. The governments of the Axis nations expected these people to act as the spearhead for their invasion of America.

In holding down the spies and saboteurs among these people during the war, the government of Brazil earned the respect and gratitude of the government of the United States. Respect and gratitude, like distrust and resentment, are geopolitical forces of tremendous power in the modern world. During the war emergency they paid dividends to Brazil in the form of great naval, military, and financial aid. They strengthened the good will which is the basis of international coöperation. Now that the war is over, Brazil is in an excellent position to grow from a merely large country into one that is both large and strong.

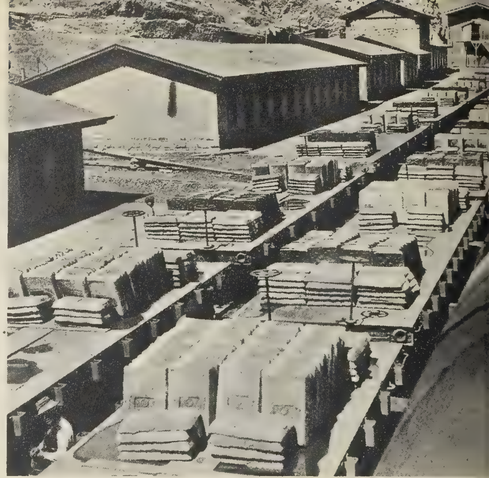
Peru. Just as Argentina is backed on the Pacific Coast by Chile, Brazil is backed, in part, by Peru. Just as Chile embraces both cold mountains and hot deserts, so does Peru. Both Chile and Peru, through most of their history, have been essentially

This plane is being loaded for the shortest possible crossing of the Atlantic Ocean: from Natal on the eastward bulge of Brazil to Dakar on the westward bulge of Africa.

C.I.A.A. Photo

mining countries, so far as their chief export surpluses are concerned.

The history of Peru is the most romantic of the histories of Latin American countries. Here was the center of the great Inca empire of the Middle Ages, perhaps the most advanced Indian civilization in the history of the world. Here the gold-seeking Spaniards under Pizarro destroyed that civilization in the sixteenth century and set up a very different civilization, which lasted for nearly 300 years. Throughout the centuries of Spanish domination, and through most of the decades since 1824, when Peru became an independent nation, mining (at first gold and silver mining but more recently chiefly copper mining) was the leading export industry of the country. One of the most interesting facts about modern Peru is that it has come to realize the value of its agricultural lands, even as had the Incas several centuries before. Nearly half the exports of modern Peru consist of cotton, sugar, and other agricultural products.


James Sawders

These carloads of copper ingots are the product of a mine in the Peruvian highlands:

These irrigation projects have made the desert coast of Peru a rich agricultural region.

Though more than four fifths of the $6\frac{1}{4}$ million people of Peru are Indians and mestizos, many of whom are uneducated, Peruvian industries are steadily expanding. The entire coast of Peru west of the Andes —1400 miles long and 80 miles wide—is a practically rainless desert. Yet through the extensive irrigation projects shown on the map on this page, this coastal strip supports about 30 per cent of the total population and yields nearly 50 per cent of the agricultural products. It also produces all the petroleum, which is the leading export of the country, and it contains nearly all the factories.

Two thirds of all Peruvians live on the highlands behind the coast; though chiefly farmers and herders, these people produce the gold, silver, and copper for which Peru is noted. Nevertheless, the highland region is neither so productive nor so promising as the coastal strip. Though the Panama Canal greatly furthered the commercial development of Peru by giving it a convenient outlet to the avenues of world trade,


James Sawders

Llama trains are the only kind of trains that move over most of the Peruvian highlands.

Peru is still greatly handicapped by poor transportation facilities within its borders. Such a llama train as that shown above is still one of the common methods of moving freight in this country.

Only two railroads penetrate the Peruvian Andes from the Pacific Coast, and neither of them reaches the tropical rain forests which occupy Eastern Peru. There is, on the other hand, a recently completed motor highway from Lima, on the coast, across the three towering ranges of the Andes to Pucallpa, on the Ucayali River. From Pucallpa passengers and goods can reach Iquitos, the chief settlement in Eastern Peru, by river boat. This highway was a great engineering feat, and was Peru's first real conquest of the Andes in terms of modern transportation.

Ecuador. Brazil shares boundaries with all the other South American republics but two: Ecuador and Chile. Ecuador, however, lies in Brazil's geopolitical back yard, along with Peru and Colombia, between which it is wedged. Though more than three times as large as Uruguay (the smallest nation of South America in area) Ecuador is the smallest nation of South America in economic importance.

Nearly all the things which have held back the development of South America as a whole have combined to hold back the development of Ecuador. The interests and sympathies of the people are strongly divided; the residents of the Pacific lowlands have never been able to work with the residents of the interior highlands for the best development of the country as a whole. Weighted down by the double handicap of the towering Andes on one side and the unhealthful equatorial lowlands on the other side, and lacking valuable mineral resources and extensive farm lands, Ecuador has made slow progress toward the diversification of industry and trade which builds economic and political strength. It shares with the almost similarly handicapped Guiana colonies of Britain, the Netherlands, and France, on the opposite coast of northern South America, the poorest prospect of any South American lands.

O. V. from Black Star

This photograph of an Ecuador industry shows that not all Panama hats are made in Panama.

Colombia. Though the republic of Colombia contains over 400,000 square miles of land, some 9 million people, and some extremely rich resources, its development has been hindered by its equatorial location. Like most wet tropical regions, the lowlands of Colombia lie under clouds of energy-sapping heat and malaria-bearing mosquitoes. The coastal areas of this country, on both the Pacific Ocean and the Caribbean Sea, rank among the most unhealthful regions on earth. These coastlands, however, are in places rich in a variety of resources which are being developed because they lie relatively close to the world's great markets. Barranquilla and other coastal cities of Colombia have been made safe (and some people say pleasant) by extensive public health measures.

In the western part of Colombia the Andes Mountains break into three great north-south ranges, which are separated by plateaus (commonly called basins) that rise from 1500 to 9000 feet above the sea. Because of their great variation in elevation and in spite of the fact that they lie within 8 degrees of the equator, the highlands of Colombia have climates which vary from tropical through subtropical to temperate. Though this region embraces only about one quarter of the area of the country, it contains practically all the land that is climatically favorable to human energy. At least three fourths of all Colombians live there, between the fever-ridden coasts and the fever-ridden jungles and rain forests of the deep interior.

As with Peru, gold mining was the chief interest of Colombia until well into the nineteenth century. But as population increased, the grazing and agricultural industries claimed more and more atten-

Though far from the sea, Bogota, capital of Colombia, is a thriving modern city.

James Sawders

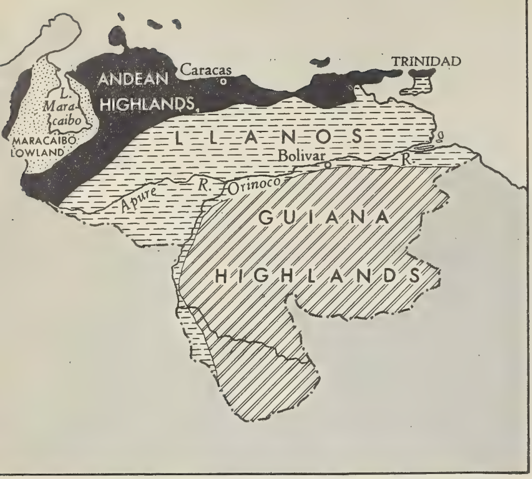

James Sawders

Pineapples are just one among the many agricultural products of Colombia.

tion. Today Colombian coffee, hides, tobacco, bananas, and other agricultural products are of greater value than Colombian gold, petroleum, platinum, and other mineral products. As with Brazil, the most valuable product of Colombia is the coffee which is grown on the mountain slopes of the highland region. This coffee normally makes up at least half of all Colombian exports. It is exceptionally fine-flavored and mild, and is in demand all over the world.

As with all other South American countries, better transportation facilities are Colombia's most urgent need. Though the highlands contain most of the highways and railways of the country, mules and human porters are still extensively used as carriers there. The great Magdalena River, which drains the economic heart of Colombia, needs many improvements before it can become a really efficient artery of commerce. Because of its natural wealth and enterprising people, however, and because of its relative closeness to the great markets of eastern North America, Colombia can look to the future with well-grounded hopes. It is already one of the most progressive nations (some people say *the* most progressive nation) in South America.

Venezuela. Much that we have written about Colombia applies also to its smaller sister republic of Venezuela. The location and the products of the two countries are essentially the same. The arrangement of highland and lowland areas, on the other hand, is different. Notice on the map on page 428 that a broad belt of plains (the llanos) divides the highlands of Venezuela into a northern and a southern belt. The southern, or Guiana, highlands, which lie south of the Orinoco River, are little known and little used lands of dense tropical rain forests and savannas. The llanos are



This map shows the four chief geographic regions of Venezuela.

chiefly grasslands, which support some cattle but which also are largely undeveloped.

Most of Venezuela's population of some $3\frac{1}{2}$ million and most of its industries are located north of the llanos. The northern, or Andean, highlands contain most of the mining, agricultural, and manufacturing developments of the country, and most of the large cities. The hot Maracaibo lowlands, however, contain the country's most valuable single resource. Peru, Colombia, and Venezuela are blessed among South American lands in possessing considerable reserves of that lifeblood of modern civilization, petroleum. Venezuela, most lavishly endowed of the three republics in this regard, stands third among the oil-producing countries of the world (the United States stands first, the Soviet Union second). The bulk of the oil of Venezuela comes from fields along the shores of Lake Maracaibo.

Through its oil Venezuela has become closely associated economically with the great industrial nations of the Northern Hemisphere. Through its location on the Caribbean Sea it has become closely related to those nations politically. Venezuela and the other countries of the Caribbean coast of South America make up the southern wall of the vital zone of Pan-American defense round the Panama Canal.

Round the shores of Lake Maracaibo, Venezuela, are some of the world's most productive oil fields.

C.I.A.A. Photo

This zone has become so important to the welfare of the United States that the Caribbean republics of South and Central America have become geopolitically practically part of the United States. In the next chapter we shall look at this zone in detail.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. The people of Latin America, like the people of Canada, are closely united with the people of the United States by bonds of common culture and traditions.

2. Latin Americans are so called because they write and speak Latin.

3. Most of the Latin American republics joined the side of the United Nations during the Second World War because they have never had very strong political, economic, or sentimental ties with European nations.

4. Argentina and the United States are similar because in both countries the natural resources favor large-scale manufacture.

5. Argentina does not have a large population, because the country is not sufficiently rich in natural resources to support many people.

6. Patagonia is the only other region in Argentina that approaches the Pampa in the production of grain.

7. Paraguay and Uruguay are usually associated in our thinking about South America because they are similar in most respects.

8. Bolivia must import much of its food from other countries because nearly all Bolivians are engaged in mining.

9. The nitrate deposits of Chile are the sole basis for the future prosperity of that country.

10. Amazonia is the largest and most valuable part of Brazil.

11. Though a giant in area, Brazil is a weak power because it lacks rich natural resources.

12. The agricultural products of Brazil and the United States are much the same because both countries are in the temperate zone.

13. Most Peruvians live in the highlands because of the unhealthful humid climate in the lowlands bordering the Pacific coast.

14. Ecuador will not always be a backward country, because someday it will develop its rich mineral deposits.

15. Colombia is a backward country because coffee is its only surplus product and Colombian coffee cannot compete in the markets of the world with the coffee which is exported from Brazil.

16. Though a minor producer of petroleum, Venezuela has been slow to develop because of its remoteness from the great world markets for petroleum.

QUESTIONS FOR DISCUSSION

1. What would you say are the chief reasons why the people of North and South America should strive to make the Good Neighbor Policy work?

2. Do you believe that Argentina and the United States have any real basis for economic and political coöperation? If so, what are the chief geographic factors that favor such coöperation?

3. Would you say that the large size of Brazil is likely to be more a help or a handicap in the future development of that country?

4. If you were to move to a South American city, which one would you choose for its climate? Which one would you choose for its industrial opportunities?

5. If all trade between the United States and South America should stop, do you think that you would personally feel the effects? If so, in what way should you feel them?

THINGS TO DO

1. Go to your public library and look up back numbers of your local newspaper (or of *Time* or *News Week* magazine) for the summer of 1940. Read the articles about the Pan-American Conference at Havana and write a report on the chief events which occurred at that conference.

2. With the help of this book and a good modern atlas and almanac, draw up a table of comparisons of the chief elements in the geog-

raphy of Argentina and Brazil. Your table should contain the following headings: (*a*) location and area; (*b*) climate and land forms; (*c*) number and types of people; (*d*) agricultural resources and developments; (*e*) mining resources and developments; (*f*) manufacture; (*g*) foreign trade.

