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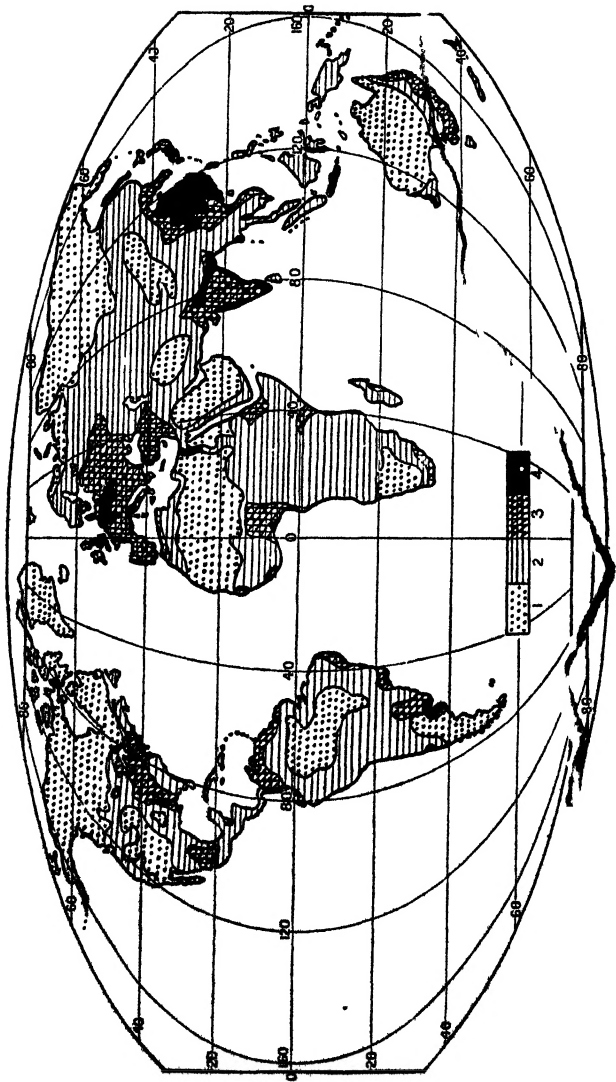
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Black's School Geography

Editor—L. W. LYDE, M.A.,
Professor of Economic Geography,
University College, London

MAN AND HIS CONQUEST OF NATURE



DENSITY OF POPULATION THROUGHOUT THE WORLD.

Under 1 person per square mile.

1 to 50 persons per square mile.

2. One to fifty persons per square mile.

4. Over two hundred persons per square mile.

MAN AND HIS CONQUEST OF NATURE

BY

MARION I. NEWBIGIN, D.Sc. (LOND.)

EDITOR OF "THE SCOTTISH GEOGRAPHICAL MAGAZINE"
AUTHOR OF "MODERN GEOGRAPHY," ETC.

CONTAINING TWENTY-FOUR ILLUSTRATIONS

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PREFACE

To all those who have followed in detail the recent progress of geography, it will be obvious that this little book is enormously indebted to those investigators who of late years have devoted themselves to studies in human geography and the allied subjects. As it has been especially the French geographers who have done this, my indebtedness to them—and notably to Professors Brunhes, de Martonne, Vidal de la Blache, Demangeon, to name only a few—for the raw material upon which the book is based is very great.

Detailed investigations upon the relations between groups of men and their surroundings, such as several of the above have made, are as yet somewhat uncommon in this country and in consequence this point of view is inadequately represented here, and has scarcely filtered through to the ordinary school-book. But if geography is to be made really interesting—and it will never be adequately taught until it is made interesting—it must become clear that its essential problem is to discover why man thrives more at certain parts of the globe than at others. Put even more bluntly, the great question which geography asks is, Why is it easier for men to make their living at some places than at others? I have tried to show that the subject is less crudely utilitarian in practice than this statement may make it appear, from the fact that everywhere man demands more than the mere satisfaction of his animal needs, so that places where he has prospered are places which have satisfied more than these.

Further, an attempt has been made to suggest, from several different points of view, the practical importance of geography. To me it seems time that the old view that the sole use of geography is to tell us where places are was definitely abandoned—a book of reference or a tourist agent will do this quite effectively. An American geographer recently attacked modern methods of teaching geography severely on the ground that he found that many college students proved unable to state the exact position of the lake of Skaneateles and the mountains of Ouachita. If this be the essence of geography, no attempt is made to teach it here. But if, as I believe, part of its object is to present some of the facts yielded by modern scientific investigation, and to suggest the meaning of scientific method, then the subject will prove of use at every turn, for every individual problem of adaptation to a changing world can be solved with reference to the experience of the ages. For this reason I have not hesitated to allude to many different social and economic problems, as these crop up in the course of geographical study; it is a great part of the value of the subject that it suggests that that systematized knowledge which we call science has something to say upon these problems.

MARION I. NEWBIGIN.

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MAN AND HIS CONQUEST OF NATURE

CHAPTER I

THE BATTLEFIELD

The distribution of human beings over the surface of the globe.—Conditions which determine this distribution—Favourable and unfavourable conditions—The Scottish moor and the tropical forest—The effect of seasonal or secular variation in climate—The changes which man has wrought.

THREE travellers once set out to walk over the hills of Scotland near one of those famous passes which pierce the mountain wall of the Grampians. It was spring in the valleys—the late, reluctant spring of Scotland—but on the hills the snow still lay in the hollows, glistening in the sunshine, feeding many streamlets from its lower edge. Here and there on the hills patches of rosy mountain azalea glowed among the sprouting heather, and the whaups screamed overhead; but for the most part there was but little sign of life, and none of human habitation.

But the travellers descended steadily, glissading down the snow-patches and plunging through the bogs below, till eventually they reached the King's highroad, which strikes remorselessly across hill and valley, and which, before the railway came, was the only link between north and south. Many weary miles those travellers tramped, till the open moor began to give place to enclosed fields, and the cluck of the hen replaced the wild scream of the curlew. Suddenly, at a turn of the road, they came to a little school-house, set down in a tiny garden above the stream, new running broad and clear in

its stony bed. It was still early, for travellers must not be lie-abeds, and the school bell had not yet rung, but in the road stood the scholars. Not more than a dozen or so, of all ages, come doubtless over the fields and moors from many a distant farmhouse and shepherd's cottage. They, too, had made an early start, tempted, perhaps, by the spring weather, and now some three or four of the girls were dancing in the sunshine as they waited, to the sound of a gay tune which the others were singing. The song and the dance both stopped as the travellers passed, for strangers with muddy boots and knapsacks are not common there, and are too interesting to be neglected; but the first picture remained, and the travellers suddenly realized that the poets had deceived them about the purple mountains and the tumbling streams. Mountains are good, and streams are good, but not so good and not so interesting as man. To-day those children in the wild Highland glen are being taught how to live in the world of men; to-morrow, in the cities of Edinburgh, Glasgow, Liverpool, and London, or in the Far West of Canada, or in Australia or Africa, they will be practising those lessons, while new generations of curlews scream over the moors, untroubled by the wider world beyond. Man is man and master of his fate; the world is his, for he has largely made it what it is.

But it was not always so. What the wild moors of Scotland are now, so was much of the world once. It has been tamed and subjected to man's will, changed to suit his ends. How has he done it? By what forces has he tamed the untamable, and moulded Nature to his needs? These are the questions we are to try to answer here, to show how man has made of intractable wastes fit habitations for himself.

Let us note first just what the statement that man has moulded the earth to his will means in detail. We all know that at the present time thousands of people are pouring every year into Canada, and that by the work of these people useless wastes are being made to produce food for man. We know that for many years the surplus population of Europe has been overflowing into the continent of America generally, and especially into the United States, so that grain is being grown, and herds of cattle and sheep are being reared in regions once inhabited chiefly by the bison. We know more than this. Every ten years a census, or numbering of the people, is taken

in this country, and we know that each census shows that the people are steadily increasing. The same can be said of most, though not all, other European nations.

Now it is obvious that, if the population of most of the countries of Europe is steadily increasing at the present time, then the further we go back in history, the smaller the population becomes. As people cannot live without food, clothes, and shelter, that means that the further we go back, the less man obtained from the earth. The more his numbers increase, the more the earth must give him, or he will die of starvation.

One other point is interesting. If we look at the map of the world showing the distribution of the population (see frontispiece), we see that human beings are by no means evenly spread. Europe is crowded with people—so crowded that it is steadily sending emigrants into America and elsewhere. China and India and the neighbouring regions are also crowded, but in all other parts of the world there are great empty spaces, regions where few people live. There are now very many people in the United States of America, but they are chiefly in the eastern half; towards the west the population is much thinner. Here and there in South America there are regions where the population is, as we say, dense; but there are great areas where there are few human beings. So it is with Africa, so with Australia, and so with Asia outside the crowded district in the south-east.

We can, then, draw two conclusions about man and his distribution over the globe. First, in the civilized regions where his numbers are carefully measured, we see that he is steadily increasing, and therefore we can go back in imagination to times when there were fewer and fewer men on the surface of the globe, till we come to a far-off period when perhaps only one part of the earth contained human beings, and the rest was a great waste. Second, we see that man is by no means uniformly distributed. A few favoured regions are densely peopled, and some of these—*e.g.*, the basin of the Nile—have been crowded as far back as we can go in history. Other regions, like much of Africa, for instance, except Egypt, have always had few people.

How has man been able to spread over the globe? for it is in spreading that he conquered it. We shall find that this is nearly the same as asking how he has been able to find food

everywhere, for he cannot live without food, though he does not always find all his food in the place where he lives. Then, we must go on to ask, Why are some places so much more suitable to man than others? We shall find that the answer to this question helps us to find the answer to the first.

If we take any part of the earth's surface where man can now scarcely find a livelihood, such as the Scottish moors, the tropical forest of Africa, and so on, we find that, though life is hard for man in these places, yet plants and animals live there. Speaking in a quite general way, we may say that man has so much in common with plants and animals that he cannot thrive in regions where they do not prosper. This is not only because he depends upon plants and animals for his food, though that is important also. But, like plants and animals, man must have air, and very dry or very wet air does not suit him well; he must have a certain amount of heat, but very hot places suit him as badly as very cold places. For these reasons we may be tolerably sure that parts of the earth's surface where plants and animals are very scarce, will never be of much use to man. In the centre of Greenland, and in the centre of the Antarctic continent, we have great wastes of ice where scarcely a living creature is to be found; it is not likely that man will ever prosper there. In the heart of some continents we find regions of very high temperature, where the air is very dry and there is practically no rain; such desert regions have very few plants and animals, and are, again, likely to be always useless. So it is with the slopes of active volcanoes, and with a few other parts of the surface. Never colonized by plants or animals, such regions will probably always elude man's grip, unless the conditions change.

Generally, however, all parts of the earth's surface are clothed with plants, and each region has its special fauna, or collection of animals. Wherever man has prospered, he has done so at the expense of the original plants and animals; he has displaced those plants and animals.

A little reflection will enable us to realize what this means. We have spoken of the Scottish moors. Now, for mile after mile these may seem almost alike. Heather is what the botanist calls the "dominant" plant. For acres and acres it may seem as if there was almost nothing but heather. If we look closer, however, we find mixed with the heather such

plants as bell-heather, blaeberry—called whortleberry in Devonshire—bearberry, with tasteless, bright-coloured berries, and some other plants. These are what the botanists call “sub-dominants.” They are not so plentiful as the heather, but they are more abundant than any other plants. Then there are often many minor plants, never very abundant, though sometimes occurring in patches. The mountain azalea, already mentioned, will do as an example, though there are many others.

Now let us leave those open moors and come to the lower ground, where man has left his traces. The heather has gone as a dominant, though we see it in scattered patches in the pastures. We have fields of oats, often with cornfield weeds springing among the grain, fields of potatoes, sown grass for the cattle, and perhaps turnips, if the land has been carefully improved. This is a somewhat poor list when we compare it with the crops which the East Anglian farmer grows, but it illustrates the point—that man has swept away the dominant and sub-dominant natural species, and put in plants of his own choosing. Now, wherever the population is dense, he has done this on a large scale.

When we travel through England and across France, we see acre after acre of well-kept, cultivated ground, covered with many different kinds of crops. Not very long ago, as the scientific man counts time, those lands were clothed only with dense wood or with marsh, now swept away by man’s industry.

The same thing has happened with animals. When we travel through lowland Scotland or England, we see flocks of sheep and cattle, pigs, hens, ducks, geese, and turkeys round the farms, with horses ploughing the fields. These, man’s domesticated animals, have driven back to the Highlands and to the uplands of Devon and Cornwall the deer which once roamed the primeval forest of Britain, while for their sakes the wolves which once preyed upon the wild animals have long since been exterminated. In other words, man can only live by destroying the balance of Nature, by favouring some animals and plants at the expense of others, by forcing those useless to him to give way to those he needs.

How has he succeeded in doing this? Well, let us consider for a little the conditions under which plants and animals live in nature. Of late years botanists have devoted great attention to the study of what they call plant associations.

They find that plants are very much influenced by the nature of the soil upon which they grow, by the amount of wind, of rain, and so forth. Going back once again to the heather moor, we find that the soil in which the plants live is peaty, full of half-decayed parts of plants, not black and friable like the soil in other regions. Such soil makes it very difficult for plants to take in water, and therefore on the moors only those plants can live which can do with but little water. Water there is in abundance, but the roots of the plants cannot take it from that sour soil. Therefore they must do with as little as possible. Look at the small leaves of the heather, the stunted appearance of all the plants, except just at the moment when they are glorious with bloom. Only such stunted plants can live on the sour soil of the moors, and plants capable of doing this form what is called the heather association, the group or company for whom alone life in this bleak region is possible.

In close dependence on this company of plants live certain animals. The deer browse upon the young heather and upon the grass which springs among it, and on the moss which grows so freely on moors. The red grouse loves the numerous berries of the moors, and, at seasons when these are not ripe, finds food in the shoots and leaves of the moor plants. In the boggy pools countless tadpoles live in spring, and the grass-snake feeds upon the frogs which result. In the grassy patches of the moors voles are abundant, and these are preyed upon by the adder. These are only a few of the animals which find food and security in the heather association.

One of the reasons why man has been able to do so little with the moors is that none of the native plants and animals are of much use to him, and his useful plants and animals do not thrive there well. It is true that potatoes and oats will grow to some extent in sour soil, but they do not thrive so well as elsewhere. Sheep also can find pasture on the hills, but, like the deer, they must be few if they are to find a livelihood.

On the whole, then, the conditions on heather moors are somewhat unfavourable; relatively few plants and animals grow there naturally, and these are of little use to man. When we read in the geography book, therefore, that the Highlands of Scotland have a scanty population, we have to realize that this simply means that the sour soil grows plants badly, and without a free growth of plants it is difficult for man to prosper.



[Sutton's Camera]

SCENE IN THE SCOTTISH HIGHLANDS.

The valley is marshy and grows only poor pasture. the hillsides are steep and rocky.

But it is not only in places where plants grow badly that he finds it difficult to get a foothold. Look again at the population map. We all know that over much of Brazil, where the sun is hot and the rainfall is abundant, plants grow magnificently, forming the dense tropical forest; yet here the population is very scanty. Much the same thing is true of parts of the tropical forest of Africa. Here it is not the paucity of life which handicaps man, but rather its wealth and variety. The tropical forest is an example of what the botanist calls a "closed association"—that is, one where the struggle for life is so keen that no new species can force its way in among the others.

Quite often round small ports one finds ballast heaps, masses of sand and stones, which have been tipped out by ships returning without a cargo. On such ballast heaps we sometimes find all sorts of plants foreign to the neighbourhood, and these may spread to the neighbouring sand-dunes. Such sand-dunes have an "open" association; they are not carrying nearly so many plants as they could carry, because the physical conditions are very unfavourable. An introduced plant, accustomed to life in sandy soil, can easily prosper and run wild. But a new plant introduced into the Brazilian forest would have no chance of success—the struggle for light and air is too keen.

A French author tells a curious little allegory about a clearing made in a forest in North America, where a little village was built. For a time all went well, and then the forest began to encroach upon the clearing. Closer and closer to the houses crept the trees, till their branches shut all light from the windows and prevented the doors from opening. At first the people strove with axe and hook to beat back the forest, but they soon found it useless, and were constrained to fly, to watch from a distance the destruction of their homes by the all-encroaching vegetation.