3. Read up on quebracho wood and on the commercial use of tannic acid, which is derived from this wood. Write a report for your class on the commercial importance of the South American quebracho industry.

4. Write a general report on the transportation facilities in South America with the help of the maps on pages 275, 411, and 422. Your report should include the following topics: (*a*) railroad development, including a list of the regions which have the best-developed railroad transportation and a list of the regions which have little or no railroad transportation; (*b*) river transportation; (*c*) airlines; (*d*) ocean ports, including a comparison between ports on the east coast and those on the west coast.

5. Two of the diseases which are most common in South America are yellow fever and hookworm disease. See how much you can find out about these diseases, and write a report on their distribution, causes, effects, and methods of control.

6. On an outline map of South America and with the help of the map on page 407, sketch in the boundaries and locate the capital cities of the South American republics. Then on another outline map of South America do the same thing again, but this time entirely from memory. Compare your two maps and make whatever corrections are necessary in your second map.

BOOKS TO READ

1. Books which deal with or touch upon the human geography of South America are produced in a steady flow, but they quickly become out of date because of the rapidity with which the human geography of that continent changes. *South America*, by CLARENCE F. JONES, is a standard and readable reference book on the general geography of South America, but its statistical information is not in all cases up to date. You will find in the back numbers of the *Geographical Review* for recent years many splendid articles on various phases of the human geography of South America.

2. *The New World Guides to the Latin American Republics*, sponsored by the office of the United States Coordinator of Inter-American Affairs and edited by EARL P. HANSON, contain much valuable up-to-date and interesting information on the various Latin American countries. Volume 2 of this series is particularly rich in information of a geographic nature. *The Face of South America*, by JOHN L. RICH, is an interesting and informative collection of aerial photographs, which will give you a good idea of what you would see if you made a circuit of South America by airplane. *Peru from the Air*, by G. R. JOHNSON, is a similar book of more restricted range.

3. The geography of the South American republics has attracted the eyes of competent observers and the pens of competent writers who are not professional geographers. Among the best and most interesting books produced by such people are the following, all published since 1940: *South American Journey*, by WALDO FRANK; *Meet the South Americans*, by CARL CROW; *Inside Latin America*, by JOHN GUNTHER; *Chile*, by ERNA FERGUSSON; *Brazil, Land of the Future*, by STEFAN ZWEIG; *Ecuador*, by ALBERT B. FRANKLIN; and *Colombia, Gateway to South America*, by KATHLEEN ROMOLI.

4. Perhaps the most pleasant way of absorbing some of the geography of South America is to read the South American stories of W. H. HUDSON and ROBERT B. CUNNINGHAME GRAHAM. *The Purple Land*, by HUDSON, and *Rodeo*, by CUNNINGHAME GRAHAM, contain descriptions of South American lands and people which have never been excelled in vividness and beauty.

XXII · THE UNITED STATES AND ITS NEIGHBORS

THE GEOPOLITICAL DEVELOPMENT OF THE UNITED STATES

Importance of the United States. All through this book we have emphasized the geography of the United States over that of any other region. We have done so partly because the United States is the homeland of most of the readers of this book and partly because the United States exerts an extremely important influence on the world as a whole. We have already seen that the United States is richer than any other country, except possibly the Soviet Union, in the elements of geopolitical strength. We have seen that it is blessed with almost all the natural resources which a modern industrial nation needs. We have seen that it contains a variety of stimulating climates and over 131 million energetic people. These people have undergone a very great geopolitical growth in a very short period of time. Let us in this chapter try to discover what that growth has come to mean for them and for the other peoples of the earth.

Growth of the United States. In 1789 George Washington became the first President of a little nation which was soon to become the strongest power in America and one of the strongest powers in the entire world. A few more than 150 years have passed since then. During much of that time the people of this nation were too busy exploring and developing their own country to be much concerned with the behavior of the other peoples of the earth. The nations of Europe, Asia, and Africa seemed to belong to another world.

When George Washington was a boy, however, everybody in both North and South America was concerned with the behavior of the nations across the seas. The map on this page will show you why. Notice that all the explored parts of America were divided among several European nations. When George Washington was a boy, America was merely a grab bag for European nations that wanted to extend their empires overseas. Four European nations—Great Britain, France, Spain, and Portugal—had grabbed practically all North and South America.

The story of the early growth of the United States is the story of the people who came to live in the narrow strip of British territory on the Atlantic coast of North America. Two important facts, one chiefly social and the other chiefly geographic, made the story possible.

1. The settlers in the thirteen British colonies which ultimately broke away from the mother country were not weak people;

When George Washington was a boy, four European nations owned nearly all America.

they were energetic, intelligent, independent, and ambitious. In time they came to need less and less the guidance of Great Britain, and to resent more and more the limitations on their independence which this guidance imposed. When, after the middle of the eighteenth century, these colonists came rather generally to believe that they were being governed unfairly, they turned their abundant energy to the establishment of an independent national government.

2. Behind the thirteen colonies was a great land with very few inhabitants. Ahead of the people was an opportunity to grow which few nations on earth have ever had.

The United States, as we know it today, began as the result of these two facts. Its early growth was naturally toward the west. British colonists were strongly established in Canada on the north. Spanish colonists were strongly established in Mexico on the south. Between the Mississippi River and the Rocky Mountains lay the lands which France had explored but which it was finding hard to develop and to hold. In 1803 the United States bought a large part of these lands in the famous Louisiana Purchase. This territory ran from what is now the state of Louisiana on the south all the way to what is now Montana on the north. It contained some of the richest agricultural lands on earth.

Spain, Mexico, Great Britain, and Russia, like France, gave way to the push of the strong young nation on the east. In 1819 the United States bought Florida from Spain, and so extended its boundaries to the Gulf of Mexico on the southeast. In 1845 it added Texas and adjoining territory in New Mexico, Colorado, and Wyoming which had broken away from Mexico, and so extended its boundaries to the Rio Grande on the southwest. In 1846, through a treaty with Great Britain, the steadily expanding United States annexed Washington, Oregon, Idaho, and parts of

This map shows how the United States grew from east to west.

This map shows the territory under the control of the United States at the start of the Second World War.

Montana and Wyoming. In 1848 and again in 1853 Mexico yielded territory which is now California, Nevada, Utah, Arizona, and western Colorado and New Mexico. In 1867 the United States bought Alaska from Russia, and so extended itself to within about 50 miles of Asia. The strong young nation on the east had pushed to the Pacific and Arctic oceans.

The early growth of the United States, like the growth of Russia, was over the land. Its later growth, like the growth of England and Japan, was over the sea. In 1898, after the war with Spain, it added the Hawaiian Islands, with their rich tropical plantations and their harbors where the ships of many nations met. Also in 1898 the United States took under its protection the former Spanish possessions of the Philippines, Guam, and Puerto Rico. It also annexed Wake and Midway Islands, and in the following year the eastern Samoan Islands. Later it acquired from Panama a permanent lease on the Canal Zone, and bought the Virgin Islands from Denmark. By the beginning of the Second World War, the United States had grown into one of the largest, richest, and strongest nations on earth. The territory under its control at that time is shown on the map above.

The United States and foreign nations. The European people who first settled in the United States were glad to leave Europe behind them. They were glad to build a new nation in a new world which would be free from the fears, jealousies, and hatreds of the Old World. As the young United States grew stronger and larger, it did more than drive out the influence of foreign nations from its own territory. In the famous Monroe Doctrine of 1823, it warned foreign nations to stay out of the affairs and the territory of *all American nations*. This doctrine, though greatly modified by time, has been the policy of the United States government ever since.

It was not possible, however, to shut out foreign nations completely. As the United States developed its rich natural resources, it found that it owned more things than it could possibly use. The United States began selling its farm products to foreign nations, and foreign nations began selling their manufactured goods to the United States. When, later, the United States became great in manufacture as well as in agriculture, it sold less food but more manufactured goods abroad. It bought increasing amounts of such commodities as rubber, tin, and silk, which it could not produce at home.

The Panama Canal is vital to the defense and the development of the United States.

Do you see, then, that the United States broke its ties with the Old World only to build up new ties later on? It, as well as all other nations of North and South America, discovered the facts which make up so large a part of the subject matter of this book. It discovered that all modern nations are tied together in a network of trade, transportation, and communication; that no nation can live by and for itself alone.

Defense of the United States. As we have seen in the earlier chapters of this unit, war is the price which nations have paid in the past for territorial and commercial expansion. Though much of the territorial expansion of the United States was achieved through purchase, not a little of it was achieved through war with Britain, Mexico, and Spain. In the beginning the commercial expansion of the United States was for the most part peaceful; more recently commercial expansion played a role, though probably a minor one, in involving the United States in two world wars.

The war of 1898 between the United States and Spain was a minor war in terms of fighting but a major war in terms of geopolitical consequences. That war was decided by naval action off the Philippine Islands, several thousand miles away from the home territory of the United States. It proved that 3000 miles of ocean on the east and 7000 miles of ocean on the west were no guarantee that the United States would avoid wars with the nations which lay beyond these oceans.

The Spanish-American War, combined with the persuasive arguments of Admiral Alfred T. Mahan and the vigorous actions of President Theodore Roosevelt, gave rise to the modern policy of United States defense. The core of this policy is the belief that the zone of defense should not stop at the coastlines of the United States but should extend far out to sea beyond those coastlines in the direction from which an enemy fleet might advance. This policy holds that the United States must possess strong bases beyond the territorial limits of the United States proper, and a strong fleet to protect these bases. It holds that only in this way can the United States be defended against invasion; that only in this way can its overseas trade be safeguarded against blockade in time of war and against unfair competition from other nations in time of peace.

Since the adoption of this general policy of defense the government of the United States has applied it in a variety of ways and with varying degrees of enthusiasm. Under the leadership of Theodore Roosevelt the United States fleet was greatly enlarged; the Panama Canal was built to shorten commercial routes and to enable the fleet to move quickly from one side of the country to the other. For decades, however, the United States thought of its fleet chiefly as a means of defense against Japan in the Pacific. It thought of the friendly British fleet as its chief defense against possible enemies in the Atlantic. It never had a navy that could fight a strong war in both the Pacific and the Atlantic oceans at once until 1944—more than two years after it had begun to wage such a war.

The reasons for this lag in the defense of the United States are rooted in the fact that geography is a living thing which may change more rapidly than men change their ideas about it. In Chapter I we saw how Americans long thought of America as it appears on a Mercator map, separated from the rest of the world by wide stretches of ocean. This view of America comes down from the days when ships were the only means of getting across the oceans, and when the time distance between America and the rest of the world was great.

In Chapter XVIII we saw how certain Europeans looked at the map of the world in a somewhat different way. They saw Europe, Asia, and Africa as one great land mass, which they called the World-Island, with America as only an outer island, far from the center of things. This view was the result of the First World War, when Germany first tried to prove that the nation which controlled the lands of continental Eurasia could also control the world. Though Germany failed to prove this, its failure only led to bigger dreams of the same kind. In these dreams America still lay off in the background, far from the center of things.

Both these ways of looking at the map of the world are old-fashioned. One way gives too much importance to the sea; the other way gives too much importance to the land. Neither way gives enough importance to the air. The modern airplane rises above many of the limitations of both sea and land transportation; it can follow the shortest route between two distant places on the surface of the globe. Today no point in the United States is more than 60 hours of flying time from any other point on earth. When that flying time is conceived in terms of enemy bombers, the United States seems very close indeed to the rest of the world.

One good way of getting an idea of the air distance between the United States and its neighbors on other continents is to study the polar map on page 9. By looking at the United States as if you were perched somewhere high above the north pole, you can see that it occupies no lonely island far from the center of things. You can see that it is part of the great cluster of lands surrounding the Arctic Ocean.

It is in this way that the men who planned the war strategy of the United States in the Second World War looked at their country on the map of the world. They knew that the modern airplane had brought the enemies of the United States very close, and closest on the north where the major land masses of the earth come together. Because of this fact of modern geography, Greenland, Iceland, Alaska, and the Aleutian Islands had become very important to the safety of the United States. They had become stepping stones on the shortest

Defense of the United States during the Second World War meant defense of all America.

Variety in land and climate is reflected in Mexico's products.

path between that country and its enemies abroad. One of the first needs of United States defense was obviously to keep these places under United States control.

The defense of the United States thus means far more than the defense of the United States alone. It means the defense of all areas where an enemy might get a foothold for the invasion of the United States. It means, in short, the defense of all America.

Pan-American defenses do not stop in the arctic regions, nor are they concerned only with possible attacks by air. From one end of America to the other, outposts of defense were set up wherever they were needed during the Second World War. (See the map on page 436.) Notice how many of them cluster round the east side of the Panama Canal, which is much nearer to enemy bases than the west side. Since the United States must be prepared to fight in both the Atlantic and Pacific oceans, the Panama Canal is the most important link in the chain of its strategic sea routes. The Latin American countries which bridge the gap between North and South America are vital links in the chain of its defenses. Let us examine these countries and their relationship to the United States.

THE UNITED STATES AND ITS NEAR NEIGHBORS

Mexico. The United States and Mexico share a boundary of some 1600 miles. For many decades the relationship between these next-door neighbors was anything but neighborly. Yet even before the Second World War, the United States and Mexico were beginning to realize that they had several good geographic reasons for co-operating with each other. Some of the best of these reasons are economic. The United States needs many of the raw materials of Mexico, and Mexico needs many of the manufactured articles of the United States.

Though Mexico is physically a part of North America, it is culturally more closely related to the South American countries

DRAWN BY RICHARD EDES HARRISON 1944 OBLIQUE CONIC CONFORMAL PROJECTION COURTESY OF AMERICAN GEOGRAPHICAL SOCIETY than to the United States and Canada. Like most South American countries, Mexico was colonized chiefly by Spaniards who were searching for mineral wealth. Like most South American countries, Mexico contains a large population of Indians and mestizos (about 85 per cent of the total), who have been held down and exploited by the ruling white people of European descent. Since the peasant revolution and reforms of the last thirty-five years, however, general social conditions in Mexico have improved.

Like most South American countries, Mexico is a land of many contrasts. Earlier in this book we saw how the subtropical deserts and steppes of western United States continue unbroken onto the Mexican Plateau. (See the maps on pages 70–71 and 100.) On the broad northern part of this plateau, 4000 feet above the sea, herding and mining are the chief occupations. The lofty mountains that flank the Mexican Plateau on either side yield forest products and minerals; the irrigated lands at the base of the mountains yield an increasing amount of farm products. (Reread page 105, in Chapter VI.)

Southward the Mexican Plateau narrows between its flanking mountain ranges and at the same time rises to an elevation of about 8000 feet. This gain in elevation southward offsets the disadvantages of its low latitude location, with the result that southward its climate grows wetter, cooler, and consequently more suitable for a variety of human activities. Here on the southern part of the plateau, more than half the total of some 20 million Mexicans live, with the highest densities of population in and near Mexico City. Here are raised most of the corn and beans on which most Mexicans chiefly depend for nourishment; nearby mountains yield much of the silver, gold, lead, zinc, and copper which make up Mexico's leading exports. Across the mountains on the coastal lowlands to the southeast are the oil fields which have placed

James Sawders

These miners are loading silver ore in cars at the shaft of a mine on the Mexican Plateau

Mexico among the world's leading producers of this mineral. These lowlands also yield cacao, bananas, sisal (a fiber for making rope), chicle (the basis of chewing gum), and other tropical products. Coffee, tobacco, other farm products and forest products are exported from the higher lands of southwestern Mexico.

Like many other Latin American countries, Mexico has long had a reputation for great natural wealth. Unfortunately, the traditional wealth of Mexico consists largely of minerals, resources which sooner or later will be exhausted. The Mexican people as a whole have not profited much from this mineral wealth; their standard of living has been and still is extremely low. With so much of Mexico given over to deserts, mountains, and unhealthful tropical lowlands, good farming and grazing lands are severely limited. Manufacture, on the other hand, should enjoy a considerable development in the future because Mexico contains some coal and iron ore and abundant water power. But only through stable and enlightened government, through scientific development of the land, and through friendly coöperation with its powerful neighbor on the north can Mexico hope to raise the standard of living of its rapidly increasing peoples.

The Central American countries. Southeast of Mexico the isthmus of Central America connects the continents of North and South America. Here the coastal mountains of Mexico are squeezed together to make a single backbone of peaks, some of which rise to a height of 10,000 feet above sea level. Most of the fewer than 10 million people of this tropical belt live on the higher lands away from the hot and depressing coastlands. One little colony (British Honduras) and six little republics (Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica, and Panama) share an area which is considerably smaller than the state of Texas.

The population of these little countries varies from the pure-blooded Indians, who make up about two thirds of the people of Guatemala, through the mestizos, who make up an even larger proportion of the people of El Salvador and Nicaragua, to the pure whites of Spanish descent, who account for about 90 per cent of the population of Costa Rica. Though producing a variety of other tropical raw materials, Central America's chief contributions to world trade are coffee and bananas. Many of the commercial developments of this region—and many of the highways, railroads, and ships through which these developments are made possible—are in the hands of foreigners.

Like Mexico, the Central American republics have a long history of bad government. Oppression of the native Indians

Indians and people of mixed blood make up a large percentage of the population of all Central American countries except Costa Rica.

Photograph by Herbert C. Lanks


United Fruit Company

Central America produces more bananas than any other region on earth.

by the ruling minorities has led to countless revolutions. As late as the early 1920's, Honduras alone had 33 revolutions. Central American revolutions have generally succeeded only in destroying laws, establishing dictators, and paving the way for new abuses—and new revolutions.

On several occasions the United States has sent soldiers into these countries to preserve peace and to protect United States citizens and property. As a result, many people below the Rio Grande came to think of Uncle Sam as a hateful combination of policeman and tax-collector. Since 1933, however, the United States has not resorted to armed intervention in any Central American country. Since then, too, the native peoples of these countries have tended to rely more on arbitration than on arms as a means of settling their economic and political problems. They have shown a willingness to coöperate in the Good Neighbor Policy of the United States. The United States, for its part, has shown a willingness to restrain those of its citizens whose chief interest in Central America has been exploitation for selfish ends.

The Panama Canal. Economic welfare is not the only reason why the United States and its neighbors on the south should strive to be good neighbors. With the growing threat of the Second World War, fear of invasion from Europe, Africa, and Asia gripped all America and gave all American nations their strongest reason for coöperation. Since the defense of the long American coastlines depends first of all on sea power, the safety of all the American nations became chiefly the responsibility of the United States Navy, the only great navy in the Western Hemisphere. Since sea power depends no less on strategic bases than on warships, the United States strengthened its old bases and built many new ones along the coastlines of America. It gave particular attention to the bases that guard the approaches to that most vital link in hemisphere defense, the Panama Canal.

This famous canal, which cuts through the fifty-mile-wide Isthmus of Panama, has

Two zones of island defense bases guard the Caribbean approach to the Panama Canal.

been one of the chief means of developing trade between the peoples of North and South America. Through it the isolated peoples of western South America have found a practical way to the great markets of eastern North America. Through it the isolated peoples of western North America have found a way to the raw materials of eastern South America. Through it the vast markets and resources of East Asia were brought several thousand miles closer to the heart of America in eastern United States and Canada. Through it, in short, America was bound much more closely together in a variety of ways, and was brought much closer to the rest of the world. (See the map of ocean trade routes on page 282.)

It is obvious that the Panama Canal is vital to the welfare of America in both war and peace. By gaining control of it a powerful enemy could inflict a disastrous blow on American defense in time of war by reducing the flow of war materials between the countries of North and South America, by reducing the range and striking power of the United States fleet, and by gaining bases for air and naval operations against that fleet. In time of peace an unfriendly power in control of the Panama Canal could restrain the overseas commerce of every American nation.

To offset this dire threat the United States has made of the Caribbean Sea and its bordering lands one of the most strongly and cleverly fortified zones on earth. If you study the map on page 442, you will see that the defense of the Panama Canal is based on the traditional United States policy of stopping an enemy before he approaches very close. Pearl Harbor and the other island bases of the Pacific stand guard far out in the Pacific. On the Atlantic side, as you can see by the map, nature has supplied an arc of defense for the Panama Canal in the islands of the West Indies.

The West Indies. Though the tropical islands of the Caribbean Sea go by the general name of West Indies, they can be divided into two groups as outposts of defense for the Panama Canal. An inner chain of islands, known as the Greater Antilles, contains the four largest islands of the West Indies: Cuba, Jamaica, Hispaniola (which contains Haiti and the Dominican Republic), and Puerto Rico. An outer chain includes the Bahama Islands on the north and the several little island groups of the Lesser Antilles, which extend southwesterly almost to the coast of Venezuela and British Guiana.

Before the Second World War nearly all these islands were possessions of the United States and the United Kingdom; a few were controlled by France and the Netherlands; only Cuba, Haiti, and the Dominican Republic were independent. The United States had leased Guantanamo Bay from Cuba, and had built the naval base which has since become the nerve center of Caribbean defense. As war drew closer to America the United States leased from the British the sites for many new Caribbean bases. These bases reach from the Bahamas on the north to Trinidad on the south.

As we have said, and as you can see on the map on page 442, these Caribbean bases make two arcs of defense for the Panama Canal. The bases on the outer arc are chiefly patrol bases, from which planes and small boats can range far out into the Atlantic Ocean in search of the enemy. The bases on the inner arc contain great fueling and repair stations, and they harbor the great batteries of airplanes and warships which guard the approaches to the Panama Canal.

All the islands of the Caribbean Sea and

San Juan, Puerto Rico, with its sheltered harbor and strategic location, is one of the important links in Pan-American defense.

By Ewing Galloway, N.Y.

Pan American Airways System

Though small in area, Cuba leads the world in the production of high-grade sugar.

all the mainland areas of North, Central, and South America which touch that sea make up a zone of defense which is under the control of the United States. They also make up a zone of considerable but only partly developed riches. The West Indies provide the United States with its nearest possible source of tropical raw materials; Cuba already produces much of the sugar and cigar tobacco which are used in this country. Aside from Cuba, however, the natural wealth of the West Indies has scarcely been touched. In return for making use of the military and economic resources of these islands, the United States is pledged by the Good Neighbor Policy to do what it can to raise the standard of living of their people.

Neighbors on the north. In Chapter XVII we saw that the United States and Canada have long been united by strong physical, cultural, and economic bonds. The Second World War added a strong military bond to the union of these two countries. As we saw earlier in this chapter, the shortest routes between the United States and its enemies in Europe and Asia follow great circle courses across the high latitude regions of the globe. Little had been done before the Second World War to build strong outposts of defense along these routes; the defensive strategy of the United States had been developed in terms of traditional middle latitude ship routes.

As the war drew closer, however, the United States realized that its great naval base at Pearl Harbor in the Central Pacific would be of little use against an enemy who chose to advance by boat and airplane along the land borders of the North Pacific. It realized that it had no defense at all against an enemy advancing in similar fashion along the land borders of the North Atlantic. To overcome these grave weaknesses the United States built a string of high latitude naval and air bases in Alaska as far west as Dutch Harbor in the Aleutian Islands. It built another string of bases in Iceland, Greenland, Labrador, and Newfoundland. (See the map on page 436.) Since the way to these bases lay across or close to Canadian territory, the United States entered into the closest military coöperation with that country. The Alaska Highway across Canada, pictured below, is one of many examples of this coöperation.

The high latitude outposts of American defense are not merely outposts of defense. They are also signposts to the future. They are supply and fueling stations along the shortest routes between North America and the great centers of population in Eastern Asia and Western Europe. As such they are destined to become of increasing commercial importance as the airplane becomes increasingly efficient as a carrier of passengers and goods. And as these high latitude bases of defense and trade grow in importance, the bonds between the United States and its neighbors on the north will inevitably grow in strength.

THE UNITED STATES AND THE WORLD AT LARGE

The fruits of victory. Through its far-flung system of defense the United States was able to avoid becoming a battlefield during the Second World War. It was able to turn itself not only into a mighty fortress for the defense of its people, but also into a mighty arsenal for offense against its enemies. Its great industries, on which enemy bombs could not readily be dropped, grew vastly greater as the war progressed. By 1944 these industries were producing more guns, tanks, airplanes, ships, and other machinery of modern warfare than were the industries of all the enemies of the United Nations combined. By 1944 it was clear that the products of United States factories, combined with the food from United States farms and the fighting men from United States homes, would ensure the victory of the United Nations.

Victory in war, however, brings more than glory; it also brings problems and

Wild rivers, high mountains, and seemingly bottomless swamplands had to be conquered by the builders of the Alaska Highway, first land link between the United States and Alaska.

From Ewing Galloway

Courtesy of Bethlehem Steel Company

The U.S.S. "Hancock," launched at the Quincy Yard of the Bethlehem Steel Company in 1944, was one of the many warships built in the United States during the Second World War.

responsibilities. Long before the end of actual fighting was in sight, it was obvious that the United States would emerge from the Second World War the strongest geopolitical power on earth. It was obvious that its farms, mines, smelters, mills, and factories would be the most productive on earth; that its air and sea power would be without a rival.