This is an allegory; but if we think of it only as an allegory, it is true of the tropical forest. What can man do against the tremendous forces of vegetation represented there? In the temperate forest the struggle is keen; but there each recurring autumn and winter brings a "truce of God," when the sap slackens in the trees, though the blood flows as fast in man's veins. During this resting period for the plants he continues the fight, and when spring rouses the trees to activity, he has

already made his clearing and got the start. Further, in the temperate forest it is the trees which are the great enemies; the undergrowth is of minor importance. In the tropical forest, tree is bound to tree by creepers called lianes, and the undergrowth is dense (see p. 61). Where is man even to begin the unequal combat? Even his movements are greatly hampered. One explorer tells us that in the equatorial forest of New Guinea a party does well if it progresses at the rate of *three* miles a day, and cannot always achieve even half this distance. He tells us also, and illustrates by the experiences of his own party, that here, with all the luxuriance of tropical Nature at hand, it is impossible for a party to live upon the products of the forest. Starvation stares the group in the face at once if their imported supplies of food fail.

One other point is important. In the forest the struggle is so keen, and the natural conditions are so favourable to plants, that every possible place in Nature is filled. Taller and taller grow the trees, each one striving to overtop its neighbour. But as they grow, and so overshadow the ground below, higher and higher climb the creepers, seeking the free air and sunshine above. Up their trunks and along their branches grow the orchids, and the other plants which we call epiphytes, which do not attempt to reach the soil, but find food enough among the decaying vegetation, and moisture enough in the heavy air of the forest.

So keen is the struggle, and so dense the vegetation, that the chances of any particular tree being able to find room for its offspring near it are small; small also are the chances of survival of any seed or germ of life. We find, therefore, that the trees, the shrubs, the lianes, the epiphytes of the forest, are not only very numerous, but very varied.

On the steamy banks of the Amazon the collectors seek for rubber to send to Europe for motor tyres and a thousand other uses in civilization; but the search is toilsome. Only near the banks of the river can the collectors hope to move freely, and the trees are scattered and few.

In the woods of Formosa, Japanese or Chinese collectors search for camphor-trees, to get camphor for making incense and moth balls; but their work, too, is toilsome, for in the forests the camphor-trees are scattered far and wide, and one patch of wood after another is worked and left as its supplies

are exhausted. How different are the conditions in the temperate woods! In the moister parts of the Mediterranean region, we may find woods consisting of practically nothing but sweet chestnuts, yielding abundant food for man. Beech and oak are similarly what the botanists call social species. If one beech occurs, there will be many, so that whole herds of pigs may be fed upon the mast. Such social species are rare in the tropical forests, and useful plants have therefore to be sought far and wide.

Let us turn now to the animal world. Many curious mammals are to be found in tropical forests, differing according to the region where the forest occurs, but these are always few in number. On the prairies of North America, bison once occurred in countless herds; on the plains of Africa, the antelopes were once found in almost incredible numbers. Even the inhospitable steppes of Asia fed great flocks of wild hoofed animals before man interfered. But no such numbers of individual kinds of animals ever occurred in the tropical forest. It is the story of rubber-tree and camphor-tree against chestnut or beech once again.

In the Brazilian forest many different kinds of monkeys occur, but never in great numbers. Those strange climbing animals, the sloths, are found there, but are rare and not often seen. There are climbing, flesh-eating animals, like the curious kinkajou, with its prehensile tail, but flesh-eating animals never occur in very large numbers.

Far more obvious than the furry mammals in all tropical forests are scaly reptiles and insects, the latter being one great obstacle to man's conquest of the forest. Many of the reptiles are venomous, but it may be doubted whether they are as dangerous as the insects and ticks. Many of these are blood-suckers, and carry about from one victim to another the germs of deadly diseases, such as malaria and sleeping sickness, and others fatal to domesticated animals. Other insects, again, lay their eggs beneath the skin, and produce torturing ulcers. Others pollute all food before it can be eaten. Others bite and sting. Indeed, there is almost no end to the catalogue of injuries to man, direct and indirect, inflicted by the insects and their allies in the tropical forest.

Not a few of these insects, like the tsetse-fly, which carries sleeping sickness, are very sensitive to exposure to bright sun-

light, which, in some stages of their life-history, destroys them at once. If man can clear the forest, then, some of his difficulties vanish. But in the equatorial rain forest the climate deprives him of his greatest aid in the conflict—fire. Where there is a periodical dry season, even though there be no winter, there he can fire the long grass, and so destroy the all-invading vegetation. The wood ashes make a soft and fertile seed-bed, in which he may insert his own plants, and these, if carefully watched, will produce abundantly. But where the atmosphere is permanently moist, and the rainfall always plentiful, there fire cannot be employed, and there man is all but helpless.

Here, then, are two regions of the earth where the battle is still "sharp and sore," where man has been only partially successful; and from our brief study of these two we may learn, better than from the regions where he has been completely successful, the conditions of the conflict. What may we deduce from these two examples?

In the first place, we may note that, though man cannot prosper where the conditions are very unfavourable to plant and animal life, yet too great intensity of plant-life is almost as unfavourable to his activities as great poverty. If he is to increase and multiply, plants must become his servants; but, especially in the early stages, where his powers are very limited, he may be too weak to master them.

We have already suggested, in passing, some of the physical conditions which help him to gain the upper hand. Intensity of plant-life is a great aid to him once it is controlled, but, if it is continuous, it cannot be controlled. A favourable situation for man, then, will be a region where there is a periodical alternation of great activity and passivity, of growth and rest in the plant world. Need it be said that, where man has been most prosperous, he has been greatly aided by the seasons? From his point of view, it matters little whether the seasonal check is due to lowered temperature, as in our country, or to periodical variations in the amount of moisture, as in India and parts of China, or to a combination of both, as in other parts of China.

The countries, then, which are most likely to be suitable to man are those where, because of seasonal changes, plants are only periodically active. This makes very cold regions un-

suitable, for there the period of activity is very short, or, in the extreme cases, non-existent. It also excludes some equatorial regions, for there the temperature is uniformly high and rain is uniformly abundant.

Under the term "seasonal" we may include also such changes as those which have made the prosperity of Egypt possible. Here the temperature is always relatively high, and rain does not fall, so that there is but little seasonal change in the ordinary sense. But the life-giving stream year by year swells and shrinks again. As it swells, it brings water, which is life, to man's crops; as it shrinks, it brings drought, which is death, to many of his enemies, such as weeds and insect pests, while meantime his short-lived crops are safely gathered in. Once he has conquered, he can bring the water at his will. Now it means only more crops, not the overwhelming of his crops by alien vegetation, as it would have meant once.

In short, the plants and animals of any region form a more or less closed combination, carefully adjusted through long ages to the natural conditions. Anything which disturbs the delicate balance, ever so slightly, gives man the chance to intervene. Such a periodical disturbance occurs over many parts of the globe, owing to the movements of the earth and the consequent changes of the seasons. Speaking generally, the regions where there have always been big seasonal changes are the regions where man has found it easiest to intervene; these have been the battle-grounds where he has snatched his victories.

But the change need not only be seasonal; a secular change—that is, one occurring through long ages—must also affect the fortunes of the combat. Perhaps in Greece and Palestine, probably in many parts of Central Asia, slow changes in the amount of rainfall seem to have been taking place through the centuries. These changes have deprived man of advantages which he once possessed, and have enabled wild nature to recover lost ground. On the other hand, another set of changes seems to have been making the surface soil of Europe drier through long centuries. At the end of the Glacial Period the drainage of the greater part of Europe had been enormously modified by the action of the ice, one effect of which was to leave the surface sprinkled with lakes, especially towards the north. These lakes have been gradually filled up by natural



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**MONT BLANC AND CHAMONIX, SHOWING THE GLACIERS WHICH HAVE PERSISTED
SINCE THE GLACIAL PERIOD.**

causes, the disturbed river systems have adjusted themselves, and the deposits which the ice left have been modified and sorted afresh. According to a French geographer, these changes have played a large part in the great progress which has been made during the last centuries in the northern parts of both Europe and America. The Glacial Period seems to have swept away primitive man, as it swept away many of the animal inhabitants of Europe. But the changes which resulted ultimately left the earth better fitted to be the home of civilized man, and aided him in his ceaseless struggle.

One other point we have learnt even from this very brief study of the battlefield. No wild plant, no wild animal has shown itself capable of spreading over the globe in the way that man has done; no animal, no plant has multiplied as he has done. The heather on the Scottish moors is abundant enough. Standing on one of the Scottish hills one may believe that the whole world is filled with heather. Yet leave the moors for the lowlands, or for the smiling plains of England, and we find that the heather has utterly disappeared. Walk through the fir or pine woods in, say, the Alps (see p. 13), and you may feel that firs and pines are the only trees in the world. But leave the mountains where they grow, and you may never see a specimen in a day's march. We have spoken of the American bison, of the African antelopes; but these, though we always quote them as examples of the prolific nature of mother earth, never occupied more than the merest corner of her surface.

Worsted here and there, forced to beat a retreat from equatorial forest and burning desert, from polar wastes, and even from moor and upland, man has yet conquered as no other living creature has done. The mountain shelves of the Alps, the cold plateaux of Tibet, have served his purposes no less than the fertile valleys and smiling plains. With him, wherever he goes, he has taken his domesticated flocks and his cultivated plants. After long warfare he has bent them to his will, and as a result they have followed him to the farthest confines of the globe, to lands which their wild forbears never knew.

In the remaining chapters of this book we shall follow man to some of these regions, and show how he has conquered Nature, and what, as captive, she yields to his sword. But before closing this chapter, let us note one curious revenge

which wild Nature has taken upon her conqueror. Most of the larger wild animals, like some uncivilized tribes of men, have refused to yield to civilized man, who, here ruthlessly, here reluctantly, has wiped them for ever from the face of the land. No aboriginal Tasmanian will ever again walk this earth, and, let the zoologists mourn as they will, there seems little doubt that soon the African elephant, the giraffe, and most of the beautiful African antelopes will vanish also.

Other animals, however, have shown a firmer hold on life. Far from disappearing as man pursues his conquering way, they have attached themselves to him as camp-followers, and have prospered with him and in spite of him. The rabbit enjoys now a wider field of activity, a larger life, than before man set himself to destroy the balance of Nature. Constantly, but quite ineffectually, man makes war upon rats and mice and their allies, who thrive on the scraps which fall from his table. Humbler still are dependents like the cricket, which sings upon his hearth, and the cockroaches, which find warmth and food in his kitchens and bakehouses. Even the common sparrow finds life where man prospers easier than life in regions where he is rare. Much the same thing might be said of many "weeds." Very many wild flowers disappear or diminish as the result of man's relentless attacks on useless plants; but others adjust themselves contentedly to the changed conditions, and find in his ploughed fields, in his sown pastures, a life easier than was their old life in the open. That these plants and animals should prosper while the others disappear is one of the curious features of the struggle.

CHAPTER II

EXAMPLES OF ADVANCED COMMUNITIES—(I) SELF-SUFFICING GROUPS

Life in the Scottish Highlands before the Industrial Revolution—Local production of fuel, food, and textiles—The general conditions of life—Life in an Alpine valley—The mountain pastures and the migrations of the cattle—The various kinds of settlements in the Val d'Anniviers, and their adaptations to local conditions—Virtual absence of trade, and reasons for the self-sufficiency.

IN the earlier stages of his conflict with Nature, man doubtless occurred in very small groups; but wherever we find him emerging into the light of history, he is a markedly social organism, finding in combination a powerful weapon in the fight with Nature. But when not elaborately organized, these communities tend to be of no great size, and to show a very close dependence on the immediate surroundings. In such cases what we call external trade may scarcely exist, and the group may produce sufficient for its own needs. When this is the case, all the great necessities of life—the food, the clothing, the houses or shelters—are closely controlled by the geographical conditions. The climate, the relief, the nature of the soil, all exercise their influence very strongly. The material conditions of life, again, affect the moral and mental, so that in their religion, their moral code, their habits of thought, the people are deeply impressed by their natural conditions of existence. The mental and moral effects often continue to manifest themselves, even when the material conditions alter, and thus we often cannot understand the nature and institutions of a people without knowing their past history.

Such self-sufficing communities may occur at all stages of

civilization, though, as a general rule, they progress less rapidly than those in more intimate relation with the outside world. All the great periods of human progress, indeed, have been periods when new methods of conquering space have been utilised, and have thus brought originally isolated groups into free communication with each other. It is, perhaps, also true, however, that the long period of isolation helped such communities to store up the energy which they used later when opportunity offered. But the most important point to be noticed is that such groups had so far conquered Nature that the ground in their vicinity yielded them all the necessities of life.

Let us begin our study of self-sufficing communities by taking as an example life on the edge of the Scottish moor less than one hundred years ago. Modifications have been going on so rapidly that such communities are now greatly altered, and are no longer self-sufficing. This in the full sense, as we shall see, they were not even a hundred years ago; but at least the locality supplied the greater part of the necessities, and the mode of life was determined by local conditions, whereas now, with a railway close at hand, and free communication by means of it with the great ports and the wide world beyond, the local conditions have less influence.

The description is taken from an account given by a farmer, living near Aberfeldy on the Tay, of life in the region during his father's and grandfather's time. The locality is on the slope of a hill which stretches from the north side of the Tay valley up to summits of about 1,700 feet in height. Three zones of land are distinguishable—the arable land near the river, which had to produce food for man, and, as we shall see, part of his clothing, the rough pasture zone, which fed his flocks, and, finally, the heather moor above, which gave him fuel and some of the material for house-building, and fed his flocks in summer.

The chief crops on the arable land were oats and potatoes, always favourite crops in such regions, both because they are tolerant of poor soil, and because they come to maturity in the short period between the spring and autumn frosts, and are indifferent to much moisture and little sunshine. The soil and climate made it difficult to grow wheat, but rye and barley were both cultivated. Flax also was grown to supply the lint for linen underclothing. The fact that there were no sown

grasses and no turnips meant that the cattle and sheep were badly fed in winter, for America as yet supplied no "cake" to make up deficiencies.

Both the lower and the moorland grazings were held in common, and pastured black-faced sheep, Highland cattle, and small Highland horses, while pigs and hens, etc., were also kept. Grouse were then much less important than now, for the shootings were not let, and in summer time cattle, sheep, and horses alike were taken up to the moors, where their herdsmen lived in rude shelters during the warmer months.

More important, however, than the grazings were the peat deposits of the moors. As we have seen, plant remains rot very slowly on the moors, and instead of crumbling away to form soil, as in regions where the soil is better aerated, form a thick mass of peat, which, after being dried, burns well, and gives out a good heat, though it is a smoky fuel and difficult to light. When we remember the climate and the paucity of wood, it becomes obvious that life in the region was only rendered possible by the presence of these peat deposits, which thus formed a very important item in promoting human settlements here.

The obtaining of the peat was a somewhat laborious business. Thick deposits—and it is only these which were worth working—lie in depressions of the surface, formerly filled by a lake or bog. Some of this water always remains, and therefore the first thing to be done was to drain away the water by means of ditches. After this the turf had to be removed, and then 2 or 3 feet of useless black earth, beneath which lay the peat proper. This was cut in blocks called "peats," which were carefully dried to get rid of the superfluous water. On account of the drying process, the "peat-casting" could only be carried on in summer, and even so the wet Scottish summer often made the process difficult. After being dried, the peats were carted to the low ground. There were no wheeled vehicles and no proper tracks. The peats were brought down on rough sledges dragged over the hillside by any route which seemed feasible.

Peat is much lighter and bulkier than coal, which has been strongly compressed under a great weight of overlying rock, and therefore a considerable quantity was necessary to supply

even the modest needs of each family. The obtaining of the peats was in consequence a lengthy process, carried out during the fine weather. As a break in the daily monotony of life, it was welcomed by all those able to take part in it, and much practical joking and merrymaking went on at the time. Not only had each family to supply its own needs, but the rent to the laird also was partially paid in peats, so that a margin had to be allowed.

Such peat-cutting still goes on in parts of Scotland, in many parts of Ireland, in parts of Germany, Belgium, Holland, and so forth; but it is steadily diminishing with the spread of railways, and has quite disappeared from the part of Scotland just described. Why is this? There are doubtless various reasons, among them the smaller population of the glens, but the basal reason is certainly that the coal-mines are worked in a systematic and highly-organized fashion, and yield a product much superior to that obtained from the peat-bogs. Life also has become more complex in the glens since the breath of the outside world began to reach them. The people work, if not harder, yet in a more systematic fashion. Now the farmer would laugh to scorn the idea that his labourers and cottars should leave their work for weeks at a time in order to gather peats on the hill, when coal can be obtained from the nearest town in exchange for the better crops and the finer sheep and cattle which his improved methods yield. In other words, the clanking machinery at the pit-head makes its echoes heard even far up the Highland glens, and has driven the primitive sledge out of existence, and has allowed the grass to grow again on the rough tracks which once scarred the hillsides.

The houses were all thatched, in early days with heather or bracken, and later with straw, but even when straw was used, "divots," or pieces of turf from the hill, were added, and formed an important part of the whole. Generally there were no windows, and the hearth often occupied the centre of the floor; the houses were built of rough stone.