But even before this became obvious it was obvious that a strong and healthy United States could not remain strong and healthy if other nations were weak and ill. The United States had tried to shut itself away from the troubles of the world at large after the First World War, but those troubles had overtaken it in a few years in the form of the much more terrible Second World War. Is it not clear, then, that from a purely practical point of view the United States should try to use its vast power to avoid a Third World War, which might be even more terrible than the first two world wars combined? But where can the wisdom which is necessary for avoiding future wars be found in a world which past wars have clouded with selfishness, hate, and confusion?

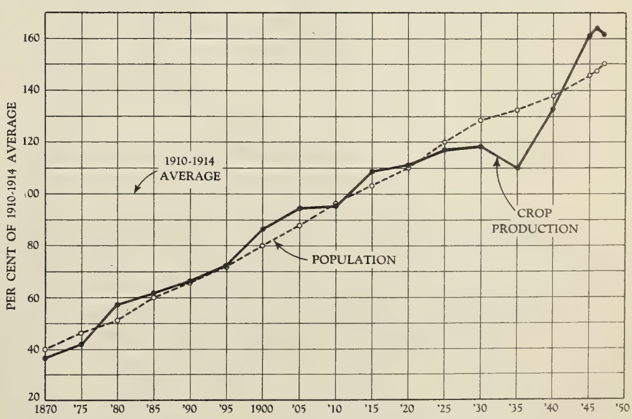
The problems of the United States. Before a nation can act wisely on a problem it is necessary to know exactly what the problem is. It requires no special wisdom to realize that some of the most critical problems of the United States have to do with conditions inside its own borders. Long before the end of the Second World War was in sight people in the United States were asking questions of themselves. What will happen to our millions of fighting men when they return home from the battlefields after the battles are over? What will happen to our thousands of war plants when materials of war are no longer needed? How shall we pay for the staggering destruction of wealth which the war will have caused? How can a government grown tremendously strong under the emergency of war be prevented from killing the very individual freedom for which individuals have fought and died? How can we hope to have both individual freedom and the economic security which a strong centralized government is able to provide for the people of a nation as a whole?

There are no easy answers to these questions, as postwar events have proved. The geographer can only point out that underneath all the domestic problems of any nation lie the fundamental relationships between men and the earth. He can only point out that the natural resources of a nation are the foundation of its welfare, wealth, and power; that if these fail no amount of law and government planning can succeed. Many of the problems of the United States are rooted in the fact that in the past its people have wasted every kind of natural resource, and have yet to develop a highly efficient system of distributing the benefits of the natural resources.

Though the United States is a symbol of wealth all over the world, it is not so rich as its reputation would suggest. The map on page 216 shows areas in the United States abused by improper use. It will help to explain parts of the graph at the right, which shows that production of food in the United States did not keep up with the gain in population from 1920 to 1940. Although food production now surpasses the gain in population, improved production methods and favorable weather have largely made this possible. Some of the recent gain in food production has come from once again using land unsuited to agriculture. Constant attention needs to be given to the improvements of farm production methods and land conservation.

Other graphs could be introduced which would show similar trends in regard to other natural resources. Recent history can supply examples of the results. Waste of natural resources and faulty distribution of national wealth partly underlay the depression of the early 1930's. From 1933 until the outbreak of the Second World War, an average of some 20 million United States citizens were receiving either relief or employment from the Federal government. With the booming of industry by the war, jobs were available to all who could work, just as they had been during the First World War. But war jobs, like government jobs and relief, must be paid for chiefly by borrowing from future generations. Though the United States has won its wars and maintained the highest standard of living of all the nations in the world, it has had to go deeply into debt to do so.

Waste of resources and faulty distribution of commodities inside the United States are, of course, not wholly responsible for this condition. Some of the most baffling problems of the United States lie outside the field of geography. Some of them lie in



Notice that between 1920 and 1940 crop production in the United States failed to keep pace with population.

large part outside the borders of the country. The bitter experiences of the past few decades have proved that no nation can enjoy peace and prosperity if other nations are suffering poverty and war.

The United States and all other nations have reached a turning point in history. Economic and political growth through the exploitation and conquest of new lands and resources is no longer generally possible. People and nations generally must learn to work with the lands and the resources which they now possess. They must learn to seek peace and prosperity through coöperation rather than conflict. If geography teaches anything it teaches that peace and prosperity cannot possibly be gained in any other way.

The road to peace and prosperity. Lasting peace cannot come only through ridding the world of aggressors. The basic causes of aggression must also be destroyed. Of all the four freedoms of the Atlantic Charter, freedom from want is perhaps the one which all people desire and need the most. No other freedom would be worth much to people who were starving for lack of food or freezing for lack of houses and warm clothing. *Modern science and invention have furnished the tools for producing more than enough of the necessities of life for all the people on earth.* One of the chief problems of the future will be to see that all the people get them.

This brings us again to the great truth which we have mentioned so many times in this book, the truth which makes possible both global war and global peace. Modern trade, transportation, and communication are the blood streams of world life. The Axis nations, realizing this truth, thought that they could control the world for their own selfish good by seizing control of these blood streams. If lasting peace is ever to come to the world, ways must be found for keeping any nation or nations from ever trying to do this again. If lasting prosperity is ever to come to the world, ways must be found for making the blood streams of the world bring nourishment to all parts of it. Unless all parts are well nourished, no part can be really healthy.

To achieve this goal, each nation will have to have access to the raw materials and markets which it needs for the development of its industries and trade. No nation can be prosperous unless it can produce surplus commodities and sell them to other nations. The only way the other nations can pay for these commodities is by selling their own surplus commodities. In an economically healthy world the value of the exports of each nation will balance the value of the imports.

Unfortunately, no such ideal balance has ever existed. Differences in the resources of countries, and in the energy and point of view of their peoples, have led to great national differences in agricultural and commercial production. These differences in turn have led to great national differences in the standard of living of the people. Countries with low standards of living can produce goods more cheaply than countries with high standards of living because the people are paid less for their labor. In the past, the United States and other highly developed countries have tried to safeguard their high standards of living by preventing the importation of such of these low cost goods as would compete with similar goods produced at much higher cost at home.

This policy has worked poorly because it has flooded the highly developed countries with surplus goods which could not be sold, while retarding the industrial development of the backward countries. The people of the United States are just beginning to realize that if they are to win general prosperity through the sale of their surplus products, they must help to make it possible for other countries to do the same. They are just beginning to learn that they cannot have good customers unless they themselves are good customers.

Europe, though torn by war, is still the greatest market for the surplus products of

Philip Gendreau, N.Y.

The Statue of Liberty in New York Harbor symbolizes the spirit of the United States.

the United States. It is therefore only good business for the United States to help Europe to heal the wounds of war through profitable trade. And Europe is not the only region whose future welfare is vitally linked with the future welfare of the United States. About one third of all the people on earth live in India and China. These people are slowly rebelling against the unspeakable poverty in which they have so long lived. They will become an increasingly rich market for United States exports if the United States uses its tremendous power to improve the standards of living—and with it the buying power—of these countries through coöperative trade agreements.

The problem of world coöperation. Modern geography has thus made the great problems of the future group problems rather than individual problems. Men or nations working as individuals cannot solve them. Neither can men or nations *thinking* as individuals solve them. If the great problems of the future are to be solved, nations must be willing to make certain changes in their old habits of acting and thinking. The hardest change will be the giving up of some of the "rights" which nations have come to consider natural. In a game of baseball no player can bat all the time. Every player must do many things for the good of the team as a whole, whether he especially enjoys doing them or not. Nations must play the game of modern life the same way if the game is to mean anything for any of them.

If we are to be free from fear and want we must also be free from selfishness. If order and prosperity are to come to all the world, there must be some sort of union of all the nations with power to preserve the order and to promote the prosperity. This will mean that all nations must give up some of their rights in order to escape the wrongs which have threatened to destroy civilization. Two world wars and a world depression should be enough to prove that the old system of each nation for itself will not work.

But neither will a system work which grinds all personal liberty under the heel of a too powerful central government. The hardships and misery of the people in the aggressor nations should be enough to prove that. The great problems of the future are group problems, but the needs of individual men and women must be the guide to their solution. Any government that neglects these needs is a tyrant, and bound to fall as tyrants have always fallen. Nobody knows exactly how an ordered world of free people will be built on the ashes of the Second World War, but the people of the United Nations have faith that it can be built. It is because of this faith that they have fought and died.

So we leave this book on world geography only partly written. You who will make the world of tomorrow must continue the writing with your lives.

CORRECT THESE STATEMENTS

The following statements are wholly or partially false. Correct them and explain or discuss your corrections.

1. The United States has been a strong power since the beginning of its history because European nations have never interfered with its growth.

2. The United States is in an ideal location to pursue a foreign policy of isolation.

3. Almost all the territorial and economic expansion of the United States has been accomplished by peaceful methods.

4. A proper program for the defense of the United States should be limited to the defense of its borders.

5. The relations between Mexico and the United States have not always been friendly, because these two countries compete with each other in international trade.

6. Mexico is a land of little promise for future development because it lacks fuel and power for the development of manufacturing industries.

7. Because the people of Central America are not capable of good government, their affairs should be controlled by the United States.

8. The sole purpose of the Panama Canal is to enable the United States Navy to move rapidly from the Atlantic Ocean to the Pacific Ocean.

9. All the islands of the West Indies belong to Great Britain and the United States.

10. The bonds between the United States and Canada will grow weaker in the future when world peace will make high latitude routes of travel unnecessary.

11. The United States has almost unlimited wealth and need not worry about maintaining the high standard of living which its people have always enjoyed.

12. Geography teaches us that periodic wars are needed to prevent the increase of human beings beyond the power of the earth to feed them.

13. If international trade is to be healtny in the future, each country should try to sell as much of its own surpluses and to buy as little of the surpluses of other countries as is possible.

QUESTIONS FOR DISCUSSION

1. The Americas are sometimes divided into Anglo-America, Spanish-America, and Portuguese-America. What countries do you think each of these divisions includes?

2. Why did European people come to the United States chiefly to make homes rather than to exploit the country, as they did in most of Africa and much of South America?

3. What in your opinion are the chief reasons for the traditional bad government of most of the republics of Central America? What in your opinion are the best ways for these republics to get better government?

4. What in your opinion are the chief ways in which the Panama Canal has affected the development of the United States?

5. What do you think are the most important world responsibilities of the United States at the present time?

THINGS TO DO

1. Divide your class into committees to look up and report on the following extensions of United States territory:

a. The Louisiana Purchase, of 1803.
b. The Florida Cession, of 1819.
c. The Texas Annexation, of 1845.
d. The Oregon Cession, of 1846.
e. The Mexican Cession, of 1848 and the Gadsden Purchase, of 1853.
f. The Purchase of Alaska, in 1867.
g. Territories gained in the Spanish-American War.
h. The Panama Canal.

2. Study the map on page 436. Keeping in mind the methods of modern warfare, and especially the use and probable development of the airplane, make a list of the places where you think the chief future defense bases of the United States should be located and give the reasons for your selections.

3. Appoint or elect two people who will be commanding generals in the following war game, which can be conducted in the classroom. Assume that there is an invasion of the United States by an enemy force from Europe. One general is in command of the invaders, and the other general commands the defending army in the United States. Each general should choose a small staff who will act as advisers. The rest of the class should act as critics.

The movement of the invading and defending armies should be recorded on a wall outline map of the United States. If no map of this kind is available one can be drawn on the blackboard. The invasion should be conducted on a reasonable geographic basis. The two armies should be permitted to use any amount of men and materials which are available to them. Reasons should be given for each move which either general makes. Both generals should take into consideration all the geographic factors involved. The critics should judge them on the basis of how well they use their geographic advantages and how well they overcome their geographic disadvantages.

4. Read up and report on the Alaska Highway, which has been built across Canada to Alaska.

5. Organize a forum on geography and world problems. Such a forum can be a group project, a class project, or part of a project for the entire school. There are several ways of carrying out such a project. There can be (*a*) a series of talks or debates by the class. There can be (*b*) a series of public round-table discussions. Members of the geography class can be selected to act as representatives of various nations and to give the points of view of those nations. There certainly should be (*c*) a series of exhibits. These exhibits should consist chiefly of maps which have been made by members of the geography class. They should also include pictures of various people, different countries, methods of transportation, products, etc.

Committees should be appointed to make plans and arrangements for the forum, and every member of the class should take part in the program. The general topics should be chosen by the class and the teacher; the following are a few of the many important topics which might be discussed. All should be discussed mainly from a geographic point of view.

a. The causes of war and the methods of preventing it.

b. The geographic factors which cause a nation to be powerful.

c. The pressure of increasing populations on national behavior.

d. The problems of small nations.

e. The distribution and conservation of natural resources.

f. The United States in the world of the future.