Furnishings were of the most primitive description. From a cross-bar suspended in the chimney hung a long chain, to which pots and girdles were suspended for cooking purposes; oven there was none. The local woods supplied timber for the construction of chairs, tables, and beds, and also for wooden porringers and bowls. The horns of the cattle supplied spoons.

made by travelling tinkers. Light, sometimes got in the most primitive mode of all, by setting fire to resinous pine-roots, was generally supplied by tallow candles.

The food was excessively monotonous. Wheaten bread was very rare, tea or coffee almost unknown. Potatoes and milk were the staple food, or, in some places, oatmeal and milk. Rye bread and barley bannocks were eaten, and the adjacent oceans supplied herrings, which could be dried and so kept. Natural products like salmon and mountain hares were obtained surreptitiously at times, and pork or bacon was furnished by the home-reared pigs. Mutton, also, was occasionally eaten.

Clothing was similarly home produced. Everyone kept a few sheep on the hill, and the wool was sent to the local mill. The cloth, when it came home, was made up by travelling tailors. The patches of flax on the arable land supplied under-clothing, the lint being also manufactured in a local mill.

Links with the outside world were few, trade being chiefly carried on by means of smugglers, who supplied the products of other regions. The younger men also went south at harvest time, and thus gained a little money and also a little experience of the outer world. On the whole, however, the community sufficed unto itself, and needed but little from the outside. That little was obtained by means of exchange, the surplus cattle, etc., being bought up by travelling drovers, or driven to the great cattle fairs, which were the meeting-place of half the countryside.

Let us contrast with this type of social life another equally dependent upon the physical conditions, and equally self-sufficing, but nevertheless differing in many respects. This is the life of the Swiss mountaineer in the regions still untouched by the tourist traffic, which is, after all, largely superficial, and affects the peasant but little.

We have seen that in the Highland glen the moor gave fuel, helped to feed the flocks, gave some thatching material, and in the old days supplied, in the wild game, a portion of the food supply. The more fertile regions near the river valleys were ploughed to produce crops, but these had to be hardy crops, tolerant of sour soil. Further, though in the old days the moors carried cattle as well as sheep, yet these cattle were not of great value, and the moors are now for the most part, where they yield grazing at all, given over to sheep, which demand

less luxuriant pasturage than cattle, are hardier, and need but little attention. Such sheep yield chiefly wool, their flesh being of less importance. They are not milked, as are the sheep in some other regions, and within the Highlands proper cheese is not made, or only on a very small scale.

In the Alps the conditions are very different. To begin with, the mountains are of a different structure. Far younger, as the geologist counts age, they are being worn down by the weather in a way which does not occur on the Highland hills. Long, long ago the surface rocks of the Highlands were worn down by wind and weather, and their waste was spread out on the Lowlands, forming the fertile lands where the chief crops of Scotland grow. But in the Alps the wearing process is still going on fast, and it is aided by glaciers (p. 13), which have long since disappeared from the Highland hills. The Ice Age, too, had a special effect on the Alps. It has left there, high up on the sides of the valleys, broad mountain shelves covered with fine rock waste and producing bountiful herbage. So abundant is this herbage that the Swiss call these mountain pasturages *the alps*. They are the only parts of the hills which are of value to them. Let the tourist talk of peak and glacier, and dispute over the name of this or that rocky needle; these interest the peasant but little, but for every stretch of herbage he has a special name, and each stretch has a well-defined ownership.

Pictures of the Alps nearly always show here and there light wreaths of cloud clinging round the snowy peaks. These fairy wreaths are the mists which water the mountain pasturages and renew again and again their herbage. In the colder months the clouds hang low, and the upper slopes, those above the forests, receive but little snow, though it lies thick in the valleys. But in summer, as the temperature rises, the zone of precipitation, as the geographer calls it, rises up the mountain side, and the ground, so dry at other seasons, is drenched with moisture, and forthwith gives birth to rich grasses and masses of lovely alpine flowers. Flowers and grasses, the placid cows will take them all, with a truly indiscriminate appetite, and will reward their herdsman and show the excellence of the pasturage by a plentiful flow of milk. Some of the milk is perhaps carried down on men's backs to the white hotels which we may see gleaming far below, but most of it is made into cheese.

It is made here, high up on the mountain-side, by the help of huge caldrons which have been carried up on men's backs, heated by wood which has also been laboriously brought up from the dark firwoods far below. The cheese will be carried down later, to be divided among the owners of the cows, but meantime the whey must not be wasted. What becomes of it? The grunting of a pig tells us. Unlike the fat stock of our agricultural shows, the Swiss pig must be agile enough to accompany his master to near the limit of the snows. Goats he takes with him also. Their milk is likewise made into cheese, and the goats will eat herbage which is not good enough for the cows, and are agile enough to crop the steep slopes which the cows cannot reach. Sheep are less often seen, the pasturage is too rich to be wasted upon them, and they do not thrive as they do on the Scottish hills or the wolds of Yorkshire.

Not only on the Swiss Alps, but on not a few other mountain regions, similar rich pasture grows. Marco Polo noticed it in Central Asia. Here, he says, is the best pasture in the world, for an emaciated mare will become fat on it in ten days. What makes such pasture so rich and nutritious, while our Scottish hills produce so meagre a growth of plants? It is partly, as we have said, the fine soil produced by the wearing down of the mountains; but it is partly also the effect of the elevation at which the plants grow. The light here is bright and the atmosphere rare. The plants do not grow very tall but they produce far less innutritious, woody tissue than on the lower ground. Far more rarely, also, do they produce those poisonous or distasteful substances which make cattle avoid certain plants on the low ground. Thus we find that plants which the cows will not touch on the low pastures, they eat greedily on the heights.

The life of the Swiss peasant, then, is based upon the fact that in summer the high mountains contain rich pasturages. These pasturages are utterly inaccessible in winter and even in spring. Necessarily, therefore, there must be a process of migration, and there must be food for the animals in winter. Further, as the peasants do not, like some peoples in Central Asia, depend entirely for food upon the products of their flocks, they must grow food for themselves, and must own some arable land. There results a very curious form of migration, which we must now describe in detail.



(Partridge and Co., Ltd.)

AN ALPINE VIEW IN SUMMER.

Note the wooden houses, or chalets, the firwoods, and the luxuriant grass, which at the lower levels is cut for hay.

Various studies of Alpine valleys and their populations have been made. We shall describe here the conditions which exist in one of the side valleys of the Valais, that called the Val d'Anniviers. Like so many of the valleys which open into the Rhone Valley, this valley is Y-shaped, being made of two tributary valleys above. Further, also like many others of the tributaries of the Rhone, the stream of the side valley runs through a steep and inaccessible gorge just before it enters the Rhone. This region is not suitable for human habitation; but farther up the valley widens, and here the hamlets are clustered together. Though the actual number of inhabitants is not large, the number of dwellings seems enormous, and at whatever season of the year the traveller enters the valley he may be almost sure of encountering a family on the march.

First comes the family mule, with the head of the household upon its back. The wife follows on foot, accompanied by her family and by the cows, the goats, the few sheep, the pig. This is not emigration, as one might suppose, but only one of the periodical movements which the pastoral life makes necessary.

As a general rule, the pastoral life means nomadism, permanent wandering, for the flocks soon exhaust a particular region, and, like their wild relatives, must then move on to a new locality. But in this Swiss valley we have only a limited and periodical migration, so carefully adjusted that the pasturages do not lose their fertility, but can be relied upon to produce abundant crops of herbage with each successive season. The adjustment is so accurate that the inhabitant of the valley demands practically nothing from the outside world. He has no use for money—a margin of fodder for his beasts, a little wine in the cellar and corn in the granary for himself, this is all he seeks to provide; for the rest he relies upon the recurring abundance of Nature.

No less than four types of dwelling are necessary for the complex life of the Anniviards. First we have the village proper, with the church and the surrounding fields of grain, placed at a spot where the valley widens, and so arranged as to catch as much as possible of the sun's rays. Unlike the Scottish Highlands, these Swiss valleys are rich in forests, and therefore wood forms the natural building material, as it is also the natural fuel. But as even this village, the seat of local

government, is only a temporary habitation, the Anniviard being always on the verge of a move, the houses so far as possible face the road, and the villages are thus long and straggling.

Each habitation is something more than a dwelling-house; here the cattle must be stalled, the fodder stored, provisions and firewood laid up for winter, so that more than one building is needed. The building itself has stone foundations and basement, but is built of wood, has balconies where sheaves of grain may often be seen drying, and is roofed with planks, often kept in position by heavy stones on top. Beside it stands the barn, or rather a combination of barn and cowshed, for the cows are sheltered below and the fodder is stored above. It also is built of wood. Two granaries are added. The one, also built of wood, is supported on piles, each of which bears a broad stone, intended to keep out marauding rats and mice. This building lodges the unthreshed grain, bundles of beans of various kinds, and other crops. Within is the threshing-floor, where during the leisure of winter the rye is threshed. In the other granary are stored the winter provisions—the rye bread, made at long intervals, and hard enough to test the strongest teeth; the dried meat for winter use; the precious cheese, which plays a large part in the dietary; and, most precious of all, the wine, which slowly matures in the cool cellar beneath, and is only used on days of high festival, or when the field work is particularly severe.

It is the number of separate buildings which makes the villages look larger than the population justifies, just as it is the fact that every family has dwellings in four settlements that makes the valley seem crowded with villages.

The dwellings are easily built, and require no professional aid. Each family group builds its own, after the traditional pattern and at a very moderate outlay. Some £20 to £30 will erect the whole "steading."

The next habitation is on the spring pasturage—the "mayen," or "voralp." Here the cows come in spring to wait till the high pasturages are clear of snow. Here they linger in autumn on their homeward journey, and here also comes the family. Here is no church, as in the village proper, nor are there fields, for the altitude is too great for cultivation, and it is only pasturage which is sought. But as the bread at least must be brought from the lower level, there is nearly always

a storehouse in addition to the primitive dwelling and the cowhouse. Such intermediate or May pasturages are far from universal in the Alps. They are, indeed, especially characteristic of the Valais, which has a peculiarly warm and dry climate, so that in these side valleys the snow melts early, and permits of an early growth of grass.

Above the mayen, sometimes far above it, is the alp, the pasturage of summer, the reason for the existence of the whole group. To it the cows and their attendants alone mount. The attendants are usually men, occasionally women, but the point is that they ascend as individuals, and not as family groups. Their duties are not only to watch the cows, but also to make the cheese; for here, in contradistinction to the mayen, where a certain amount of grass is cut and stored as hay, the whole produce of the pasture is transported below in the form of cheese. The access to the Alps is too difficult for hay to be carried down. It is sometimes so difficult, indeed, that it seems a miracle that cows, cheese-making utensils, and wood can all be conveyed up.

On the alp the buildings are very simple, the essential one being a hut for cheese-making. As we have seen, wood is absent at these heights; and that which is carried up, is too precious to be used for building. But the numerous stones which the winter frost rends from the mountains, give building material enough; they are piled up into a rough and unbeautiful building, whose one object is utilitarian. No emotions cling round this heap of stones, as they do round the buildings of the valley below; no family life exists here, and therefore it is enough if cheese can be made. The accommodation for the herdsmen also is rude and rough enough, as many a benighted Alpine tourist has found to his cost. Further, as the cows are here only for the short summer—for a period of from two and a half to three and a half months, and then often at different levels on the alp—there is generally no shelter for them; they sleep in the open, sometimes scattered on the hillside, sometimes herded into an enclosure.

The stretches of pasturage are never extensive, and the flocks are often large, so that the herdsmen must manage the wanderings carefully. It may often be that a considerable expanse of difficult ground separates one stretch of pasture from another. In this case two or even three sets of cheese-



AN ALP IN WINTER.

Now the pastures are drowned in snow, and out-of-door activities are practically impossible.

huts may occur at different levels, and from the one to the other the cheese-making appliances must be carried as the flocks move. Thus the traveller may often find empty and apparently deserted huts on a pasture in summer-time, in which case he will probably find the herdsmen and their flocks at a still higher level.

Butter is made as well as cheese, and the whole product is divided at the end of the season according to the number of cattle possessed by each proprietor, and their average yield of milk. This yield is carefully tested in the presence of the owner once or twice in the season.

Meantime the other members of the community have not been idle. The fields round the village have to be tilled and sown, and later the crops must be reaped; but, in addition to this, still a fourth type of habitation has to be considered. As we have seen, the tributary valley is separated from the great Rhone Valley by a steep and narrow gorge, where the construction of a road presents great difficulty. Thus a natural slow extension of the population down to the fertile Valley of the Rhone is impossible; main valley and tributary valley are cut off from one another by a physical obstacle. But the main valley presents great attractions to the mountain folk. There, and there alone, can fruit-trees be grown; and most precious of all fruit-trees to a community condemned to a monotonous diet without stimulants or condiments is the vine.

From an early date, therefore, the eyes of the Anniviards have been directed longingly to that great valley in which the Rhone flows, and bit by bit they have acquired lands there. But the journey from the village, and much more from the mayen, or alp, to the Rhone Valley, presents considerable difficulties, and cannot be undertaken lightly. Down on the hot and steamy plain, therefore, a fourth habitation must be built, for two or three times a year the vineyards must be visited. In the early spring, before the mayens are open, a journey is made down to the Rhone to prune the vines. But down on the plain the herbage is already growing, so the cattle come also, in order that nothing may be wasted. Then in autumn the whole community must descend for the vintage. Here, then, is another dwelling, less substantial than the village house, and adapted to the milder climate.

Though it is the vine primarily which brings the mountaineer down to the valley, he does not neglect the other crops, which can be grown there and there alone. Thus his little plot on the warm and sunny plain enables him to cultivate maize and various kinds of beans, as well as other plants. The new wine, so soon as the vintage is over, is carried up to the village, where, as already explained, it finds the necessary cool temperature for the ripening process to take place. It is this slow ripening which gives the wine its fine flavour, and makes it so much sought after.

The ambition of the people is, so far as possible, to suffice to themselves, and to reduce to the minimum the needs which must be supplied by barter. As we have seen, the fields and the flocks produce all that is required for food. The furniture, like the houses, is home-made, and fashioned of local wood. The sheep yield wool which is spun by the women to make the clothes. In the Scottish Highlands in the old days the home-grown wool made also the "blue bonnets" which formed the headgear of all the men, old and young. In the Val d'Anniviers, where the sun is much stronger, the women plait straw for their hats, instead of going bareheaded. In both cases local conditions and local products determine dress and habits.

The type of life which we described in the Highland village, has now disappeared, or has become so modified as to become unrecognizable. The cattle have gone from the moor, and the sheep are being replaced by deer and grouse. Many of the inhabitants are emigrating to Canada or the Argentine; but the Anniviards still live almost unaltered in their native valley. They do not emigrate; and narrow as is their valley, it can accommodate the natural increase of the population. What is the cause of this difference? There are many reasons, some geographical, some largely economic; but we may at least notice that the Anniviard group was always more stable because more favoured by Nature. Their houses, their fields, their tiny patches of garden, all face the sun, for the sun is here the life-giver. Where it shines, growth is rapid; where the mountains shadow the valley, but little grows. In the more powerful sunshine the Anniviards have an advantage which more than counterbalances the effect of elevation as compared with Scotland.

The climate of Highland Scotland is damp, and the moisture comes especially in the height of summer, when it is little needed, and may be insufficient in spring, when it is most wanted. Further, the clouds hide the sun and prevent the soil from obtaining sufficient warmth. The latitude, also, makes the climate colder. In the Val d'Anniviers the rainfall is low and the sun is hot. The insufficient rainfall would be a great disadvantage if there was not, locked up in the glaciers, an enormous store of water, which can be used most easily at the time of greatest need. If we stand on the bridge over an Alpine torrent on a blazing summer day, the stream will seem to swell before our eyes. Twigs and leaves which lie on the banks, are swept away by the rising flood. If we lift up our eyes towards the hills, we may see, high up on the slope, the glacier which feeds the stream. The longer the sun shines, the faster the ice melts, and the bigger load of water it pours into the stream. Of this fact the prudent Anniviard takes full advantage. All along the hillsides run his irrigation channels. They water the high pasturages if the cloud bank disappears before the summer sun ; they carry their life-giving waters to field, and even, if necessary, to vineyard far below. Thus in his struggle he is favoured, as compared with the Highlander, not only by the climate, but by the fact that the last glaciers of the Ice Age still linger on his mountains, though they have long since melted from the Scottish hills. The more favourable natural conditions are reflected in the greater stability of the social polity, which has proved more resistant than that of the Highlander.