BOOKS TO READ

1. Among many interesting books on the nearer Latin American neighbors of the United States, *The Caribbean Danger Zone*, by J. Fred Rippy, and *Mexico*, by Stuart Chase, are outstanding for their readability, authenticity, and emphasis on geography. *Here Is Alaska*, by Evelyn Stefansson, is one of the most up-to-date and best illustrated books on the largest United States possession.

2. *America as Americans See It*, edited by Frederick J. Ringel, is a collection of articles and pictures by many prominent North American writers and painters. Though chiefly concerned with the purely cultural aspects of modern life in the United States, this entertaining book does not neglect the geographic aspects. Among the many books that deal with one phase or another of North American geography which we have already recommended, *North America*, by J. Russell Smith and M. Ogden Phillips, offers just as excellent supplementary reading for this chapter as for earlier chapters of this book.

3. The serious postwar problems of the United States are discussed in a stimulating manner by Stuart Chase in *The Road We Are Traveling*. *America's Strategy in World Politics*, by Nicholas J. Spykman, is perhaps the most comprehensive book by a geographer on the geopolitical relationships between the United States and the rest of the world. *America and the Race for World Dominion*, by Albert Demangeon, is an older but still pertinent work on the same subject.

THE EARTH GRID AND ITS USES

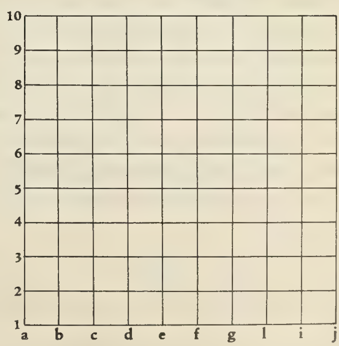
The importance of maps. A carpenter uses saws, hammers, and planes in building a house. A geographer uses certain methods and devices in building knowledge of the earth and man. These methods and devices are the tools which a geographer uses much as a carpenter uses his saws, hammers, and planes. Among the tools which the geographer uses, maps are by far the most important. The purpose of the following pages is to describe the types of maps which the geographer finds most useful, and to show you how to use them in building your knowledge of world geography.

If you were going to drive your automobile to an unfamiliar town, you would consult a map. If you wanted to know the location of London and the distance to it, you would look for these facts on a map. If you were flying an airplane across the ocean, you would plot a path to your destination on a map, and you would keep a record on the map of where you were from time to time while you made your journey. Maps are essential tools for recording all sorts of information about the surface of the earth. A person who understands how to use maps has the power to bring any part of the world into his own home.

How to make a grid. One of the first purposes of a map is to enable a person to locate a place with reference to other places. The simplest method of doing this is by means of a device which is known as a grid. Some sort of grid forms the basis of every type of map. You can easily make a simple grid and learn how it works by following these directions.

Take two small unruled pieces of thin paper of the *same size.* Keep one piece yourself and give the other piece to another person. Place a small cross somewhere on your piece of paper away from the edges. Now tell the person with the other piece of paper, as best you can, where you have placed the cross. Do not let him see your piece of paper, but let him try to put a cross in the same spot on his paper. Then place the two papers together so that their edges are even, and hold them to the light. It is very doubtful that the two crosses will be in exactly the same position on both papers.

Now erase the cross on each piece of paper and draw lines a quarter-inch apart on both papers. One series of lines should be parallel to the top and bottom of the paper, the other series parallel to the sides. When the papers are properly ruled, they will be entirely divided into little squares which are a quarter-inch tall and a quarter-inch wide. Number the horizontal lines 1, 2, 3, etc., beginning at the lower left-hand corner and working upward. Letter the vertical lines *a*, *b*, *c*, etc., beginning at the lower left-hand corner and working to the right. When you have done this, the papers will resemble the illustration below.



Place a cross somewhere on your paper. Now tell the person with the other piece of paper where your cross is located, as "between 5 and 6 and between *c* and *d*." The other person will be able to place his cross in the same square on his paper with no difficulty. If you had made a sufficient number of lines on the paper, you could have told him *exactly* where your cross was located, and he could have put a cross in *exactly* the same position on his paper. *Such a series of cross lines which is used for the location of anything is called a grid.*

The earth grid. The earth is a sphere, and the student of geography must know how to locate places on its surface. We all know something about the earth grid which is pictured on page 37 and which is used by all civilized people in the world today; its general aspects were described on pages 36–37. We saw that this standard earth grid is a system of circles drawn round the earth from west to east (parallels of latitude) and from north to south (meridians of longitude). We saw that by using the equator and the prime meridian as starting points for all measurements made on this grid, we can locate any place on earth in terms of degrees and their fractions. All modern maps of the earth are based on this standard earth grid. You should therefore study pages 36–37 very carefully before you go on with this discussion.

Why time differs from region to region. The earth grid is useful not only in the location of places; it is also useful in the measurement of time. Before we examine the ways in which the earth grid is used on different types of maps to help us visualize the earth and make measurements on its surface, let us see how it is used to help us tell time.

One of the first things you learn when you travel to distant places is that different regions have different time. This difference in time from region to region is caused by the fact that the earth makes a complete turn, or rotation, on its axis once every 24 hours. In doing so it turns from west to east, a fact which is quite obvious if you stop to think about it, because the sun "rises" in the east. The sun, of course, does not really move, but stands still in the heavens. It only *appears* to rise in the east because the earth turns on its axis toward the east. Since the earth turns toward the east, *the sun rises earlier at any place which lies to the east of any other place.*

In rotating on its axis the earth turns through 360 degrees of longitude in 24 hours. It thus turns through 15 degrees of longitude in 1 hour (360 degrees divided by 24 equals 15 degrees). Sunrise is accordingly 1 hour earlier in Philadelphia than in St. Louis because Philadelphia lies 15 degrees of longitude east of St. Louis, and it takes the earth 1 hour to turn through these 15 degrees. Sunrise at Denver is 2 hours later than sunrise at Philadelphia because Denver lies 30 degrees west of Philadelphia. Sunrise is 3 hours later at Los Angeles because Los Angeles is 45 degrees west of Philadelphia. If you look at the map on page 455, you will see that when it is noon in Philadelphia it is midnight in Chungking on the other side of the earth.

Sun time and standard time. From what we have said above, it should be clear that the sun and the earth grid provide a basis for telling time. When the sun is directly over any given meridian of longitude, it is noon by what might be called sun time at all places on that meridian from pole to pole. But it is not noon by sun time anywhere else. At places to the west it is earlier than noon; at places to the east it is later than noon. If you wrote to a friend in a town to the east or west of your town that you would meet him tomorrow noon by sun time, you would have to say whether you meant noon by his sun time or by yours.

If sun time were used everywhere, there would be many similar difficulties. If you traveled anywhere to the east or to the west, you would have to be constantly setting your watch. Transportation time tables would be so complicated that only an ex-

This map will give you a general idea of how the time zones of the globe are arranged.

pert in mathematics could solve the problem of when to catch a train, bus, or boat. To avoid these difficulties, the same international congress which decided to use the Greenwich meridian as the basis for measuring distance in an east-west direction on the globe decided to use the same meridian as the basis for a uniform world-wide system of telling time.

It was decided that the Greenwich meridian should be known as the *standard time meridian.* A *time zone* just 15 degrees wide was established, with the Greenwich meridian running through the middle of it. It was decided that time throughout this zone would be the same as sun time at the Greenwich meridian. Thus, when it is noon by sun time along the Greenwich meridian at zero degrees of longitude, it is noon everywhere within the time zone which is based on the Greenwich meridian.

West of the Greenwich time zone another time zone was established, with the meridian of 15 degrees west longitude running through the middle of it. In this time zone, as in the Greenwich time zone, the central meridian was used as the time meridian; its sun time was established as the time which would be used for the zone as a whole. Similar time zones were established all round the earth, as shown on the diagram on this page. In each one the time

Convenience has demanded that the time zones of North America have irregular boundaries.

is that of the time meridian which runs through the middle of it. In each one the time is one hour earlier than the time in the time zone which adjoins it on the east, and one hour later than the time in the time zone which adjoins it on the west. This standardized time of the time zones is known as *standard time.*

If you compare the generalized world map of time zones on page 455 with the map of the actual time zones of North America on this page, you will observe that the boundaries of time zones are not so regular as the above discussion would lead you to believe. Practical considerations have made it necessary to draw the boundaries of time zones with some reference to the convenience of the people who live near those boundaries. If the boundary of a time zone ran through the middle of a city, for example, it would be very inconvenient to have it noon in one half of the city when it was 11 or 1 o'clock in the other half. Notice, however, that though the boundaries of the time zones are irregular, they are approximately 15 degrees apart.

The International Date Line. The other night, let us say, you listened to a news broadcast over the radio. One of the news reporters was speaking from "somewhere in Australia." It was on a Sunday evening when you were listening. The reporter said, "It is now a few minutes after 1 o'clock Monday afternoon in Australia." On the same radio broadcast there was another news reporter speaking from London. He said, "It is now a few minutes after 3 o'clock Monday morning in London."

This was more than a little confusing. You looked at your watch to reassure yourself. It said a few minutes past 10 o'clock in the evening Eastern Standard Time. You looked at your calendar. It was Sunday. How could both this and what the news reporters said be true?

To solve the problem of how this all could be true, let us take an imaginary trip round the world. Let us suppose that we have an airplane which can make a nonstop flight round the world in a single day. Let us start our trip at Chicago (we could start anywhere else if we chose) and fly west along the latitude of Chicago.

Let us leave Chicago at exactly noon Monday, when the sun is at its highest point in the sky. Let us travel toward the west at the same speed as the earth is turning toward the east. Under these circumstances we find that everywhere on our journey the sun is directly overhead. It is therefore Monday noon at every place on our journey. We thus return to Chicago, after circling the earth, at noon. It appears to us that it is noon on the same day (Monday) on which we began our trip because we have experienced no period of darkness, no change in the angle of sunlight, no change in time at all. The people who have stayed in Chicago, however, have had a different experience. One night has elapsed at Chicago since we left there, and it is now noon on Tuesday. It appears that we have lost a day and we must set our calendar one day ahead.

No matter how slowly or in what latitude we should travel round the earth from east to west, we should have the same experience of losing a day. If we should make the complete journey round the globe, we should have to turn the calendar one day ahead at some place along our route. Accordingly, to avoid confusion, all countries have agreed on a north-south line extending between the north and south poles where all world travelers shall make this change of date. This line nearly corresponds to the 180th meridian and is called the International Date Line. On our trip round the world, which we began on Monday at Chicago, we should have set our calendar to Tuesday when we crossed this line.

The International Date Line nearly corresponds to the 180th meridian.

When you cross the International Date Line going from west to east rather than from east to west, you *gain* a day and must therefore turn the calendar *back* to the previous day. If, for example, you approach the International Date Line on a Tuesday, you must turn the calendar back to Monday. You have already been through Monday and now you have to go through it again. What day should this second Monday be called? Unfortunately, there is no provision in the calendar for it. It is sometimes called *Meridian Day* and sometimes simply "that other day."

TYPES OF MAP PROJECTIONS

What is a map? The chief use for the earth grid is as a foundation for the construction of maps. We might define a map in very general terms as *a representation of all or part of the surface of the earth.* A globe is really a model rather than a map of the earth, because a map in the ordinary sense of the word is drawn on a flat piece of paper. If properly made, however, a globe is a more accurate representation of the earth as a whole than any map of the earth. If this is true, you might ask, why do we not always use globes instead of maps? The answer is simple. Globes are expensive to make and awkward to handle, and they do not show the various parts of the earth in detail. It is cheaper and easier to keep a detailed record of facts on a flat piece of paper than on a ball, and several pieces of paper are easier to carry and to handle than several balls.

A representation of the surface of the earth on a flat piece of paper is known as a *map projection.* All map projections are not alike, and different kinds of projections will show the same area of the earth differently. Look at the map projections of North America on pages 5 and 10. Each of these is a type of map projection which is useful for one purpose or another, and yet each gives a different picture of North America. These maps are different because they represent different ways of showing the curved surface of a sphere on a flat piece of paper.

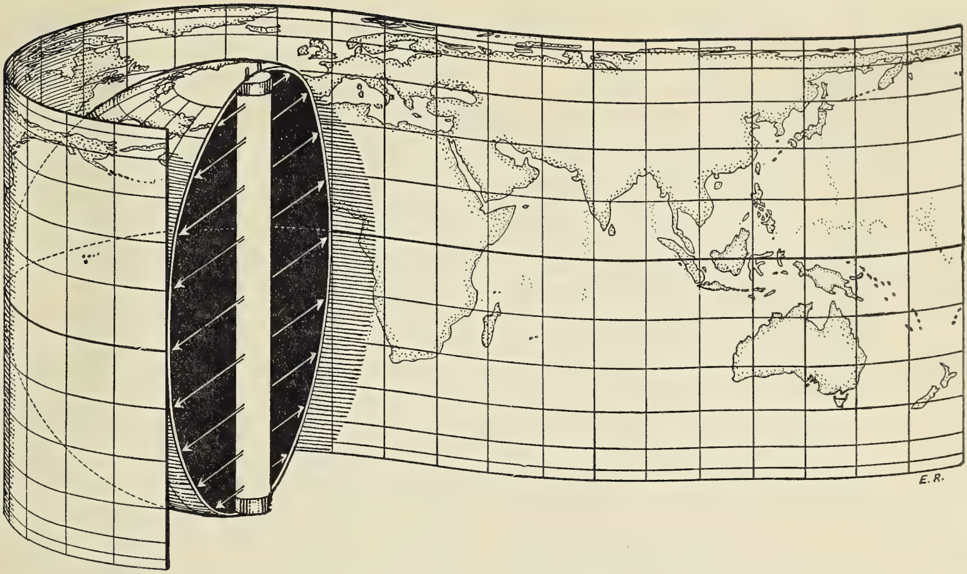
The difficulty of picturing the earth on a flat piece of paper is discussed on page 6. You should read this again and, if you have not already done so, try the suggested experiment with an orange skin. Because of the difficulty of representing the features of a curved surface on a flat surface, no map of the earth can tell all the truth about its appearance. All good maps, however, tell some part of the truth. The first requirement of a good map is that it be useful *for some purpose.*

The simple cylindrical projection. Maps that show all or nearly all the surface of the earth are known as *world projections.* They are useful for showing the world distribution of such things as climatic regions and natural resources, and the world courses of such things as ocean currents and trade routes. They are less useful for showing the size and shape of land and water areas because it is impossible to make a world projection which does not distort either the size or the shape of the earth's features.

On pages 4–6 we saw how for many years the earth was widely conceived in terms of the projection of its surface features on a cylinder. Part of the reason for this is that cylindrical projections are the easiest of all world projections to construct. A sphere, as we have seen, cannot be flattened without ripping or wrinkling, but a cylinder can easily be split in one place and rolled flat. It is also easy to project the surface features of a sphere onto the surface of a cylinder, as the diagram on page 459 will show.

The globe in the diagram is made of material which allows the rays from a light to pass through it. Notice that the light is not the old-fashioned pear-shaped bulb, but the newer style electric cylinder which provides more even illumination of surrounding areas. The rays from this light illuminate the transparent surface of the globe more evenly than a bulb would. The globe in the diagram is cut in half to show how the rays from the light strike its surface.

The cylinder of paper (which is exactly the same height as the diameter of the globe) is wrapped round the globe so that it touches the globe at the equator. Though the cylinder does not touch the globe at any other place, the markings on the surface of the globe are thrown, or "projected," onto the cylinder by the parallel rays of the light. When all these lines are traced on the cylinder and the cylinder is unrolled, the map of the earth which is shown in the diagram appears.



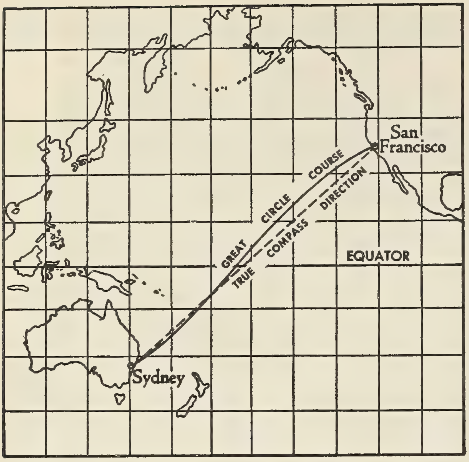
This diagram shows how a simple cylindrical projection of the earth can be made.

The first thing you will notice about this simple cylindrical projection of the earth is that the north polar regions have been greatly pulled out of shape in an east-west direction. On the globe the north and south poles are only points; in the cylindrical projection of the globe the poles are stretched into lines which are equal in length to the equator. The meridians of longitude which come together at the poles on the globe are everywhere equally spaced in the projection. The second thing you will notice about this cylindrical projection is that the parallels of latitude are not equally spaced, as they are on the globe. Notice that they get more and more crowded in both the Northern and the Southern Hemisphere away from the equator.

Can you see that the result of all this is that east-west distances are greatly increased and north-south distances greatly decreased, away from the equator? The high latitude lands are so pulled out of shape that they look silly. In spite of its faults, however, the simple cylindrical projection has certain advantages. Many men for many years have tried to change it so as to keep its advantages and do away with its disadvantages. The most successful attempt of this sort is the famous Mercator projection.

The Mercator projection. The Mercator map is described in general on pages 4–6. It is the result of much thinking and measuring by Mercator and his successors in the attempt to balance the stretching of longitude and the squeezing of latitude which mar the simple cylindrical projection.

Notice in the Mercator map on page 5 that in order to offset this east-west distortion of the simple cylindrical projection, the parallels of latitude on a Mercator projection are spaced farther apart in the high latitudes than in the low. On the basis of very careful measurements and calculations the north-south expansion of areas has been made to increase at the same rate as the east-west expansion. The result is what is known as a *conformal projection,* in which the shapes of small areas are accurately shown. On the other hand, both the shapes and



When plotted on a Mercator projection, the great circle route between San Francisco and Sydney differs considerably from the compass direction between those two cities.

the sizes of large areas are greatly distorted away from the equator. Some of the worst of this distortion, however, is avoided by the simple device of not showing any areas north or south of Lat. 80° 30′.

The Mercator map is a great improvement over the simple cylindrical world projection. Though it still distorts the lands of the high latitudes, it is the only widely used map on which a straight line between two points gives the true direction between those points. Unfortunately, the true compass direction between two points on a Mercator map is not in most cases the shortest route between the two points. We have seen on page 8 that only a great circle (which divides the earth into halves) marks the shortest distance between any two points on the surface of the earth. Inasmuch as the equator and the meridians are the only lines on a Mercator map which describe great circle courses, how does a navigator plot and follow a great circle course on a Mercator map between points which do not lie directly on the equator or on a single meridian?

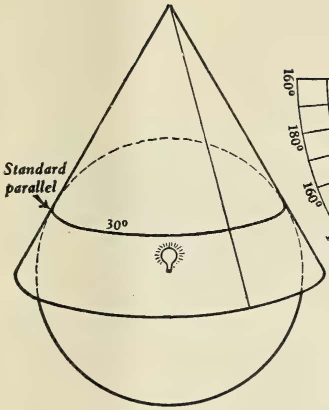
The answer is that he does not plot and follow such a course exactly. The map on this page shows how the great circle route between San Francisco and Sydney appears when drawn on a Mercator map. To follow such a course would require much shifting of direction. It is much easier and safer for a navigator to sail (or to fly) along the straight line of true compass direction, or in a series of straight lines that approximate a great circle route, on the Mercator projection.

Oval world maps. The Mercator map is widely used, not only in navigation but also to show the exact direction of such lines as routes of world transportation. Other world projections, however, must be used if the sizes of land and water areas are to be shown in true proportion. Any map of the earth which shows sizes accurately is known as an *equal-area map.* Most equal-area maps of the earth as a whole are oval or roughly oval in shape.

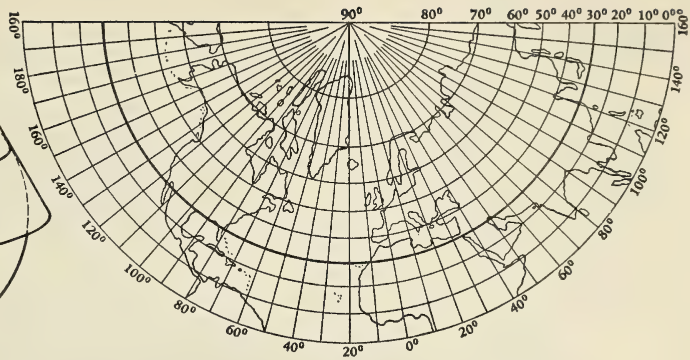
The map on page 6 shows one of the most commonly used oval world projections. In all maps of this type the equator is a straight line which is twice the length of the central meridian between the north pole and the south pole. All maps of this type are equal-area projections.

Interrupted world maps. Although oval world maps show the relative sizes of areas correctly, they all have one disadvantage. The shapes of areas are very much distorted away from the centers of the maps. The shapes of the continents at the edges of the maps are so distorted that the continents can hardly be recognized by their shapes. Only the land masses which lie near the straight meridian in the center of each map have fairly accurate shapes.

This disadvantage can be largely overcome, as we saw on page 6, by splitting the oval world projection. There are several different types of split, or interrupted, projections in use today, but they are all alike in certain ways. They all show the earth in segments, each segment with a



DIAGRAM



MAP

These diagrams show how a simple conic projection can be made.

straight or nearly straight central meridian. By splitting the maps so that the chief land masses of the earth are centered over these straight meridians, the land masses are given approximately their true shapes. The oceans, on the other hand, are so badly distorted that such lines as world trade routes and ocean currents cannot be accurately shown on this type of projection. (See the interrupted projection on page 6.)

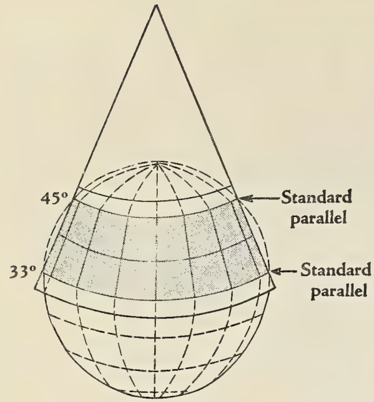
Conic projections. Map projections which show part of the earth are even more varied than those which show all the earth. A useful map for showing a single continent or smaller area is known as the *simple conic projection.*

If you should cut out a piece of paper shaped like the map above, and if you should fasten it together along the straight edges, it would form a cone. If this cone were placed on a transparent globe with a light bulb at the center, as shown in the diagram above, the projection shown above would be produced. Notice that in this map all the meridians spread out like spokes from the hub of the north pole. Notice that all the parallels are circular. If you use a piece of string, you can demonstrate that the center of the circle for each parallel is the north pole.

Notice that the cone touches the globe at only one parallel of latitude. In this case the cone touches at 30 degrees north latitude, and that parallel is therefore called the *standard parallel.* We have seen that parallels of latitude on the standard earth grid are everywhere an equal distance apart. If you measure the distance between the parallels on this map, on the other hand, you will find that it increases both north and south of 30 degrees. Where the cone touches the globe at 30 degrees north latitude, the map is the same size as the globe. North and south of 30 degrees north latitude the size of areas is enlarged.

Such a simple conic map is useful for representing areas which extend chiefly in an east-west direction, and which do not extend far north and south of the standard parallel. Large north-south areas shown on simple conic maps are increasingly distorted north and south of the standard parallel.

Lambert's conic conformal projection is one of several types of maps which are based upon the simple conic projection described above. It differs from the simple conic projection in that the cone cuts through the surface of the globe and comes out at another place, as shown in the illustration on page 462. The



These diagrams show how a Lambert's conic conformal projection can be made.

cone thus touches the surface of the globe at two places instead of at one place, and therefore has two standard parallels.

The advantage of Lambert's conic conformal projection is that through its two standard parallels it widens the area of minimum distortion of the earth's features. This map is excellent for representing areas which extend in an east-west direction. Another advantage is that a straight line drawn on this map approximates a great circle route. For this reason the projection is widely used in navigation, especially in air navigation.

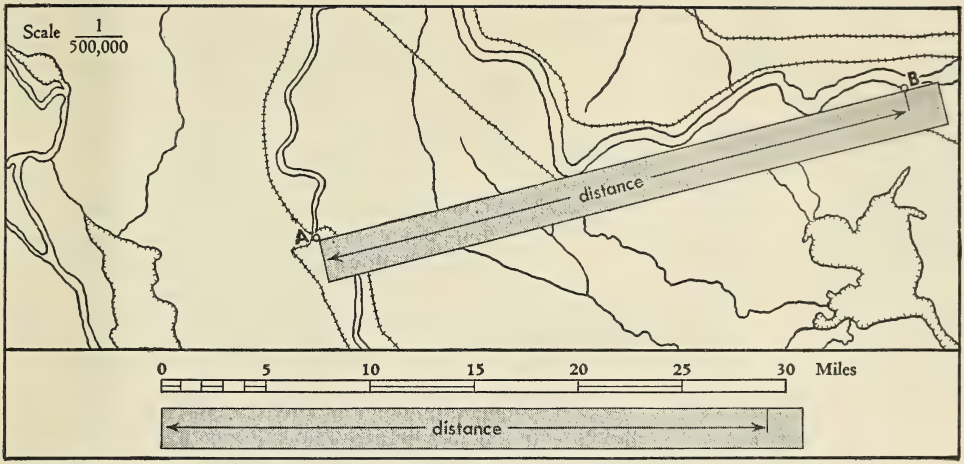
From Deetz and Adams

The stereographic projection is good for showing areas which extend in a north-south direction.