CHAPTER III

EXAMPLES OF ADVANCED COMMUNITIES (*continued*)— (2) DEPENDENT GROUPS

The origin of towns—Venice: her origin and her trade—Contrast with Milan and Florence as other types of trading cities—Position of towns in general—Contrast between the old trading cities and the new—Dependence of the latter upon food and raw material brought from a distance—The manufactures of modern towns.

As a contrast with the two communities just described, whose members, either from need or from desire, were all but independent of the existence of other groups, we may take one or two examples of other communities whose dependence is absolute. These examples may conveniently be urban or town communities, for, by definition, a town is a dependent, and not a self-sufficing, organism.

What is a town? Let us go back a little in time and consider its origin, and its original inhabitants. Where are towns placed, and what causes them to originate? We need not go very far back, for the beautiful towns of medieval Italy, the prototypes of the towns of modern Europe, will tell us all we want to know, without it being necessary to discuss the ancient cities of the East. Let us run over the names of a few of the old Italian towns and think of their position.

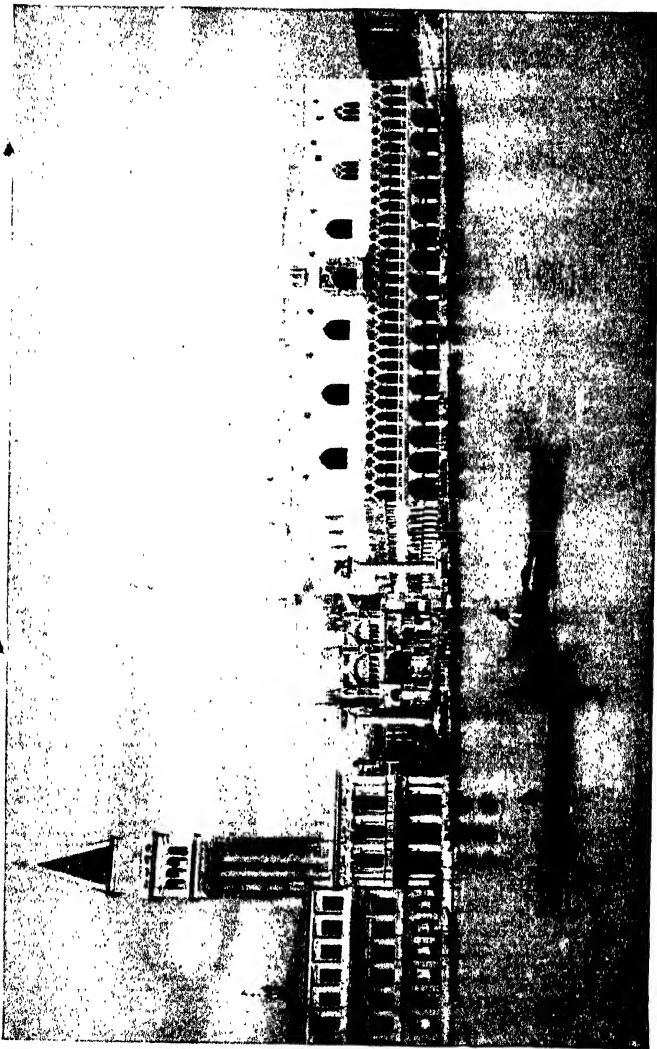
First there is Venice, placed for safety on the islands of a shallow sea, in origin nothing but a stockade in a marsh, a means whereby a handful of frightened folk found safety from the dreaded Huns. But while safety is good, it is not enough; the mere fact that a little group of dwellings is protected by swamps and marshes from marauders, will not enable its inhabitants to prosper. We know what made Venice great. Down the Adriatic Sea went the great route to the East in the

olden days. No sea-route to India yet existed, and the pepper and spices, the silks, jewels, gold and ivory of the fabulous East, had to travel a long and costly journey overland to the eastern end of the Mediterranean, and were then carried by Venetian ships to Venice for distribution to the West. Behind the marshes lay the fertile plains of North Italy; northwards lay passes through the barrier of the Alps to the countries of the north. The swamps could produce no grain, no wine; it was the business of the Venetians, then, to persuade the outside world of the value of the products of the East, for they could only live by exchanging these for the food their own territories would not produce. The citizens of Venice, then, must have been first of all traders.

But once her Eastern commerce was established, and strange products were poured into her port, the imagination of her people was stimulated, and with the wealth her trade brought the most pressing needs of food and shelter and clothing were easily satisfied, and yet a margin of wealth remained. Her people soon ceased to be content merely to engage in commerce, they began to manufacture, and especially to make beautiful things, to develop that artistic spirit which can only thrive when the elementary needs of a human group can be satisfied without very heavy toil.

The eastern trade of Venice has largely gone; it was all but destroyed when the sea-route to India was discovered, and even the piercing of the Suez Canal did not bring it back—the old conditions had gone for ever. But Venice still bulks largely in men's imagination, is still visited by thousands, has still much prosperity. Why? Partly because the old skill of its artisans lingers among the present population, as witness the beautiful Venetian glass, but chiefly because those dead and gone artisans and artists have left their imprint deep upon the city. Among the ugliness, the imperfect organization of the modern cities, the thoughts of men turn backwards longingly to those beautiful cities of the Middle Ages, which seem to us even more beautiful and better organized than they did to their inhabitants.

But let us turn back for a moment to the early Venice, the first settlement on the islands of the lagoons. Here, as we have seen, the first inhabitants found safety and easy access to the sea, but they found but little else. Agriculture was impos-



**VENICE: THE CAMPANILE, SAN MARCO, AND THE DOGE'S PALACE, THE REGION WHICH
FORMS THE CENTRE OF THE TOWN.**

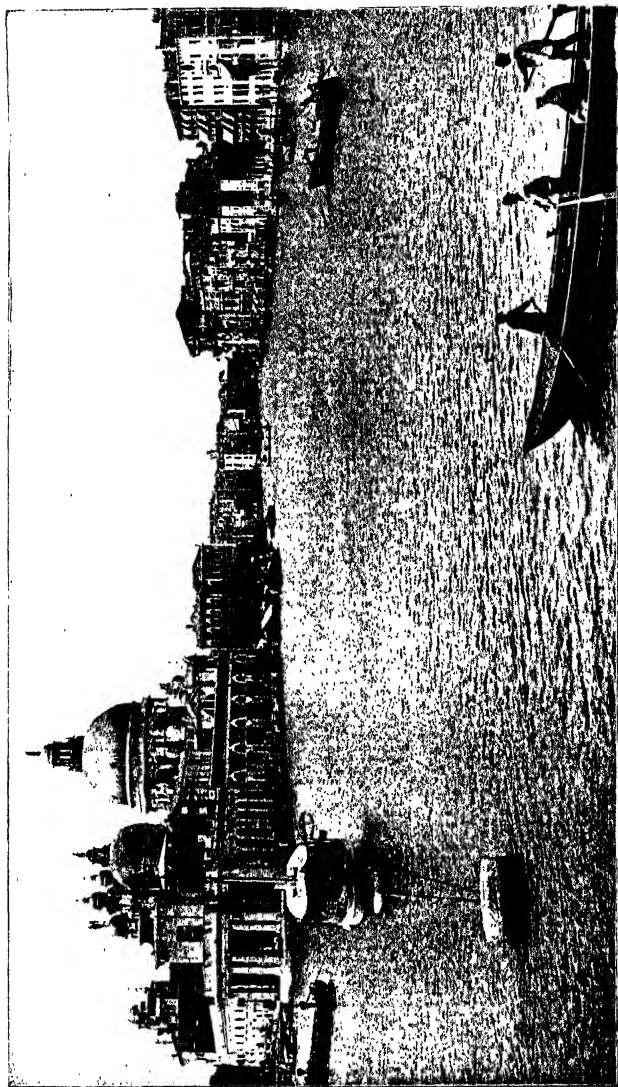
G. W. Wilson and Co., Ltd.

sible; even wood to build boats was hard to get. Two things, however, they did find to their hand—the lagoons swarmed with fish, and from the water salt was easily obtained. Salt is a necessary condiment very highly prized by inland people, who, except where deposits of rock-salt occur, find it hard to get. Not only is it a necessary condiment, but it is very valuable as a preservative, and was thus especially important in early days, when commerce was not well developed, and it was difficult to preserve food for the winter or for times of scarcity, or to transport it rapidly.

Salt and fish, then, the Venetians had, and these they could, and did, exchange for corn and wine and wool and wood from the regions round. Placed on a narrow sea, and with their own settlements on islands, they must acquire skill in navigation or starve. Here was the beginning of their trade, and the rest followed easily. We have shown that the inhabitants were primarily traders or artisans—men skilful with their hands, or shrewd enough to carry on exchange. Such artisans and traders must always form the basis of the population of a town, whatever other sets of men be added to them, and it is one great difference between the medieval town and the modern one that the artisans of the former were highly skilled and resourceful, as well as very artistic. The modern artisan, who is almost always aided by elaborate machinery, has less opportunity for becoming an all-round man, and their cities reflect the difference between the two sets of men. Travellers do not go to study Leeds and Sheffield as they go to Florence and Venice.

Venice is one type of the medieval city—the port. Its great rival, Genoa, has an almost similar position on the other side of the peninsula of Italy. Both these cities owe their origin to their position, which gives them a double advantage. On the one hand, placed on an inland sea, each commands, or did once command, extensive sea commerce, especially important from the way that inland sea runs far east, and so promotes communication with a part of the earth's surface yielding products very different from those of the west.

The second advantage of both cities is that they have behind them passes leading through the Alps, and could thus easily obtain the products of the North to sell to the inland towns of Italy, and could also send northwards the greatly-



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VENICE : THE ENTRANCE OF THE GRAND CANAL.

The Grand Canal, which winds through the city, is probably an old river channel.

prized products of the South. Both cities were absolutely dependent upon their commerce. Venice especially could have been starved at once if her land and sea-borne commerce were cut off. Both prospered greatly on account of this commerce. The Highlander we studied in the last chapter, had no wealth save his handful of cattle and sheep; the Anniviard has none save his livestock, his land, his stored fodder, and his tiny cellar of wine. The wealth of the old Venetians still remains in their beautiful buildings, in their mosaics and pictures, and is a heritage for all time. The Anniviard who holds that it is a proof of degeneracy to buy necessities from the outside world, may boast of his proud independence, but he will never enrich the world as the trading cities have done.

Milan and Florence are two other examples of Italian cities, with certain resemblances and well-marked differences. Milan is situated in the midst of the fertile plain of Lombardy on a very insignificant river. This last is a peculiar feature, for as a general rule great cities, when they are not seaports, are placed upon large rivers capable of carrying on river traffic.

Though Milan lies on the plain, the snow-clad Alps are visible from its cathedral tower; it lies where the mountains merge into the plain. Over those distant mountains the great passes of the chain run, so that Milan, like Venice and Genoa, is placed where free communication with the states of the North is possible. But Milan is primarily an example of a market town.

The plain of Lombardy, favoured by climate and fertilized by the waste of the Alps, is a rich agricultural region. It produces, and has produced for a prolonged period, abundance of grain, of wine, of mulberry-trees to feed silkworms, of such crops as flax and hemp; and, further, the pastures of the mountain slopes feed flocks of cattle and sheep, and the flat plain of the Po, with its many tributaries, easily connected by canals, is admirably suited for irrigation. The irrigated meadows have been known to produce as many as nine crops of grass in the year. Granted peace, then—not always obtainable in the Middle Ages—the region will produce a surplus of agricultural products. Such a surplus leads to the establishment of market towns, where the overflow is sent for distribution to less favoured regions. Further, on the plain of Lombardy

communication is easy, and, as we have seen, there are outlets to the North over the Alps, and east and west through Genoa and Venice there is easy communication with the productive regions of the Far East and the West. The proximity of the mountains gives water-power, now very extensively used in the valleys of Lombardy.

In the highland glens and the Swiss valleys, both, as we have seen, regions where cultivation is difficult, and the crops small, the inhabitants themselves use (or once used) their own raw material, spinning and weaving the necessary textiles. But in Lombardy, and similarly in Tuscany, both regions where the earth produces freely, a division of labour naturally takes place. The farmers bring the flax and wool to the market-town, first, no doubt, because they have a surplus after their own needs are satisfied. Here, then, manufactures spring up, skill is acquired, a demand is created for dyestuffs and other accessory substances.

More than this, the home weavers, working at first only for themselves, make what they can of the raw material that their land supplies. But the town weaver, dealing with material supplied by different localities, finds many minor differences of quality, learns that this wool is best suited for coarse cloths, that for fine. He searches then for materials which will suit his purpose, discriminates between the product of one region and of another.

At an early date the skilled weavers of Florence and Milan found that their home-grown wool was inferior to that grown in colder countries. An interesting letter, dated London, January 6, 1284, has come down to us, in which a representative of a Florentine house describes how he bought wool, in many cases for several years in advance, from several English monasteries, wool which was to be sent to Florence to be manufactured. Textiles, then, especially woollen and silken fabrics, were early manufactured in Milan.

Another of its manufactures is interesting. Unlike Venice, its natural bulwarks were scanty, and though it was well fortified by man, it had to stand many attacks, and wars were frequent in the neighbourhood. Arms, then, were naturally made there, for the manufacture of steel is not a domestic industry. Curiously enough, though the particular need for arms has gone, Milan retains an important cutlery industry.

Further, as Venice was near, and could supply gold and ivory and precious stones, gold-work was made, and various artistic trades carried on.

This account enables us to explain generally the causes which led to the foundation of Milan. It was originally a market-town, specially favoured by the fact that it lay at the junction of mountain and plain, so that there mountain-dwellers could exchange their wool, cheese, and hides for the products of the plain. It was also favoured by the easy communication over the plain, and by its agricultural wealth. At first a mart—a place where traders dwelt—it soon became also a busy hive of industry, its artisans manufacturing the raw material brought to the town, and developing in skill and efficiency as the traders proved more and more able to supply all their needs.

Florence had a similar origin. As Milan lies at the foot of the Alps, so it lies at the foot of the Apennines. As railways converge from the Alps on Milan, so they converge from the Apennines on Florence, and in both cases the railways mark old routes. As Milan lies on the fertile plain of Lombardy, so Florence lies upon the most fertile part of the plain of Tuscany. There is, however, one great difference. No one great artery connects Milan with the sea-board, but Florence marks the limit of navigation on the Arno, and by means of that river communicates directly with the sea. Lower down the stream lies its ancient rival Pisa, and the ceaseless conflicts between the two in the old days show us how much depended upon the water traffic.

Farther south, and in a warmer climate, Florence in early times enjoyed several advantages over Milan. The plain is smaller, the hills are nearer, and in the old days defence was easier. The rampart of the Alps rises only to the north of Milan, but the Apennines sweep round Florence, so that it is not, like Milan, open both to the east and west. In 1162 Frederick Barbarossa sacked Milan, and ordered it to be razed to the ground. His sentence was not completely carried out, but in a very few years the destroyed parts of the city were rebuilt. The causes which had produced it continued in action, and no Imperial edict could prevail against them. The position of Florence rendered it less liable to such attacks, but it also makes it a less suitable site for a town in

a more peaceful age. It now lives largely upon its past, while Milan is a thriving modern city.

Like Milan, Florence had early a great woollen trade. A great part of its raw wool was obtained from England, Spain, and Portugal. Woollens manufactured in Flanders and Brabant also were brought to Florence to be finished and dressed, by one of two possible routes. The one led down the great Saône-Rhone Valley to the Mediterranean, whence the goods could be carried by ship across the sea, and up the Arno to Florence; by the other they reached the city via Germany and the Alps. Florence, no less than Milan, had an outlet to Venice, and there was therefore considerable rivalry between the two for Venetian commerce. Some of the woollen cloths of Florence were exported through Venice.

The relatively sheltered and safe position of Florence during the Middle Ages, like that of Venice, enabled the people to become highly artistic, and has led to the preservation of many works of art, which are here much more prominent than at Milan. It is notable also as the birthplace of a number of famous men—especially artists, writers, and politicians. The existence of these great men suggests the high level of general development reached by the whole community.

This brief account of a few famous Italian towns helps us to understand the conditions which determine the position and origin of towns. They are primarily places for traders, and therefore occur in regions where there is a surplus of products over the needs of the community. Based upon the principle of exchange, they must necessarily occupy a site where locomotion in several directions is possible. Such positions occur especially near water, and therefore very many towns are sea or river ports; but as skill in navigating the open ocean was only slowly acquired, early towns tended to face narrow and sheltered seas, where navigation was relatively easy. Tyre, Sidon, Carthage, Venice, are ancient cities; Cardiff, Liverpool, Southampton, which depend upon traffic carried on over a wide and stormy ocean, are but of yesterday.