Other map projections. Just as the conic projections are particularly useful for showing areas which extend chiefly in an east-west direction, the *stereographic projection* shown on this page is particularly useful in showing areas which extend chiefly in a north-south direction. Notice that in this map all the parallels except the equator, and all the meridians except the central one, are curved.

With the emphasis which the airplane has given to the north polar regions, many *polar projections* are being made today. Such projections can be made in a variety of ways. In all, however, the meridians are straight lines which radiate from the pole; the parallels are concentric circles round the pole. (See the polar projections by Richard Edes Harrison on pages 10 and 11 for fine examples of this type of map.) All polar maps have one general weakness: they cannot be extended beyond the equator without tremendous distortion.

Though the study of map projections begins in geography, it ends in mathematics. No widely used modern map projection is drawn simply as the reflection of an illuminated globe on a piece of paper. All are



This diagram shows how to measure distance on a map by means of a graphic scale.

the results of extremely complicated computations, the details of which carry us far beyond the range of secondary-school interests.

HOW MAPS SHOW DISTANCE AND DIRECTION

Distance and the scale of maps. The size of a map is even more important than the type of projection in determining its usefulness. The size of any map must have a definite relationship to the size of the part of the earth's surface which it represents. Surveying an area for the purpose of making a map is essentially a measurement of the size and shape of the area. The actual size of the area, of course, cannot be shown on a map; so the map is made to some definite fraction of the actual size. This fraction of the size is called the *scale* of the map. Since the size of the map is a fraction of the actual size of the area which the map pictures, it is possible to measure distances on a map if we know what this fraction, or scale, is.

One scale which is used on maps is $\frac{1}{63{,}360}$, or 1:63,360. This means that one unit of measurement on the map represents 63,360 units of measurement on the ground. The unit of measurement which is easiest to use on a map is the inch; therefore one inch on a map with a scale of $\frac{1}{63{,}360}$ represents 63,360 inches on the ground. The unit of measurement which is easiest to use on the ground is the mile. Since there are 63,360 inches in one mile, the scale $\frac{1}{63{,}360}$ may be written simply as 1 inch = 1 mile. Similarly, $\frac{1}{31{,}680}$ may be written as 1 inch $= \frac{1}{2}$ mile, or 2 inches = 1 mile.

Many maps provide a graphic scale in addition to a fractional scale. A graphic scale looks like a small ruler. It is divided into units which represent definite distances on the ground which is shown on the map. An easy way of measuring distance by means of a graphic scale is shown in the diagram above. The map distance between *A* and *B* can easily be determined by laying a straight-edged piece of paper on the map and marking on it the positions of *A* and *B*. By measuring this distance with the graphic scale, the ground distance between *A* and *B* is easily determined.

Different scales make the same area look different.

When you look at a map you should always determine the size of the area which it represents. The same area looks different on maps of different scale. Look at the maps of San Francisco on this page if you do not believe that this is true.

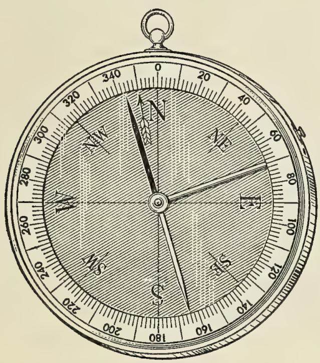
Many countries use the kilometer instead of the mile as a unit of measurement. The kilometer is approximately 0.62 mile. The kilometer contains 1000 meters and each meter contains 100 centimeters. A meter is approximately 39.37 inches; about 5 centimeters equals 2 inches. By this system of measurement $\frac{1}{100{,}000}$ is equal to one kilometer of ground distance to one centimeter of distance on the map.

The problem of direction. The distance between places is important, but it is also necessary to know the arrangement of the places. If you should wish to go to another town, you should know how far you must go; it is absolutely essential that you also know the direction of the town. We usually speak of a place as lying to the north, south, east, or west; or to the northwest, northeast, southwest, or southeast. These general directions usually are adequate where there are well-marked streets and roads. But such generalized directions are not enough for making a map, for the accurate reading of a map, or for going between places where there are no well-marked roads.

Direction usually is determined by means of a magnetic compass. A magnetic compass consists mainly of a magnetic needle, one end of which points north. This needle is surrounded by a circle which is divided into 360 degrees. In one of the most common types of compass the circle is numbered so that North is 0, East is 90, South is 180, and West is 270. The face of the compass is also lettered to show the eight principal directions. (See the figure on page 465.)

The direction of a place may be given as north, south, east, or west, if that is the true direction. If the direction is halfway between north and east, or 45 degrees, it is northeast; if it is halfway between south and east, it is southeast; if halfway between south and west, it is southwest; if halfway between north and west, it is northwest. An easier way of expressing compass direction is to state it simply in terms of degrees, as shown on the face of the compass below. Northeast is thus stated simply as 45 degrees, southeast as 135 degrees, and so on round the dial. All possible angles with north can easily be stated in this fashion.

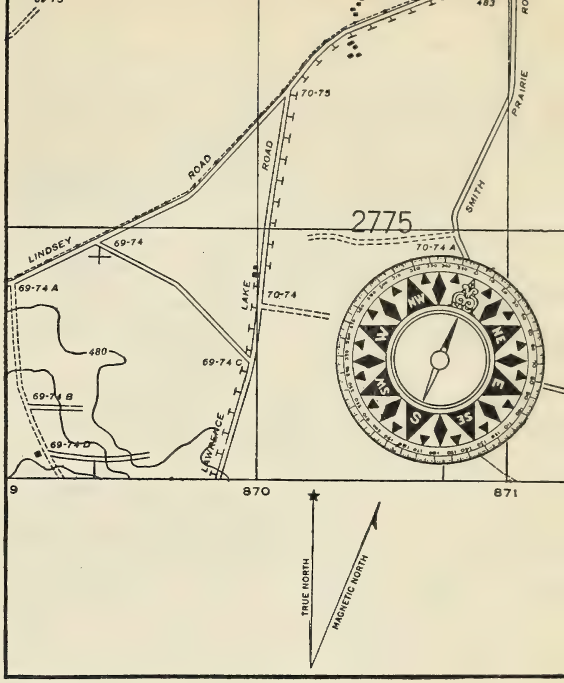
The magnetic compass does not point to the north pole, which is *true north*, except at certain places in the world. The magnetic needle of the compass points to the *magnetic north* pole, which is approximately north of Hudson Bay in Canada and not at the same position as the true north pole.



A common type of compass is numbered like this.

The difference between the direction of magnetic north and the direction of true north is called the *magnetic declination.* Two pointers are generally printed on a map which is designed to be useful for precise measurements, one pointer showing the direction of true north and the other the direction of magnetic north in the area which the map represents. (See the diagram above.)

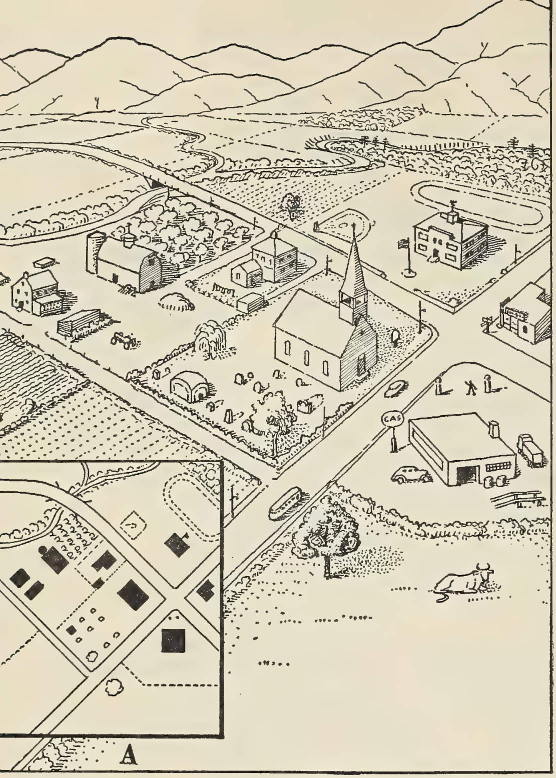
How to orient a map. On pages 8–10 we saw that most ordinary maps show north at the top, south at the bottom, east at



This diagram shows how to orient a map with the help of a compass.

the right, and west at the left. We saw that this way of arranging directions on a map is purely a habit. In the days of the Roman Empire, most maps had east at the top because east was the direction which most commercial and political ventures took. The Orient was the chief center of geopolitical ambitions in those days; to fix the location of a place with reference to the east was known as *orientation.*

Though today we seldom put east at the top of a map, and seldom use that direction as the chief line of reference for fixing the location of places, we still use the word "orientation." No matter how we view an area of the earth's surface, and no matter how we picture that area on a map, we must know its position with reference to our own position and with reference to the "lay" of the earth's surface as a whole. Setting up a map so that it corresponds with the directions of objects on the ground is still known as orientation, even though north



A map can be oriented easily by lining up the positions of objects on the map and the positions of the same objects on the ground.

instead of east is the direction which in these times is generally used for this purpose.

The most accurate method of orienting a map requires the use of a compass. Simply place a compass on a map and then turn the map until the magnetic north pointer which is printed on the map is parallel to the compass pointer. The map will then be oriented with reference to directions on the ground. (See the illustration on page 465.)

Unfortunately, not all maps show the direction of magnetic north and not all people carry compasses. Fortunately, there is a simpler way of orienting a map which works satisfactorily in a vast majority of cases. Let us say that you are standing on the spot marked *A* in the landscape on this page. You can easily orient a map of this landscape by simply turning the map until the positions of the objects shown on it match the positions of the objects on the ground.

MAPS FOR SPECIAL PURPOSES

Outline maps. So far, our discussion of maps has dealt chiefly with the ways in which a realistic representation of the shape and size of land and water areas can be drawn on a flat piece of paper. There are, however, a great many different features on the face of the earth besides shape and size of land and water areas, and no map can show them all. Most maps, accordingly, are designed to set forth special aspects of the earth's surface. Though all maps show the arrangement of things, the things which are shown vary widely from map to map.

The simplest of all maps show merely the arrangement of land and water areas, and are known as outline maps. The outline map is the foundation on which such special information as the distribution of climates, land forms, and natural resources is shown. An outline map may be constructed on any projection, but when used to show distribution the projection should be of the equal-area type, which portrays the sizes of areas with a minimum of distortion.

Colored and shaded maps. The most striking method of showing distribution on a map is by the use of colors. In colored maps different colors are used to represent different things or different amounts of the same thing. Color may be used to show the distribution of climatic regions, as in the map on pages 70–71; the distribution of human activities, as in the map on pages 254–255; and a variety of other things.

Closely related to colored maps are the maps in which black, white, and different shades of gray are used to show the distribution of different things. Another type of shaded map uses dots, dashes, and lines in various arrangements to bring out the arrangement of different things. Examples of these two types of shaded maps may be found on pages 60 and 119, and at various other places in this book. There is no uniformity in the style of shading used by different map-makers.

Both colored and shaded maps have a shortcoming which should be remembered when they are being studied. This shortcoming can be illustrated in the map of the land forms of the earth on pages 162–163. The boundaries that set off the mountains, hills, plateaus, and plains are shown as sharp lines on this map. This suggests that if you cross one of these lines you will come abruptly to a different type of land surface. This, of course, is not necessarily true, because in many places on the earth one type of land surface grades gently into another type. Abrupt lines give a wrong impression of the distribution of things on the surface of the earth by making the distribution appear simple when it is really very complicated. In using colored and shaded maps you must remember that they are generalizations which in most cases can set forth only the larger facts of distribution—and this only by falsifying many of the smaller facts.

Dot and circle maps. To avoid the misrepresentation of colored and shaded maps, dot maps are frequently used. On this kind of map, distribution is shown by a series of dots. (See the map on pages 18–19 and also the maps on page 128.) Each dot represents a certain amount of whatever is being represented, such as numbers of people, bushels of wheat, or barrels of oil. The dot is put in the place where these numbers of people, bushels of wheat, or barrels of oil occur. The result is that the dots approximate the actual distribution of the things which are shown. (Triangles or other devices may be used instead of dots, as on the map on page 246.)