Again, as exchange is only possible when the two parties can bring different products, towns tend to occur where two regions with varying natural products abut upon one another. The city of Lyons stands where the transverse Rhone enters the longitudinal valley of the Saône. Here three regions

meet—routes leading from north, south, and east. Toulouse commands one route between the Atlantic Ocean and the Mediterranean Sea. It is also placed where the roads from the mountains converge on the plain. Buda-Pesth is the geographical centre of the fertile, wheat-producing plain of Hungary, but it has the hills at its back, and stands on a great river, which acts as a highway.

Once a town has been established, round the original nucleus of traders and artisans other interests and groups cluster. The facility of communication may make the city a good centre for local government; it may become a great teaching centre, a religious centre, and so on, but, save where it is a purely artificial structure, the original cause of its foundation was the fact that it offered facilities for trade.

The ancient cities of Italy just described are extraordinarily interesting from many points of view, but we must not forget that, in comparison with the great modern cities, they were mostly small, and their trade was insignificant. It was doubtless a great change from the Highlander's or Annivard's point of view when the Venetians dared to leave cornlands and vineyards and face the world with only their fish and their salt in their hands. But we cannot forget that they got their wheat and their wood from a region which was practically at their own door.

Now in the Highland glens the inhabitants sit down to a table bearing bread made of wheat which was perhaps grown in the United States, or Canada, or the Argentine; they drink tea brought from Ceylon or India, sweetened with sugar brought from Belgium or Jamaica; the table may be covered with a tablecloth from Dunfermline, but there will be somewhere in the room cotton goods made from cotton grown in Egypt or the United States. We might extend the list considerably, but the point is simply that, when the trade of Venice reached its maximum, those of the daily necessities which were brought from afar, were always few in comparison with those obtained from the regions immediately adjoining. It is not so now. In the house of the poorest artisan of Great Britain the goods made of imported materials may largely outnumber those made of native materials. Indeed, so far have we moved from the Venetian position that, while with them the imported goods were precious and used only for the rich,

with us the goods and food-materials which are British-made or British-produced, are often luxuries for the rich. The rich and well-to-do eat British beef and mutton, the poor get theirs from the Argentine or New Zealand. "Creamery butter" is dearer than "Danish"; British glass is better and more expensive than the imported; the linen shirts which the Highlanders used to wear, are now too costly for him, and so on.

Let us consider for a moment in detail just how large a part imported materials play in our daily life. We build our houses of stone or brick, and roof them with slates or tiles; these are home products. But the wood fittings are nearly all of imported timber—timber from Norway and Sweden, or Canada or the United States. The furnishings are also made of imported wood; sometimes they are even imported in the finished or partly-finished state. Of the textiles, linen is too dear for common use, and though flax is still grown in Ireland, linen is less used than cotton. Cotton is obtained from the Southern United States, or from Egypt, or India, but it is manufactured here, especially in Lancashire. Our sheep still, as in the thirteenth century, produce fine wool; but far from selling it to the Italian towns, we have now to send our representatives out into the markets of the world to buy foreign or colonial wool, for we need far more than our own country yields. Silk we cannot produce. The raw material which Lyons sends us, is manufactured here to some extent, but we also take many of her manufactured stuffs, and many ribbons from St. Etienne. Hemp is not grown, but Russia and other countries send us much; Calcutta sends us jute, and we are thus able to make much canvas and coarse sacking. Iron goods are partly made from native iron, but a great deal of iron and steel is imported from Sweden, Spain, and elsewhere.

We no longer depend upon horn spoons and wooden bowls and platters for eating purposes, and quite a number of the metals are called upon to supply our needs. Tin, so extensively used in making tin utensils and in lining copper pans, etc., used to be supplied by the mines of Cornwall. Now we need more than these mines can yield, and the Straits Settlements are called upon to supply our demand. Copper was also once yielded by Devon and Cornwall, but now Chile, the United States, and Spain send it to us. Silver and gold

were poured into Europe freely when the New World was discovered, and it is still the newer parts of the world which produce them in quantities far greater than the East did in earlier days.

But it is when we come to food, that our dependence upon outside countries is most obvious. Now, throughout practically the length and breadth of Great Britain and Ireland, everyone eats wheaten bread. This, as we have seen, is a recent phenomenon. Less than one hundred years ago wheaten bread in many places was a rarity, and formed no regular part of the food of the poorer people. Yet in those days the country was producing her own wheat. In the early part of the nineteenth century she produced far more than at present, and in the eighteenth century England was a wheat-exporting country. Now less than a third of the amount of wheat consumed is grown in the country; more than two-thirds has to be imported from other countries. If we look in at the window of a baker's shop, and regard the shop as representative of all the bakers' shops in Great Britain, then we may be sure that less than one loaf in three is made of British-grown wheat.

We have just said that now, though wheat is so largely imported, yet everyone eats wheaten bread. This is because the price has gone down steadily since we ceased to supply all our own demand for wheat. The wheat that comes overseas from Canada, from India, from the plains of the United States, is far cheaper in the English towns to-day than was the wheat of the old days which was grown on their immediate outskirts.

It is much the same with other articles of food. A great deal of our meat is imported—frozen, or tinned, or preserved in some way. Even the best "British beef" is not all home fed, for though the British islands are famous for their pastures, yet those pastures will not supply food enough for the huge herds of cattle necessary to feed their teeming populations. "Cake" made from linseed comes from the United States to help to feed the farmers' flocks here; Manchuria sends soya beans for the same purpose: the cattle of the British Isles would starve as quickly as the human beings if food supplies from distant countries were cut off.

We produce hardly any sugar, but we all eat quantities of it, and it is cheaper with us than it is in the countries where

it grows freely. Not France, with its acres of sugar-beet, nor Italy, which could grow sugar-cane as well as sugar-beet, has such cheap sugar as we have.

Though our climate is not very well adapted for fruit-growing, yet fruit is cheaper with us than in many countries better fitted to produce it. Every little street boy in Liverpool or London eats oranges and bananas, and can buy grapes for a trifle, yet all these have to be brought over the seas from considerable distances. In the market at Lisbon, with orange-trees growing in the neighbourhood, the oranges are no cheaper than at Liverpool. You may buy them there and carry them home with you, perhaps in a ship whose hold is full of other oranges; but when you land on the quay, you will find that you might have saved yourself the trouble, for the man with the barrow whom you will find on the dock, will sell you as good oranges for the same price.

How can we explain these extraordinary conditions? The whole world, civilized and uncivilized, is pouring its products into that little island in the north-west corner of Europe; do her people simply sit and allow the golden shower to fall into their laps? We know that this is far from being true. The people work as they perhaps never worked in earlier times—work steadily and continuously from morn to night.

To find the explanation we need only examine that rather dull thing, a table of exports and imports. There we may learn that by far the most important item in the list of British exports is manufactured cotton goods and yarn, which are sent to India, China, Turkey, Egypt, Brazil, and so on. Other very important items are manufactured woollen goods, and iron and steel goods, including machinery, ships, cutlery, and so forth. The other items are less important, though a considerable amount of coal is exported. Briefly, then, we supply much of the world with cotton and woollen goods, and with the iron and steel goods so necessary for civilized life. It is in return for these that they send us their raw material and their natural products so cheaply, for the ships which carry out the manufactured goods, can easily bring back raw material and food.

How is it that we can manufacture these things in such quantities? We have abundance of coal, mostly near the surface and easily worked; we have—or had—rich iron deposits, generally near the coal, so that the ores are easily

smelted. It is with our coal, and with the brains that made and drive our machinery, that we buy the products of every climate and every land. The numerous and ingenious machines to be found in every cotton mill in Lancashire multiply man's power of doing work many times, and cotton is a fibre which lends itself to the use of modern machinery, much more than lint, for instance, does. It is for this reason that the cheap cottons of Manchester have ousted the primitive linens of the Highland glens, and have replaced local hand-made textiles over so many parts of the globe.

One point is perhaps worthy of note before we leave this subject. We saw that the prosperity of Venice received a very severe blow when her monopoly of the trade of the East was taken away. Are the conditions prevailing in the British Islands any more stable? Can we expect that the world will go on buying British cottons and woollens indefinitely, and that our coal-beds will never give out? It may be difficult to determine how long present conditions will last, but we can hardly doubt that they are temporary, and that the fortunes of Britain will alter, as have done those of the great States of the past. But this is to look far ahead.

The main conclusion that we have to draw from this chapter, however, is that a dependent community always means a more perfect conquest of Nature than a self-sufficing one, for such dependent groups must be based upon trade, and trade means a conquest of space, a power of transporting goods, and a power also of doing work which the self-sufficing groups do not possess. In the way in which they can transport goods, and in their capacity for doing work, modern towns show greater control of Nature than the older ones, and in a future chapter we shall have to consider how they acquired this enhanced power.

CHAPTER IV

PRIMITIVE CONDITIONS : THE COLLECTING STAGE

Difficulties of the collecting stage in regions with seasonal variation—
Limitation of groups in this stage to special regions—The Tasmanians; the conditions of their life and their numbers when discovered—The African negro: his early stages—The Fans of the Equatorial forest: their combination of some cultivation with the collecting stage—Their wasteful methods.

THE communities which we studied in the last two chapters were highly advanced; their members are heirs of a long tradition, and heritors also of much property in the form of cultivated plants and domesticated animals, and of much written knowledge, perhaps the most valuable heritage of all. But there are other communities which contrive to exist at a very much lower level, and it is difficult to understand the higher without some knowledge of the lower.

If we go back in time to the very early days, before man knew how to work metals, before he had tamed animals or grown plants, we come to a time when, like the monkeys of the forest, he was constrained to subsist by gathering wild fruits and products. This is the Collecting Stage, and a few examples of it still linger on in odd corners of a globe which is fast becoming civilized.

We have already noted that all animals, apart from man, have a very limited distribution, this being especially true of the herbivorous forms, which are often closely bound to a particular set of conditions. We might have added that this limited distribution is closely connected with the fact that most animals are fitted by nature for one kind of food, and one kind only, and therefore cannot prosper outside the region where that food is obtainable. Parrots, for instance, live in warm countries where

there is abundant forest. Their feet permit them to climb about the trees, their beaks are nutcrackers enabling them to crack the shells and coats of seeds, and they are also very fond of fruit. They could not live, *e.g.*, in an Alpine fir-forest, because they could not find there sufficient food. The hippopotamus lives in the rivers of tropical Africa, but could not extend into Europe, for there it would not find the succulent tropical vegetation which it needs. So it is with most animals. Man differs from other animals notably in this respect, for he eats a great variety of food, and is exceedingly tolerant of changes. Perhaps we may even add that, the more civilized he is, the more easily he adapts himself to new articles of food, the more willing he is to give up articles to which he is accustomed if the occasion demands. This tolerance has been a great factor in his spread over the earth, a great aid in his conquest of Nature.

If we compare with him, for example, the monkeys and apes, we find that his willingness to take all sorts of foods has enabled him to spread far more widely over the earth than they. The large apes have a very limited range in latitude. In West Africa and the Malay region, they occupy a narrow belt of tropical and equatorial forest. They eat nothing but tropical fruits, and therefore their extension to the North or to the South is absolutely prevented. The monkeys will take insects, eggs, and even small birds in addition, and manage to extend over a slightly wider area; but there is no fishing monkey, no purely flesh-eating monkey, and therefore great areas of the earth's surface are entirely devoid of monkeys. It is otherwise with man. He has pushed his settlements far up into the frozen North, where he must depend wholly upon the produce of the sea; he lives under the equator and in the steaming tropical forests; he thrives best in temperate latitudes, where he can work hardest.

Everywhere, to begin with, he must have been a collector of wild produce, a hunter of wild animals, a fisher in the seas and lakes. But the great disadvantage of the collector's life is its uncertainty. To-day there may be an abundance of game or of wild fruits; to-morrow there may be none. This is especially true in regions where the seasons are well marked, for there animal and vegetable life show a rhythm, an alternately swelling and sinking cadence. In tropical regions such a

rhythm is much less marked, and there the collecting life is easier. In such regions the continuity of life makes it unnecessary to store food, and we find that tropical peoples, except where there is a striking contrast between a dry and a rainy season, are excessively improvident. Farther North and South man and animals alike must be more foreseeing. The hamster of the German plains, the squirrel in the forest—these and not a few other northern animals lay up food stores for the recurring time of scarcity, while their allies in the South look forward to the future with utter unconcern. But the hamster especially depends greatly upon man to grow the seeds which fill its store-chamber; it would fare badly if he were not prudent and provident. The fact that man has had to be prudent in those middle latitudes has meant much in the history of civilization. He must grow food; but most groups, even in the tropical forest, do that on a small scale. His special peculiarity is that he must store his food. The granaries and storehouses we described in the Swiss valley, and also the elaborate arrangements to ensure that the distant pastures are eaten down by the cows, while the accessible ones are cut as hay—these suggest the lessons that man had to learn in regions of severe winter. The periodic occurrence of a very dry period, like the Mediterranean summer, has had much the same effect.

Unless, then, like some wild herbivorous animals, he migrated with the changing seasons, man as a mere hunter and collector would have but little chance of survival in regions of marked seasonal variation. This condition, therefore, would be most likely to persist in peoples inhabiting warm forest regions with little seasonal change. Not many groups at this stage persist at the present day, but throughout a great part of tropical Africa we find races which have risen but little above it, for they cultivate little, and store no food, provide for no uncertain to-morrow.

Curiously enough, however, one of the most marked examples of the Collecting Stage which persists is that of the Eskimos, who live in a region of almost eternal winter, and yet depend wholly upon the animals they can catch for food. They are, however, few in number, and their existence can be explained, as we shall see later, by the rich life of the northern seas.

Let us note, briefly, one example of the pure Collecting Stage which is important because we can estimate, more or less

accurately, the number of members which the group contained, and show how wasteful a method of existence this is. This example is furnished by the Tasmanians, the now extinct aboriginal inhabitants of the Island of Tasmania.

The Tasmanians were a dark-skinned, woolly-haired people, in some respects resembling the inhabitants of New Guinea. When discovered they were confined to Tasmania; but it is believed that they once occurred in Australia, and were driven out of that continent by the native Australians, who reached the continent after them, and were in some respects better fitted to survive there.

✓ The Tasmanians had no knowledge of metals, and all they possessed in the way of tools and weapons were wooden spears, clubs or waddies, and rough stone scrapers. These last were roughly chipped, made of the hardest stone found in the island, and were used to sharpen the spears, to scrape the flesh of shell-fish and the other animals eaten, and also for any necessary cutting purposes. The Tasmanians knew how to make fire by twisting one piece of wood in the hollow of another; and they used fire regularly to clear portions of the forest, in order to make little pastures where the kangaroos might be tempted to come out to feed. They also cooked their food and cremated their dead. Their food consisted of shell-fish and crayfish—the latter being very abundant both in the streams and in the sea, and growing to a large size—of kangaroos and the other wild animals of the island, of the eggs and flesh of sea-birds, and of such vegetable matter as they could get, especially the rootstocks and young shoots of ferns, and seaweeds and fungi.

Their numbers are not believed to have exceeded 2,000 to 3,000. Now the island has an area of over 26,000 square miles, so that in the old days it took from about 9 to 13 square miles—that is, 6,000 to 8,000 acres—of territory to support one individual! This is far, indeed, from the three acres and a cow standard! Tasmania is still scantily peopled as we count population in the Old World; but it now keeps over 200,000 people—that is, a hundred times as many as before—in comfort, since the white man took out his sheep and his fruit-trees. Scotland is less fertile, and has a worse climate; yet, though not much larger—it has an area of about 30,000 square miles—it feeds $4\frac{3}{4}$ millions of people. Whatever the advantages

of the collecting and hunting stage, it is thus not economical. If man had never risen above it, the world would not be peopled; it would only have a few scattered, half-starved tribes on the more fertile parts of its surface.

Let us turn from Tasmania to Tropical Africa, where the conditions are very different. Tropical Africa has been for long the home of the negro, but he did not always live there. Probably he once lived in Southern Asia, and some connected form, perhaps, spread down through New Guinea to Australia, and so to Tasmania. Into Africa the negro spread at a time when the climatic conditions were somewhat different from the present. Then no great belt of desert wastes shut off the northern part of that continent from its tropical regions.

When he entered Africa at least, the negro seems to have been much at the Tasmanian level. Thus he had no specialized weapons, and was dependent upon pointed sticks and flaked stones, upon clubs and fragments of shell and bone for all the needs of his hunting and house-building. He realized the importance of fire, for he often saw the bush fired by lightning, but whether he could or could not make it artificially, we have no means of knowing.

Houses were not necessary as a protection from cold, but the heavy tropical rains made some shelter necessary. This was obtained by "sticking long twigs or pliant boughs into the ground and bending them over so that their tips again entered the soil, describing an arch" (see p. 51). Over these sticks leaves were fastened to throw off the wet. Where the country was more open, grass was used as a thatching, and thorn stockades were made to keep off wild animals. In rocky country natural caverns were used as shelters.