Related to the dot maps are circle maps, in which circles of different sizes are used to show the distribution of things which vary in number or amount from place to place. In the map on page 376 the relative importance of the chief manufacturing districts of the Soviet Union is shown by circles of different sizes. The total number of people engaged in manufacture in each district is represented by the *area* of the circle for the district. This device can be used to show the distribution of a variety of things.

Layered relief maps. All the maps which we have discussed thus far show land areas as if they were perfectly flat. Everybody knows that perfectly flat areas of land are relatively rare; that even regions which may be described as plains show some irregularities in their surfaces. We all know that the irregularities of the land profoundly affect the activities of men.

Maps which show the irregularities of land surfaces are known in general as *relief maps*. In many atlases you will find maps in which a particular color represents a particular range of elevation above the level of the sea. In such a map, green might be used for all surfaces that lie between sea level and 500 feet; yellow, for all surfaces between 500 and 1000 feet; brown and red, for still higher elevations. Different types of shading can be used instead of different colors in maps of this kind. Such maps portray land surfaces as a series of layers at different levels above the sea. Strictly speaking, they are not true relief maps, because they show elevation rather than relief. (See pages 159–160 for the difference between elevation and relief.)

Shaded relief maps. Early in the history of map-making the imagination of the artist was added to the measurements of the scientist in the attempt to portray land surfaces on maps as they appear in nature. Various types of shading were employed toward this end at an early date. French map-makers perfected the art of using little lines, or *hachures*, to show the shape and amount of slope of a land surface. The hachure map on page 468 will give you an idea of how this end was achieved.

Notice that the hachures follow the direction of the slope of the land. Notice that where the land slopes gently the hachures are relatively light and far apart, and that where the slope is steep the hachures are relatively heavy and close together. The net effect of this method is to portray gentle slopes in lighter, and steeper slopes in heavier, shades. The advantage of the hachure map is that it actually looks considerably like an air view of the land surface which it depicts.

A hachure map uses little lines to show the shape and slope of the land.

Hachure maps of the type shown above are still widely used in Europe. American map-makers, on the other hand, have advanced the art of showing relief by shading so that their *pictorial relief maps* achieve a greater semblance of reality than the older-fashioned hachure maps. The illustrations on page 161 are good examples of modern American relief maps in which little lines are used for shading. Notice that a much greater variety of line is used in these maps than in the hachure map, with the result that a more realistic picture of land surfaces results. Most maps of this type are really diagrams rather than maps (though the devices of shading which are used in them can be applied to an outline map of any projection) and are called *physiographic* ("nature writing") *diagrams*.

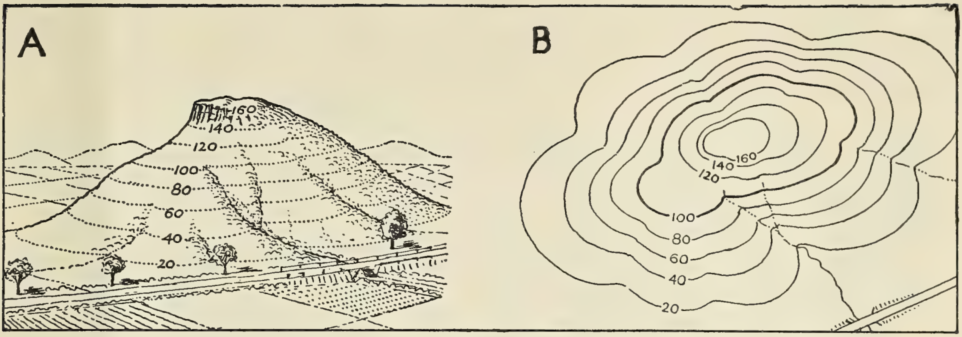
A variation of the physiographic diagram is the colored pictorial relief map, in which the shape and slope of land forms are shown by colors rather than lines. A handsome example of a colored pictorial relief map is shown on page 10.

Topographic maps. Though shaded relief maps are useful in giving a lifelike *general picture* of land forms, they cannot be used to give an accurate *detailed picture* of land forms. The most accurate relief maps show relief not by a complicated arrangement of many short lines, but by a simple arrangement of a relatively few long lines.

Let us say that you want to explore a hill in the neighborhood of your home. You begin to climb the hill, but halfway up you feel tired. You sit down to rest and decide to give up exploring the hill by climbing to the top. You decide instead to explore it by walking round it in a horizontal plane, neither rising nor falling in elevation, until you have returned to the place where you are now sitting.

You set out on this hike along a level path round the hill. You soon discover that the hill is not perfectly circular, because you change your direction irregularly as you walk. Where a gully carves a notch in the hillside, you must first turn sharply toward the hill and then sharply away from it. Where the side of the hill is relatively straight, you walk for a relatively long time in one direction. Where the hill is rounded, you walk in a steadily curving direction. When at last you return to your starting point, you have gained a good idea of the shape and size of the hill at the level along which you walked round it.

The line along which you walked is called a *contour*—a horizontal line on a sloping surface. If instead of walking along a contour halfway up the hill, you had walked along a contour one quarter of the way up, you would have learned the shape and size



Contour lines on a hill, when plotted on a map, give a detailed picture of the shape and size of the hill

of the hill at that elevation. If you had walked round the hill several times along several different contours, let us say at intervals of 20 feet all the way from the bottom to the top, you would have gained an excellent idea of the shape and size of the hill as a whole.

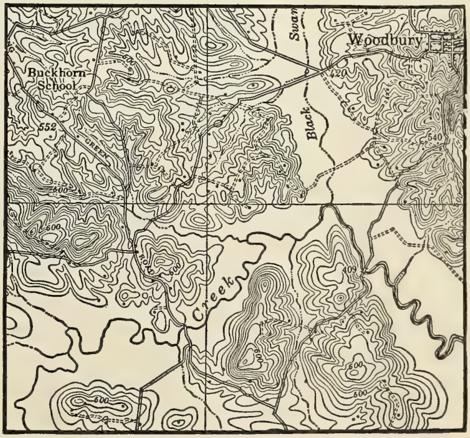
A *topographic* ("place writing") *map* could be made on the basis of your exploration of the hill. In Figure *A* above you see the several paths which you would have followed if you had explored the hill along several contour lines. Each path passes through places which are all at the same elevation above sea level; each path is just 20 feet in elevation above the path which lies directly below it. In Figure *B* you see how these paths look when they are drawn on a flat piece of paper. Notice that the contour lines, which mark on the map your lines of march round the hill, give an accurate detailed picture of the shape and size of the hill.

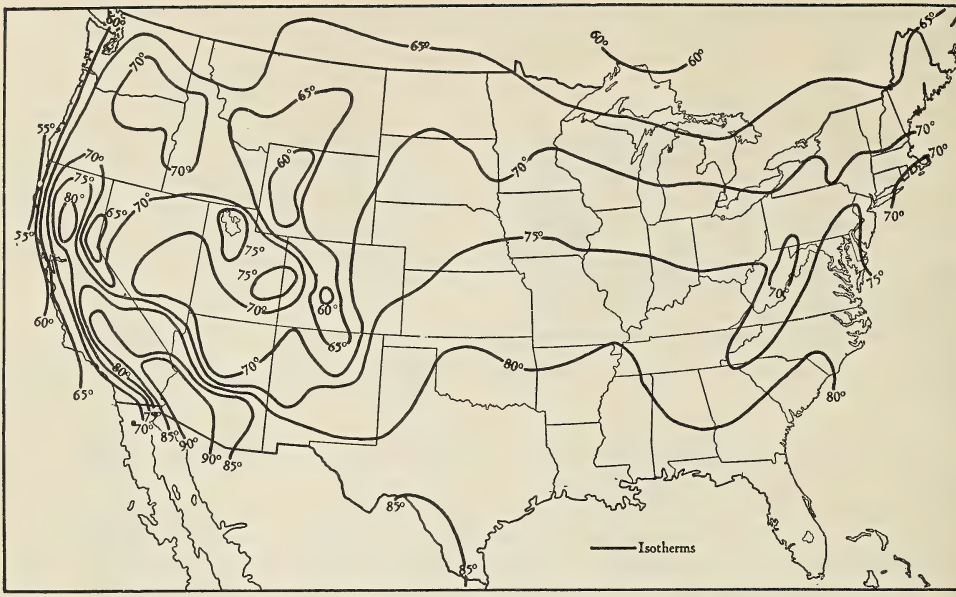
Any kind of land surface can be mapped in this way. Large-scale topographic maps have been published for much of the United States, and can be purchased cheaply from your neighborhood bookstore or by writing to the United States Geological Survey in Washington, D.C. A portion of one of these maps is printed at the right. At first sight this map may look technical and difficult, but with practice you can learn how to visualize the land surface which it accurately depicts.

In studying this map and others like it, you must always remember that each contour line passes through points which are all at exactly the same elevation above sea level. You must remember that the difference in elevation between contour lines (the so-called *contour interval*) is always the same on any given topographic map. In the map below the contour interval is 20 feet. In maps of flatter country a contour interval of 10 feet is frequently used.

This portion of a U. S. Geological Survey map shows the details of a hilly land surface by means of contour lines.

U. S. Geological Survey





Isotherms, which pass through places with the same average temperature, show temperature conditions just as contours show relief. This map shows average July temperatures in the United States.

In maps of steeper country, contour intervals of 50 and 100 feet are not uncommon.

Once you understand how to read a topographic map, you can learn the exact appearance of any land surface for which such a map has been made. This is a great advantage in planning cross-country hikes and pack trips in the mountains, and in studying regions which you cannot visit in person. Topographic maps are also of great value in military operations. During the Second World War many of our soldiers studied maps of this type in their Army Orientation Course.

Lines of equal value. The contours used on topographic maps are called lines of equal value because each contour line connects points which have the same, or equal, elevation above sea level. Contours are not the only lines of equal value which can be used for presenting information on a map. Lines can be drawn on a map to show, for example, places which have the same average temperature at a given time. Such a map is shown above.

The lines on this map are called *isotherms* ("same heat") because every point on each of these lines has the same temperature. Observe the position of the 70° isotherm. Every point on this isotherm has an average temperature of 70° during the month of July. Similarly, the other lines on the map connect places which have other temperatures. The spaces between isotherms have temperatures which are between the temperatures of the isotherms that enclose the spaces. The advantage of this map is that you can see the distribution of average July temperatures in the United States at a glance, once you have learned how to use it. Maps of this sort can present a great amount of information quickly and clearly.

The weather maps which are issued daily by the United States Weather Bureau demonstrate another common use of lines of equal value. If you examine a weather map you will see that lines are drawn through places having the same air pressure. These lines are known as *isobars* ("equal pressure"). Each isobar represents a definite reading on the barometer; together the isobars give an accurate picture of the size and shape of the pressure belts and areas of the atmosphere which are discussed in Chapter IV and Chapter VII.

Maps and the study of geography. Maps are the best sources of general information on geography. A knowledge of maps and how to use them is indispensable to anyone who wants to build a sound conception of the world. We have had space here only to skim the surface of the vast art of map-making and map interpretation. A whole book could be written on this subject, and indeed a very interesting one has recently been written: *Down to Earth*, by David Greenhood.

The best way of learning about maps, however, is by studying actual maps. Everybody should own a good atlas. Everybody should consult it frequently in connection with the day's news. *Goode's School Atlas*, *The Oxford Advanced Atlas*, and *Appleton's Modern School Atlas* are a few of the better small and relatively inexpensive atlases which may be easily obtained.

I N D E X

KEY. ā as in āle; ă as in ăm; â as in senâte; â as in câre; ȧ as in ȧsk; ä as in ärm; ă as in ăccount; ȧ as in sofȧ; ē as in ēve; ḛ as in hḛre; ĕ as in ĕnd; ê as in êvent; ẽ as in makẽr; ĕ as in recĕnt; ī as in īce; ĭ as in ĭll; ĭ as in contĭnents; ō as in ōld; ŏ as in ŏdd; ô as in ôbey; ô as in ôrb; ŏ as in sŏft; ŏ as in cŏnnect; ū as in ūse; ŭ as in ŭp; û as in ûnite; û as in ûrn; ŭ as in circŭs; o͞o as in fo͞od; o͝o as in fo͝ot; oi as in oil; N as in boN; th as in then; ' as in evil (ē'v'l)

Pages on which maps and diagrams appear are indicated by *italic* type.

PRINTED IN THE UNITED STATES OF AMERICA

Date Due