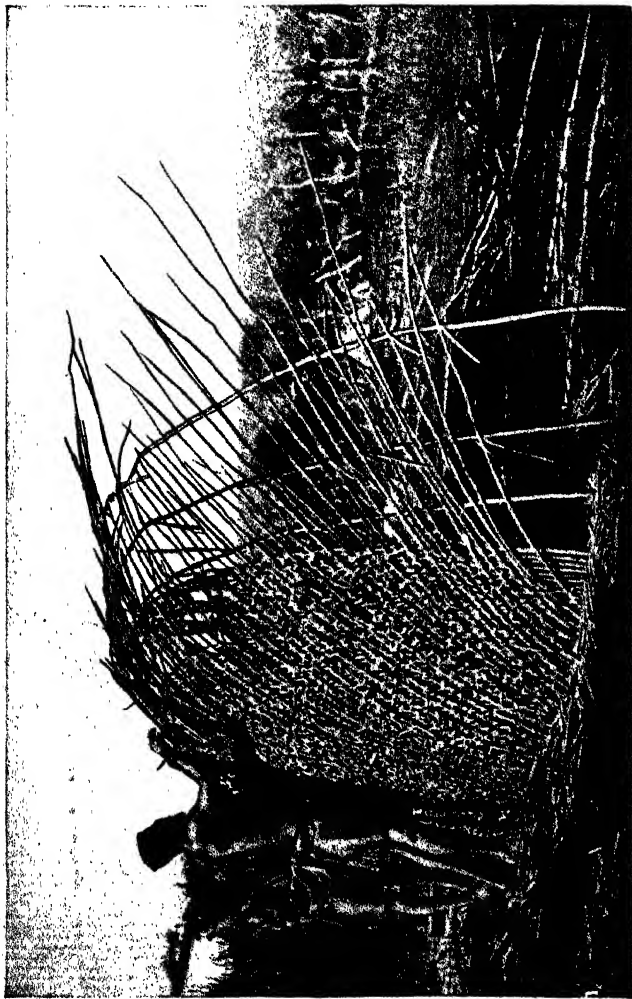
Food was obtained by hunting and collecting fruits and roots. As a general rule, it was the woman's business to obtain the vegetable food, while the more arduous but less continuous labour of hunting fell to the man. The nests of the wild bees were robbed for honey, and fungi also entered into the food supply. There were no domestic animals, except, perhaps, the dog, and no cultivated plants. In the absence of the last named, the negro showed far less interest in the sky than many other primitive peoples—*e.g.*, the early Britons, who were obliged to watch the changes of sun and stars in order to know when to sow their crops.

The negro is not believed to have originated on his own account any great improvement on this condition. After he had reached Tropical Africa, a gradual process of desiccation went on in the North, which cut him off from easy communication with other peoples. Within the tropical forests he acquired a condition of balance; but his numbers were probably few, and he must have been constantly liable to famine.

But though the northern deserts offered great obstacles to the immigration of other peoples, these obstacles were not insurmountable. Meantime also great progress had been made outside Africa. At the south-eastern end of the Mediterranean and round the valleys of the Tigris and Euphrates, another great division of the human race had been undergoing development. Aided by the possibilities of irrigation along the river valleys, stimulated by the recurring drought, these peoples had taken great strides along the path of progress. They had learnt to domesticate animals in order to obtain their milk and flesh, and to use them as beasts of burden and of draught. They had learnt to cast some of their hoarded seeds upon the waters, giving freely in order to gain freely. They had begun to watch the sky so that they might learn times and seasons; they were substituting for the primitive "tabus" of the Australian rules and regulations which were enshrined in religion, and linked one generation to the next.

In successive stages such higher peoples found their way into Africa, and whatever cruelties the individuals might inflict, the net result was to enrich the negro races with new knowledge, new power over Nature. The Australians and Tasmanians were less fortunate. They were utterly isolated from the outside world till the white man came with his excessively complex civilization. Then the gap between the two races was too great for the lower to learn anything, and it went down utterly. In Africa communication with higher civilizations took place at many successive stages, and thus the negro had already learnt much before Africa was finally opened to invasion from North-western and Western Europe.

Did the negro originate *anything* on his own account? This is a question difficult to answer. Sir Harry Johnston believes that he may have learnt to cultivate yams and millet in a small way, and possibly a few other plants, but even this is doubtful.



[From Kidd's "The Essential Kafir,"

KAFIRS CONSTRUCTING A HUT.

It is characteristic of negroes that they employ forest produce in this way for house-building.

Domestic animals, except perhaps the dog, he does not seem to have had. But Egypt gave him a considerable number of cultivated plants, and gave also oxen, goats, and sheep, and the domestic fowl. Some tools and utensils he got also, such as iron or copper axes and swords and daggers; but though the plough was early used in Egypt, it never reached the negroes till the nineteenth century, and, till the white men came, they showed very little skill in the technical arts. Thus they had risen very little above the Collecting Stage, their cultivation being done in a wasteful ineffective fashion. Yet their condition shows much progress as compared with that of the Australians or Tasmanians.

In order to make this account more definite, we may describe the life of a negro group which has remained at a very primitive level; we shall take as our example the Fans of the French Congo region, who live in the equatorial forest round the middle course of the River Ogowe. These people differ in several respects from the typical negroes, for their skin colour is not very dark, and their hair is not so woolly as in the typical negro.

We may begin with the climate of the region, for this has an important bearing on the life of the people. The region is equatorial, and therefore heavy rains come twice a year, at the equinoxes, or periods when the sun crosses the equator. Thus there is very heavy rain at the beginning of October, and these rains continue throughout November, diminishing in December. In January, and especially February, they diminish still further, while the temperature rises. This is the short dry season, and as the forest has been copiously watered by the preceding rains, plant-life is very active. Many fruits ripen at this season. March and April form the second rainy season, the rain being accompanied by tornadoes. Our summer is marked by a second dry period, longer and better marked than the preceding. But though the rainfall is then slight, the sky is covered with cloud, and this lowers the temperature pleasantly. This is the favourite season of the year for the natives, as life in the open is possible; the tracks are easier, because no longer marshy, and in the streams and lakes, now at their lowest point, fishing can be carried on. The vegetation, however, receives a partial check from the drought, and some trees even lose their leaves.

The Fan villages are always built near a stream of water, for the people have never learnt to make aqueducts or to store water in any way. This is, indeed, not necessary in this damp climate. But the streams swell and shrink with the seasons, so that a suitable situation is one where the water is accessible at all times, while the village is safe from flooding during the wet periods. "Town-planning" is here a simple business. Two long rows of houses are built, each house joined to its neighbour, the two rows facing each other. At either end of the street so formed is a *corps de garde*, a guard-house with a narrow gate and loop-holes. These are for purposes of defence, but they also serve as a kind of club for the men, and as places for the reception of strangers. Behind the houses stretches the equivalent of our kitchen gardens. This is a belt of cultivated ground where each woman has a few banana plants, some sweet potatoes, etc. There is no larder or store-house, and if the weather is too bad to visit the plantations, and other food is scarce, this little patch will supply the immediate necessities of each family. The patch also serves as a cemetery, and as the meeting-place of the women. That the men should meet in the guard-houses, and the women in the gardens, is very suggestive of the division of labour among the sexes which exists among primitive peoples.

The houses are very simply built, and do not last long. It is characteristic of the African negro that it never occurs to him to build with stones—forest products suffice. A tree particularly prized for building purposes is the wine-making palm (*Raphia vinifera*), which has a short trunk, but enormously long spiny leaves. Posts stuck into the ground form the beginning of the hut. On these a light framework is erected, and the whole is covered with raphia or other leaves sewn together. Bark is used for doors and partitions, and these, in default of hinges or nails, can be fixed by tying with lianes (see p. 61). The guard-houses are more solidly built, and a particularly soft wood is employed through which the native missiles cannot pass.

Various changes in the life have been introduced by the advent of Europeans; thus the men can now obtain guns, and they sell forest products to the white traders. Nevertheless, we can still trace the older conditions.

Most of the forest fruits ripen in the short dry season, that

is, in February, and this seems the only period when the Fans make special collecting journeys to get fruits, though doubtless they also gather forest products at other seasons. During this time groups of men, women, and children make temporary camps in the forest, in regions rich in particular kinds of fruit. Here the men help to make the camp, and cut down the trees, if this is necessary to get the fruits. The task of the women is to collect the harvest, to cook the fruits or nuts, and to preserve these so far as their resources make this possible. The children who accompany the group, gorge themselves with the fruits without thought of the future, but the women collect all they can to take with them on their return to the village.

Since the white man came, the forest is also searched for rubber and ebony, which are exchanged for European products. This search also necessitates temporary camps in the forest, as the supply in the vicinity of the villages is naturally soon exhausted.

As the forest does not supply enough for the needs of the group, a certain amount of cultivation is carried on. In making a new plantation, the ground is first selected, and work begins during the short, dry season of February. The first thing is to cut away the undergrowth. This used to be done with a double-edged cutlass, which the Fans forged themselves, the making of iron weapons being a craft learnt from some other race. Now they prefer axes of European manufacture as being much more effective. Once the brushwood has been disposed of, the much more toilsome task of cutting down the large trees has to be faced. This is slow and difficult. Some trees prove too much for the skill or patience of the men, and are left in the midst of the plantation. Others are spared because they yield useful fruits, this being as far as the Fans have gone in the direction of orchard-making.

This work must be carried out during February, before the rains of March begin. But the Fans have no calendar, and, like negro tribes in general, do not seek to base one on the movements of the heavenly bodies. They are therefore dependent upon certain natural phenomena as indications of the seasons, upon the ripening of certain fruits, the shedding of its leaves by a certain tree, and so forth. Some means of determining the approach of the rains is an absolute necessity, for, before they come, the brushwood, grass, leaves, and

generally the débris of the clearing, must be burnt. We have already spoken in Chapter I. of the fact that, as a general rule, in the equatorial forest man cannot use fire as an aid to clearing. The occurrence of dry seasons in this particular area makes the existence of the Fans possible, and the burning process can only be carried out when the hot sun of February has dried the refuse, and before the March rains wet it again.

This done, the men's work is finished. It is the women's business to plant in the soft wood-ashes bananas, manioc, and other products. Once planted, these are watered by the equinoctial rains, and grow rapidly, so that the plantation yields produce at all seasons. No granary is thus necessary, and there is no harvest season. But no new fertilizer is added after the first wood-ashes, and the care is limited to the destruction of weeds, a process apparently carried out in a somewhat slack fashion. In consequence, the plantation only lasts two years before it becomes exhausted, and the forest overwhelms it. New plantations must therefore be constantly made, and famine waits on the village whose old plantations are exhausted before new ones are made.

In addition to the main plantation, small clearings are also made, where minor crops, such as maize, cucumbers, flavouring materials like capsicum, and so forth, are sown in time to receive the autumn equinoctial rains. These short-lived crops ripen in February, and supplement the produce of the plantations proper.

The plantations are often some distance from the village, and where this distance is more than can be covered in an hour's walking, then a supplementary village is erected to lodge the workers. It may seem a short-sighted policy to place the plantations so far away; but it will be recollected that cleared land is exhausted in two years, and therefore this wasteful method of agriculture destroys an ever larger and larger radius of land round the village.

But we have still to note the sources of animal food. Domestic animals exist, but are few and poor. A few fowls and ducks, a very few sheep and goats, constitute the whole village assets in this direction. The forest also contains much less game than is generally supposed, and again it is the occurrence of a dry season which comes to the aid of the community. During the long dry season which corresponds to our summer,

the lakes and streams, as already noted, reach their lowest level, and this gives many opportunities for fishing, fish being luckily abundant. No idea of sport enters into the ideas of the fishers. Any device which will yield food is justifiable, and therefore the water is poisoned with herbs from the forest, dams are erected to cut off special areas, pools are drained, nets—now often of European manufacture—are largely used, and so on. If the vicinity of the village affords no suitable fishing-grounds—and this must often happen—the whole village migrates to a more favoured region, and here a temporary camp is set up. At first, the one desire of the whole group is to eat as much as possible; but the prudence of the women soon asserts itself, and a portion of the catch is carefully dried for future use, though apparently the dried fish does not last long.

One other resource remains in the game of the forest, but here again the vicinity of the village is highly unsuitable for a hunting-ground, and small parties set up temporary camps in isolated areas where game is more abundant. It is there obtained rather by ruse than by the chase in the strict sense. The rainy season of October is the most suitable time, for then parts of the forest are almost impassable for the wild animals owing to the floods. At such times a corner more or less isolated by water is selected, and barriers are constructed, broken by hidden pits into which the animals fall, when they are quickly despatched. A portion of the meat is again dried for future consumption, but this is only possible if vegetable food is brought from the plantation to the hunters. It is this difficulty of the food supply that makes the sojourn on the hunting-ground necessarily of limited duration.

From all these temporary dwelling-places the Fann returns to his village, but the village itself is but a stage in a larger migration. The huts, as already stated, are but lightly built. At the end of four or five years the fragile materials begin to show signs of wear, and reconstruction is necessary. This may be effected on the same site, or on a site in the immediate neighbourhood. Sooner or later, however, the exhaustion of the ground in the vicinity, the increasing distance from fishing or hunting-grounds produced by the wasteful methods of the group, necessitate a move. Sometimes also this is determined by the presence of wild beasts—*e.g.*, elephants—which

utterly destroy the plantations, or by some calamity or disease, associated in the minds of the people with the particular locality.

As a general rule, however, there is a provisional migration of the more active members before the final migration *en masse*. Time is no object. A few of the able-bodied members of the group may form a new clearing, and proceed in leisurely fashion to build a few houses, sometimes at a considerable distance from the first village. Here a few gardens are made, but the whole encampment is provisional. A disaster, an alarm, false or real, may determine a return to the original village. But, if all goes well, there comes a day when the whole group, carrying the children, fetishes, and family furniture and utensils, starts for the new camp. Now cultivation is begun seriously, but there is always a critical period before the plantations produce abundantly, when the food of the group has to be eked out by supplies bought or borrowed from neighbouring communities.

The period of sojourn at a particular spot varies greatly, but five to six years is a very usual period. One old man, apparently sixty-five to seventy years of age, could tell of thirteen moves since the tribe left his birthplace. Where conditions are specially favourable, a long stay may be made, but this is unusual.

We noted in the first chapter how unsuitable is the equatorial forest to the activities of man, and to how great an extent he has proved unable to conquer it. We might further note here that, just because no highly-developed groups live in the forest, it tends to become, in the course of time, not more but less fitted for man. The apes and parrots feed on the fruits of the forest, but they do not destroy the fruit-bearing trees, and the seeds they drop help to spread the species. The Fans cut down the trees to facilitate the collection of the fruits, and their greater intelligence makes them less likely than are the animals to scatter the seeds involuntarily, while it is not great enough to make them scatter these seeds intentionally. So with those products that civilization has made valuable. They hack down the rubber vines, and so destroy one source of wealth. Further, by firing the forest they destroy the original balance of Nature, while from their ignorance of agriculture they do not redeem the cleared patch perma-

nently for man's use, but leave it to be grown over by a poorer and less useful type of vegetation.

They are doubtless more successful than the Tasmanians in that they probably people their land more densely, but they are in a sense more dangerous in that they render it progressively poorer. Theirs is, therefore, a singularly useless and destructive form of conquest.

CHAPTER V

MAN'S HELPERS—(1) DOMESTICATED ANIMALS

Man's need of property and his difficulties in transporting this—His domestication of transport animals—The horse, ass, and mule—The uses of cattle and oxen, first as draught animals and then as sources of food—Sheep and goats: their various uses—The camel and llama—The dog as aid to the hunter and as a draught animal—The raising of large numbers of cattle for food.

MAN'S struggle with Nature would have been more severe than it has been if he had not known how to attach to himself various allies, strong where he is weak, and able to give him of their strength. Of these allies, the domesticated animals are of enormous importance.

How have these animals aided him? They have done so in many ways—ways which vary at the different stages of civilization—but at every stage man's debt to them has been great. To understand how great, it is necessary first to note some of his obvious weaknesses when faced with wild Nature. The most patent of these are certainly to be found in his lack of physical strength and swiftness. He cannot run like the horse; his strength is nought as compared with that of many wild animals. Without weapons he cannot kill wild animals for food as the great carnivores can. Compared with horse or cow, his digestive organs are weak and his teeth unspecialized. Further, useful as his big brain has been to him, it brings with it a more stringent need for sleep than the animals know. The cat and the dog doze away long hours, but their rest is never so sound that they cannot wake in an instant on an alert. Man needs steady, uninterrupted repose for several hours at a time, and during this repose he is as one dead. Therefore during those hours he must be protected, and that

means that he must always build himself a shelter—a place where he is secure from attack. Once again, though he can tolerate almost all extremes of climate in a way no animal can do, he must be protected from heat and cold, from the chill which comes even under the Equator when the sun goes down, from the winter cold elsewhere. Almost everywhere he must clothe himself. All the animals must have food, but in that he must always have a shelter, and generally clothes, man has greater needs than the animals. Further, in his helplessness he needs tools and weapons, which have to be sought or made, and are therefore precious.

The result is that nowhere can man live without property. He has been defined as an animal with pockets, and this helps us to realize his need of owning something. The poet Walt Whitman expressed the desire to live with animals, because "not one is demented with the mania of owning things." His zoology was, perhaps, not quite sound, for the sparrows under the eaves will quarrel fiercely for fragments of coloured wool or pieces of paper, and the viscachas on the South American pampas are said to collect even such useless objects, from their point of view, as watches. But the poet was right if he meant simply that animals are furnished by Nature with the powers and weapons which they need in their daily life, and do not, like man, need to borrow strength in order to live. This, however, is only another way of saying that they have not conquered Nature as man has.

But though human beings must thus always have some property to carry about, yet they are poorly fitted to act as transport animals. Further, just because man has conquered the earth, it is more necessary for him than for most animals to be able to move about freely. One great use of the domesticated animals, then, has been to carry his goods about for him.

We have mentioned this use first, not that it was first in time, but because we, who have lived all our lives in lands where railways and steamboats abound, are apt to forget how difficult it used to be for man to travel from place to place. We hear about travellers in dense forests or in polar lands, and their fearful difficulties with transport. We see pictures of polar travellers painfully dragging their sledges over ice-hummocks, and ferrying them on ice-floes over open "leads"



CUTTING A WAY THROUGH AN AFRICAN FOREST.

Note the creepers or lianes which bind the trees together.

Reproduced by permission from "The Foreign Field."

of water, but we forget that similar difficulties were once universal. To conquer the earth man had to learn to traverse it, and this he would never have done without his animals. One of the reasons why the tropical forest has been so resistant to human enterprise, is that movement within it is so difficult that man is almost the only means of transport available, and as a porter he is the dearest and least efficient animal known. Throughout the forest regions of Africa to this day human portage largely persists, and this is a great obstacle to progress.

Of all the domesticated animals, the horse, considered as a transport animal, is perhaps the most useful. The hardy ass, though it is despised in countries like our own, where horses are easily reared, is of great importance in those where pasturage is scanty; and the mule, obtained by crossing the ass and the horse, is exceedingly useful in mountain regions, as well as elsewhere.

✓The horse was apparently first tamed in Eastern Europe or in Western Asia. It is a steppe animal, requiring in the wild state great stretches of rich grass. It does not thrive well in the tropics, and at the present time is most abundant in Europe, in the temperate parts of America, and the western parts of Asia. It is used as a beast of burden (pack-horses)—a very old use, as a riding animal, and in drawing wheeled vehicles. In this country also it is almost invariably used in ploughing, but this is far from being universal. Even in a land so near to us as France, it is often the ox which draws the plough, and this is a very ancient custom.

The ass was first domesticated in Egypt. It is a much harder animal than the horse, less liable to disease, and much less particular as to food. It is thus much less costly to keep, and is suited for regions, such as the district round the Mediterranean, where pasturage is scanty and not rich. The ass is a much more democratic animal than the horse. Though the wild asses are swift, the domesticated ones have not been bred for speed as horses have, and everywhere their function is more or less utilitarian; but the horse has always been an instrument of luxury, and also of war.

✓Two great advantages which the ass possesses over the horse, are that it is less timid and much surer-footed. It can thus be used in mountain regions, where it will take the poorer grass

if the better is wanted for more important animals. Thus in the Alps and the Pyrenees it is very important as a beast of burden, and in the Mediterranean region generally is commoner than the horse.

The mule has most of the advantages of the ass—that is, it is hardy and sure-footed, while at the same time it is a larger and more powerful animal. It also is largely utilized in mountain regions. Thus in the Alps, wherever the paths are too steep for wheeled vehicles, the mule is used as a beast of burden, so close being the association that we speak of a “mule-path” in contradistinction to a carriage-road. As the slope steepens still further, even the mule becomes useless, and recourse must be had to that costly transport animal, whose physical feebleness is compensated for by his agility, the skill with which he circumvents obstacles, and the proofs of intelligence which he displays on every hand. In other words, recourse must be made to human portorage.

Humbler than the horse, without the spirit which has made that animal so often the instrument of man's aggression against man, but perhaps even more useful in his conflict with Nature, are the many kinds of oxen, which in some parts of the world form the sole draught animals. In Europe the aurochs, or wild ox, was very early domesticated, and used to draw the plough. Egypt had its own domestic ox, also used to draw the plough. In India the humped, or Indian, ox was used for the same purpose, and its domestication goes back to the far-distant past. The Egyptian ox was passed on through Egypt to negro Africa, but the negroes did not use it for ploughing, and this is one of the reasons why their land so soon lost its fertility. No domesticated ox was known in America till the European colonized it, and no true plough was known there. Generally, there is a close association between the ox and the plough, the strength and docility of the animal rendering it of great use in turning up the soil, while its slowness is here no disadvantage.

In addition to the true oxen, some other members of the same group of animals are also used as transport animals. Thus, India has its domesticated buffalo, a much more powerful form than the ox, used for drawing carts, and also as a beast of burden. The buffalo has also been introduced into Italy, where it thrives in marshy regions. Naturally an in-

habitant of marshes, it has the great disadvantage as a transport animal of being unable to pass water without manifesting a desire to roll over in it—a habit highly detrimental to certain kinds of merchandise!

We have so far spoken of oxen only as transport animals, and this may seem absurd when we recollect how important a part cow's milk, and butter and cheese made from the milk, as well as beef and veal, play in our food. But to a large extent this is a modern development. The countries which contain large quantities of cattle, not used for transport, are mostly new countries. Thus North America, the Argentine, parts of Australia, New Zealand, the recently developed parts of Siberia, all produce much beef, and have a large output of dairy products. In the British Isles milk-cows are elaborately and carefully tended; they must be kept warm and protected from the weather, they must be carefully fed, and, even so, it would not pay to keep dairy cows if there was not a good demand for beef, for the animals are fattened for the butcher after a few years. In India it is the buffalo, and not the cow, that yields the kind of butter called "ghee," which figures so largely in Indian stories. In China and Japan dairy products are almost unknown, and the Europeans who live there import condensed milk from America, Switzerland, and elsewhere for their own use. Generally, we may say that beef and cow's milk are luxuries not obtainable in quantities except in those parts of the world where the natural wealth is considerable, or where, as in mountain regions, the land gives rich pasturage, and yet cannot be tilled. In the early days the great use of the ox was to serve as an aid to man in doing work.

One other kind of ox must be mentioned before leaving the subject of cattle. This is the long-haired yak of Tibet, a very important beast of burden, but something more than this. It lives on the plateau of Tibet, and is impatient of heat, but very tolerant of cold. It ranges up to a height of 20,000 feet—that is, we might put Ben Nevis on the top of Mont Blanc, and we should not have reached the limit of height to which the animal reaches. From this fact we can deduce several things. Living at these elevations, the yak must have a thick coat. Now it is one drawback to most cattle that, because they do not extend high up on mountain chains, they do not usually have a long and thick coat like sheep. In this, as in some

other respects, therefore, the yak differs from other ox-like animals, and approaches the sheep.

Again, at these heights arable land is not likely to be plentiful, nor are roads likely to be level. Therefore we may guess that the yak is not likely to be used to draw either the plough or wheeled vehicles. We have already mentioned that mountain pasture is rich. We should expect, then, to find that the yak yields rich milk, from which various dairy products can be made. Thus, this animal, together with the cows of the Swiss Alps, already described, helps us to understand how it is that regions producing butter, cheese, and so forth were in earlier times generally mountain countries, because only here were the cattle saved from use as draught animals, and sufficiently well fed to give milk abundantly.

But to yield milk is not the only use of the yak. As agile as sheep or goat, but stronger and larger, it is practically the only means whereby the inhabitants of Tibet can carry on commerce. Its long coat also is used as a material for weaving textiles.

In parts of the Himalaya and Tibet sheep and goats are used similarly as beasts of burden, but as a general rule these animals have the double function of supplying wool or hair and milk. Native to mountain regions, sheep and goats are hardier than cattle, require less careful feeding, and, where the richer cow's milk is not obtainable, yield milk and cheese. Such cheese is not much appreciated among people able to obtain that derived from cow's milk, but is important elsewhere. The Pyrenees, for example, which from a variety of causes do not produce such good pasturage as the Alps, carry sheep rather than cattle, and in Spain generally sheep are more abundant than cattle. The cheese so obtained has, however, a very limited sale outside the region where it is made.

Horses, cattle, sheep, and goats are by far the most important of the domesticated animals, but a considerable number of others occur, many of which are useful as beasts of burden or as draught animals. Thus the reindeer makes life possible for the Laplander in high latitudes. Harnessed to the light sledges, it carries the goods of its owner long distances over the smooth snow. The rich summer pasturage of the Arctic region, recalling in many ways that of high mountains, enables it to yield rich milk. Its flesh is edible, its skin supplies clothes

and coverings; after death indeed hardly a single part of its body is wasted by its thrifty master.

Almost as important was the llama to the ancient Peruvian. Like the reindeer, it supplied its master with wool, milk, and flesh; like the reindeer, it was the only beast of burden available. Just as the reindeer is adapted for life in polar regions, so is the llama adapted for life in mountain regions. The alpaca, a near ally of the llama, is a smaller animal, prized for its long and fine wool.

One more transport animal, with a very perfect adaptation to a particular habitat, is found in the camel, as perfectly fitted for life in the desert as the other two are to their special regions. We need not describe in detail the characters which fit the camel for life in deserts. Its spreading toes, with pads below, its fat-storing hump, or humps, the water cells in its stomach, the power to sustain life on prickly desert plants—all these are familiar facts. Like the other herbivores, it adds to its prime function as a worker the power to yield milk, while its coat is used in making textiles. Like most of the others also, it can be used as a riding animal as well as a beast of burden.

The Indian elephant need not detain us, for, though it does a considerable amount of work, it is primarily rather an instrument of luxury than an aid to man, being far too costly to be of general use. Further, the fact that it does not breed in captivity, excludes it from the list of domesticated animals in the strict sense.

Of the important herbivores there remains the pig, an exceptional animal in that it has been domesticated solely because its flesh is valuable as food. But it is not a pasturing animal in the strict sense, and the fact that it is a very indiscriminate feeder, and will thrive upon what—from the human point of view—is refuse, makes it greatly prized in countries like China, where land is scarce and meat difficult to obtain.

We have said nothing of the dog, which bulks so largely among the domesticated animals so far as our feelings go. It was, perhaps the earliest animal to be domesticated by man, and is very widely distributed. Even the native Australians, low as they were from many points of view in the scale of civilization, possessed dogs. But the domestication of the dog

was a slighter achievement than that of the larger herbivores, because it presents far fewer difficulties. Dogs have been derived from wolves and jackals, and their ancestors doubtless possessed the jackal's peculiarity of feeding both upon carrion and on the remnants which the stronger carnivores left behind after they had satisfied their hunger upon their prey. As man became a hunting animal, then, his footsteps would likely be dogged by such jackal-like animals, which would seize upon the parts of the prey which the weaker teeth, or the more fastidious tastes, of the hunter left untouched. We know how the puppies of even our carefully bred dogs will attempt to eat any kind of refuse which they may find. When primitive man saw the dogs thus feeding on his scraps, or following, it may be, the animal which he had wounded, but not disabled, the idea of a more intimate partnership would soon occur to him.

The Australians sought for the puppies of the *dingo*, and brought them up with infinite care, often only to lose them as they grew to maturity, and felt the call of the pack. Such a process must have gone on in many parts of the globe before man found skill and patience enough to attach the dog more or less permanently to him. Even then there were long strides to be taken before our domesticated dog was reached. Many dog-owning tribes do not feed them at all, but leave them to forage for themselves among the refuse of the settlement. The first dogs must thus have been aids in hunting, and then scavengers. Only when the herbivores had been tamed were they needed to guard the flocks, and this instinct was probably derived from the earlier habit which the half-wild dogs of a settlement acquired of attempting to protect their territory from the incursions of wild forms. Thus gradually was the friend of man evolved from the cowardly, skulking jackal or wolf.

In China, where, as we have seen, meat is hard to get, dogs are eaten, as they are also in some other parts of the world. The fact that even the Arctic explorer eats his dogs when all other food fails, suggests that this must have often happened in the old days. That the animals could be eaten at a pinch, was doubtless one reason why man had the patience to tame them, though in most cases they must have been of more value as aids in the chase than as an addition to the dietary.

The Eskimo, as is well known, use dogs as draught animals,

just as the St. Bernard monks use them, to a limited extent, as beasts of burden. As draught animals they are chiefly useful in regions covered with snow, and it was, perhaps, their usefulness in snow-covered regions which enabled the Eskimos to push farther and farther north into the icy wastes round the Pole.

To a small extent they are used in drawing wheeled vehicles in parts of the continent of Europe, as is shown in the illustration.

This short account of the chief domesticated animals enables us to draw some general conclusions. We have suggested in the previous chapters that man could not prosper to any great extent till he became a cultivator. Groups which depend entirely upon the collection of wild produce are always small, and their existence is very precarious. We have described the difficulties under which cultivation is carried on in the forest of Africa. Successful cultivation, on a considerable scale, must have been begun in fertile river valleys, or on flat land where water was abundant, but did not lie continuously. Such land will only continue to produce if it is constantly stirred, exposed to sun and wind, so that it is thoroughly aired and moisture is not allowed to stagnate. Man is too weak to carry on this process on a large scale without aid, and the taming of the ox or buffalo which could help him in the process, must have marked a great step in advance.

Again, because of the movements of the earth, almost every part of the earth shows some kind of seasonal change, whether this be in temperature, in amount of moisture, or in both. This produces variations in the amount of available food, and the group which could move about most freely, would have most chances of availing itself of different sources of food-supply. But man is never without some property, and therefore the taming of animals which could carry his property, must also have meant a great step in advance.

Skill in the rearing of animals was not likely to be easily acquired, and we may be sure that in early days the flocks and herds were far too precious to be killed for the sake of their flesh, save in extremest need. But the flesh of animals killed by accident, or becoming too old for work, would doubtless be consumed.

As important as the flesh would be the coat of the dead animal, which could be used as clothing. Gradually, no doubt,



DOGS DRAWING MILK-CART IN BELGIUM.

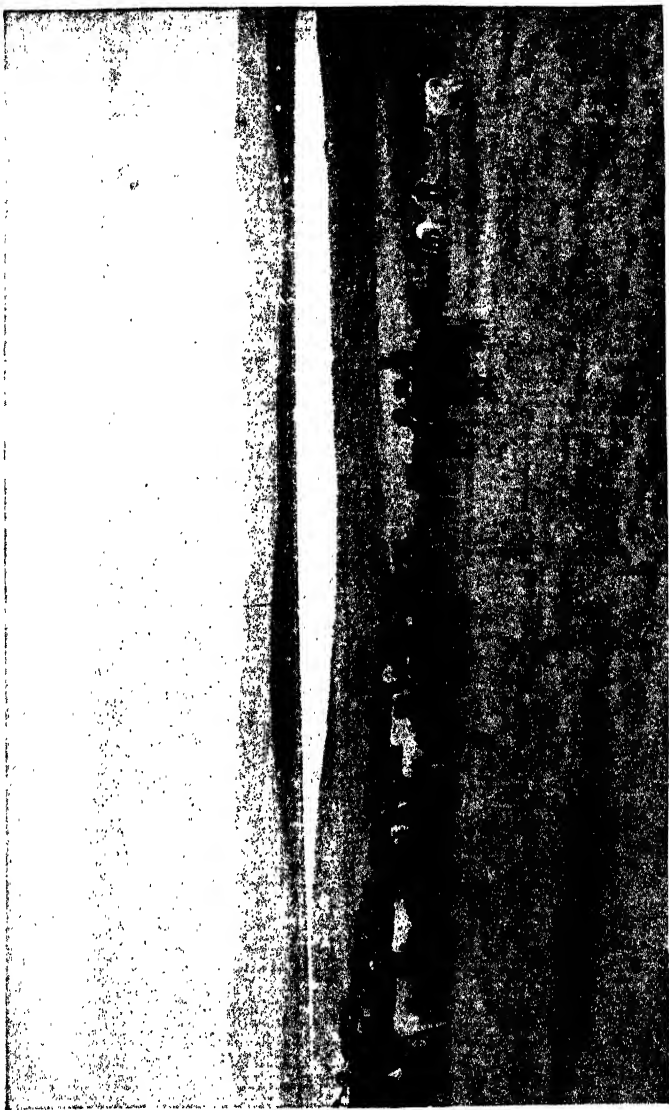
the idea would arise that the long coat of an animal could be shorn so that its master might share its warmth-giving qualities. So also the milk of the female animals would be used. But in most cases there can be little doubt that the first use of the animals was to do work, whether as aids in hunting, like the dog, or in ploughing the earth, like the ox, or in carrying useful articles from place to place, like most of the larger domesticated animals.

Animals used exclusively for food, like the pig and rabbit, would tend to be those which did not make heavy demands on the fertile tracts of land wanted for man's own use. So markedly does this consideration reign in countries like Japan and China that these large domesticated animals are rare; the land is too precious to be set apart to grow food for them.

One other point is important in regard to the large herbivores. Not only is their labour useful, but they yield manure which enriches the soil. Till the discovery of the usefulness of artificial and mineral manures in recent years, the only known means of rendering land more fertile, apart from ploughing, was by adding animal manure. This is, therefore, another use which the animals have.

We have already seen that the primary use in most cases must have been for the doing of work, and the breeding of enormous herds exclusively for use as food is a very modern development, rendered possible by the opening up of great areas of new land in America, Australia, and elsewhere. It has also been assisted in the older countries by the draining of the population away from the country to the towns, which has left room for beasts to be pastured over land once brought under the plough. Countries which have remained predominantly agricultural and are yet densely populated, like China and Japan, have no room for great quantities of horses and cattle.

But there is something more than this. In the United States of America not only are great stretches of land given over to pasture, but also there is much ploughed land whose only use is to produce food for animals. Great fields of maize are grown for the exclusive use of pigs, just as fields of turnips are grown here for the exclusive use of sheep. So it is with linseed and with some other crops. Now, it is very much more costly to grow maize for pigs, and then to eat the pigs,



CATTLE ON THE WESTERN PLAINS OF CANADA.

than it would be to grow the maize or some other grain directly for man's use. The first is a wasteful process, rendered possible by the great increase in the world's wealth in recent years. As the population increases, will the American be able to allow so much land to be used to grow food for pigs instead of for man? Many geographers reply in the negative, and say that we shall have to abandon our wasteful modern habit of eating quantities of meat, and to reduce the number of animals kept in civilized lands.

Less wasteful, because less costly, is the keeping of flocks of sheep, because for the most part sheep are pastured on lands which cannot be brought under the plough. But they also occur especially in new countries, and as those countries develop, the sheep tend to be pushed nearer and nearer to the mountains, or farther and farther into the interior, into parts where the elevation or the deficient rainfall makes the ground difficult to cultivate. This is happening in the Argentine, where the land once used to feed sheep, cattle, and horses is more and more being put down to crops. It is happening also in South Africa and in Australia. It seems probable, then, that the present huge herds of cattle, sheep, and so forth are but a temporary phenomenon, and that these numbers are destined to diminish considerably as time goes on. Such a diminution would not greatly affect man's power of doing work, for he has learnt, to a considerable extent, to substitute for the willing labour of his first conquests, the animals, mechanical aids, which are more efficient and less costly. In the next chapter we must consider some of these mechanical aids.

CHAPTER VI

MAN'S HELPERS—(2) MECHANICAL AIDS AND MEANS OF TRANSPORT

Man's use of wind and water as aids in doing work or transporting goods—Means of communication in aboriginal North America on land and by water—Absence of sails and wheeled vehicles in North America before the advent of the European—The introduction of the horse—The development of railways and steamers—Motor-drawn vehicles.

WE have suggested in the previous chapter two kinds of work which man had to do from very early days. These were the transport of his goods from place to place, and the preparing of his fields for crops. These do not, of course, nearly exhaust the kinds of work necessary to him. Not merely had the land to be prepared for crops, the manure and seeds conveyed to it, and the harvest carried away, but the food itself had often to undergo an elaborate process of preparation. As we have seen, man's teeth as grinding instruments are very inferior to the horse's. The food which the horse can masticate without difficulty, has to be carefully prepared for man. In the tropical parts of Africa, where so many primitive conditions linger, it is a great part of the work of the women to prepare the food for cooking. The pounding of maize or millet in wooden mortars—a slow and laborious process—is necessary before these foods can be used.

Similarly with clothing; the hair or wool obtained from animals, or the fibres obtained from plants, all have to be woven before they are of any use. Thus the animals used in preparing the land for crops must also have been early used in the later processes of making ready the food for man, and doing other necessary kinds of work. But at an early stage man must have noticed that wind and water moved objects,

just as they could be moved by his muscles and those of animals. At an early stage, then, it must have occurred to him that this energy also could be used for his purposes. Here, as with the animals, the energy could be used more easily simply to transport objects in space, than for the more delicate operations necessary, *e.g.*, for grinding corn. The negro in Africa is stated never to have learnt, till taught by European races, even how to nail or fasten pieces of wood together; he was not, therefore, likely to learn how to transmit the power of wind or water to rods or wheels. The negroes did learn at an early stage, however, to use the force of water to transport themselves and their goods on rafts or boats made of planks and bundles of reeds. From the early stage of simply allowing the moving water to carry the rude boat, to the idea of directing its movements, or forcing it to move against the current, the transition is not great. It was from such drifting with moving water that man's power of navigating the great oceans began.

In every part of the earth's surface the way in which man used natural forces, or the aid of animals, depended upon the geographical conditions prevailing in the region. This is very clearly illustrated by the means of communication and transport adopted in different parts of North America before the advent of the European. We shall describe these different means in some detail, for they throw a good deal of light upon man's utilization of natural forces.

We may begin with the region of the Far North. Here are the barren grounds, or tundras, where no trees grow, and the ground is permanently frozen, though the surface layer may thaw in summer-time. The region fringes the coast-line, which is deeply indented, and more or less protected by islands. The land yields very little to man. Cultivation is impossible. In summer there are a few berries, and, where pasturage occurs, such animals as the musk-ox, the reindeer, the polar hare, the lemming, and so forth, may be found; but these are always few in number, and markedly migratory, travelling about from place to place in search of food. The land produces no fuel; at most, driftwood is found on the stormy shore, used to help in boat-building and house-building, and for sledges.

The Eskimo here has no tamed reindeer like the Lapp, but he has dogs which drag his sledges. These sledges are heavy, and are suitable for the hard icy surface found in winter.

Smooth in any sense the ice is not, but the friction between its surface and the runners of the sledges is not very great, and where great hummocks are not present, the dogs can pull these along rapidly.

But the Eskimo only lives on land close to the sea or on the sea-ice, and it is the sea which supplies the greater part of his needs. From the seals and whales so common in those Northern waters he gets skins for clothes and boat-making, oil for fuel and light during the long dark winter, blubber and flesh for food. The cold waters of the Arctic Sea teem with small animals, and these attract fish, which, in their turn, bring the great fish-eating mammals whose flesh becomes oily from the fatty nature of their food.

The Eskimo cannot live, then, without complete mastery of the water. The seas are stormy; no mere drifting with tide or current is possible, the hunter must be able to turn and manoeuvre as he follows his prey, must avoid ice-floes, must be able to land on wind-swept shores. In point of fact, his skin boat, or kayak, is one of the most perfect adaptations of means to an end that we know. No exchange brought to the Eskimo—at least in the old days—the products of another region. All that he possessed had to be manufactured with the means at his immediate disposal. With the skins of seals, then, he covered his waterproof boat, which holds one man only. Once the hunter has entered it he becomes part of it, his coat being, as it were, united to the boat. With his paddle he can right himself in a moment, if the waves upset his frail craft. In it there is room for all that he needs in his hunting. He has thus so far acquired control of the sea that he can obtain from it almost everything he requires.

But the fish and seals may leave the particular region where he is encamped, or may be too far away for convenience. Then the whole group may have to move. For such a migration the kayak is no use, and in the summer months the ice-sledge cannot be used. There is, therefore, another kind of boat, a much bigger structure, capable of transporting all the household baggage. It is not to be supposed that the hunters, accustomed to the light and easily-directed kayak, would condescend to enter this clumsy bark, and, as all the men are hunters, the big boat is naturally the women's boat, rowed by them and filled with their property.

One other means of locomotion the North-American Eskimo has, and this is the snow-shoe, which allows him to glide easily over the smooth surface of the snow. But his climate is a dry one, with much ice and little snow, and the snow-shoe displays less perfection than the other parts of his equipment. It is similar to that used by the forest Indians.

South of the Eskimo's barren grounds, and inland from the sea, comes the region of the Northern forest. This occupies a large stretch of country from east to west, and to the east comes down to the latitude of the Great Lakes. To the east of the Rocky Mountains, where rain is scanty, the forest is pushed northwards by the development of the Great Plains, but on the western slope of these mountains it stretches far south.

Over a great part of this region communication at the present day is very difficult, even with all the aids that civilized man has brought. Neither his steamships nor his railways have yet made transport easy, and he is still largely dependent upon the solution arrived at by the Red Men of old.

The difficulties arise from the fact that a very short time ago, geologically speaking, the region was covered with ice. The ice ground out and scarred the whole surface. It altered old river valleys, it gouged out lakes, it smoothed away inequalities. The result is that, when it finally melted away, it left a swampy region, with a very badly developed river system. The presence of forest, though it makes life in some ways easier for man, prevents the rapid development of river systems, for forests hold up water and diminish the power which rivers possess of hollowing out channels for themselves. The result is that there are many lakes, great stretches of marsh, where the direction of flow of the water is very uncertain, and, what is especially important, low "divides."

Let us consider what this last statement means. Where a country has not been recently covered with ice, we generally find that a distinct elevation, or divide, separates one river system from another. After following one stream to its source, it is necessary to cross a distinct water-parting before reaching the upper tributaries of the next. Quite often in Scotland, however, and in other recently glaciated countries, or in countries where changes of level have recently taken place, we find that there may be only a marshy region, or an almost flat stretch of

moor, between the two river systems. This we describe as a low divide. Such low divides are a help in communication, for they enable us to pass easily from one river basin to another, and they are very common in the *taiga*, or northern forest region of Canada.

We have said that low divides are a help to intercommunication, but this is only partly true. If they are very marshy they may be a great hindrance. This is one of the difficulties in the forest region of Canada—the occurrence of great areas of marsh, so that it is almost impossible to move about on land in summer. On the other hand, the fact that the water is not running down very steep slopes means that the streams can be easily navigated by craft not requiring any great depth of water.

Again, the region is one which is very cold in winter, and the snowfall is heavy. Over marsh and ice-bound lake a soft mantle of snow is spread in winter, forming everywhere a smooth surface offering but little friction, over which man can travel without roads or tracks. In summer, then, he must use the shallow streams to move about; in winter, the snow-covered land. To this day land communication here is much easier in winter than in summer, and piles of goods lie waiting the first snowfall before they can be carried to their destination.

But we must return to the Red Man's means of transport, first noting what he had to carry. The land yields more to him than to the Eskimo, and therefore in a sense he has less property to convey. Fuel is found everywhere in the forest, game is abundant, shelters can be easily constructed. Here, again, we find a sledge, but it is lighter and carries less. Dogs are few, and as the sledge contains the women's property, it is naturally dragged by them, just as the household boat of the Eskimo is rowed by women. But progress over the soft and yielding snow is not so rapid as over water; the sledge must needs be light, or it would sink deep.

The men, who must hunt at all seasons, have snow-shoes, on which in winter they glide swiftly and silently over the snow; but, except when the streams are ice-bound, and the snow lies thick on the land, progress is much easier by water than on land, and the birch-bark canoe is used. This, in its way, is as perfect as the Eskimo's kayak. It can be made anywhere in the forest, as the birch grows freely; it is light,

and so can be carried across from one stream to another ("portage"). By means of the paddle it is easily steered, and the way in which the Red Man navigates rapids in it is said to be marvellous. So well is the canoe fitted for the streams of this region that the French Canadians early learnt that without it life was impossible here, and they soon acquired a skill as great as that of the Red Man.

No sail is ever used in this canoe. Navigation in these winding streams, strewn with rapids, is too precarious, and the portages make it necessary that the whole 'boat' should be as light as possible. But it is noticeable that, throughout the whole length of North America, even in regions where sailing-boats could easily have been used, none were known before the advent of the European. The Red Man's conquest of Nature was strictly limited; he had no wheeled vehicles, no domesticated animals save the dog, no sails for his boats. These were among the reasons which made his numbers so small. Without these aids, and the aid also of steam and electricity, Europeans could not have multiplied in North America as they have done since its settlement.

To the south and east of the Great Lakes, on the Atlantic slope, another type of forest and of surface replaces the northern coniferous forest region. This district lost its ice-cap earlier, and the rivers have had time to dig out channels for themselves. Lakes have been filled up, divides are well marked, and the rapid streams forbid the use of such frail vessels as bark canoes. The rivers also are large, and, while splendidly fitted for steamboats, were not suited for the boats of the more primitive types of men. Here, therefore, water transport did not play a very large part in the life of the native, and through the dense forest and undergrowth communication was carried on by narrow paths or trails. These trails mostly followed the paths used in migration by the wild animals, especially the bison, and it is curious to note that some of the present-day roads follow the line of these old trails. When water transport was used, the vessel employed was a "dug-out," a stronger but much clumsier contrivance than the canoe. In this region, however, rapid transport was not very necessary, for the Red Man could find anywhere almost all that he needed.

Beyond the Mississippi there stretches the vast area of the Great Plains. These reach almost from the shores of the Gulf

of Mexico far up into Canada, and have a remarkably uniform surface. Forest growth is here scanty, and the region is liable to be swept by very severe storms. Shelter also is much more difficult to get than in the forest, and the cold is severely felt in places.

It is therefore much more important that some rapid means of locomotion should be adopted. The relative evenness of the surface and the scarcity of forest make it possible even in summer to drag burdens rather than to carry them. The saving in strength and speed when dragging is resorted to is enormous; thus, one horse can drag a load which, to be carried, would have to be divided among six. But, till the White Man came, there was no horse on those plains, splendidly as they are fitted for them. The Red Man was obliged, therefore, to fall back upon his dog. In winter the dogs pulled ordinary sledges, but in summer a curiously primitive form was used. This consisted of two long sticks, which were attached to the animal, and trailed behind it. These at night formed the poles of the tent, but during the day the burden was fastened to them. This obviously was not a very satisfactory means of transport, and the value of the horse became so rapidly apparent to the natives that they learnt to use it almost from the moment that it was introduced to them by the Spaniards, and it modified their whole mode of life profoundly.

One other means of transport, however, they also possessed. This was the curious bull-boat, a hemispherical structure made from the skin of the bull-bison, and used chiefly by the women to transport wood and food.

Farther to the west we reach the region of plateaux and interior basins, where life was very hard and rain deficient. The natives here were mostly vegetarians, as game is scanty. They cultivated some plants, especially maize and pumpkins, but they also collected a great deal of wild produce. In the absence of any other means of transport, recourse had to be had to human portage, it being especially the business of the women to collect and carry home the food. To do this with the maximum of ease they made many ingenious kinds of baskets, which were used to carry the produce. Most of these had some means of attachment, so as to leave the hands free for other purposes. Thus there were head-bands, breast-

bands, and so forth. Many kinds of clay vessels were also used.

Still one other mode of life was represented in the old days on the North American continent. On the coast of what is now British Columbia and northwards to Alaska there is a region clothed with dense and luxuriant coniferous forest, cut off from easy communication with the interior by the mountains behind. Here the shore is deeply indented, forming many bays, fiords, etc., sheltered from the open ocean by islands and promontories. The margins of these calm areas are clothed with trees almost down to the water's edge, and the conditions favour the development of a maritime people. Here we find that means of communication overland have not been developed, for landwards the obstacles are too great. But the sea is easily navigated, even by timid seamen. The result is that we find large boats, called pirogues. These have the form of a canoe, but are richly decorated, and may be fitted for as many as forty oarsmen. Farther South, so soon as the coast-line loses its sheltering islands, the pirogue disappears, and communication is carried on by land over a trail.

We thus see that in the old days there was a very close connection between the natural features of each part of North America and the means of transport and communication used. To a large extent this is altered now, and it is interesting to note some of the contrasts between then and now.

We have already noted the advent of the horse. But Europeans not only brought the horse as a riding animal, they also introduced wheeled vehicles. These, which mark an extraordinary advance upon the mere dragging of bodies over the surface, had formerly a very limited distribution over the globe. They must have originated in regions where the surface was smooth and fairly hard, and were early known round the Mediterranean. It has been suggested that they originated in desert regions, perhaps in Egypt, for the surface of the desert is sometimes covered with firm sand or gravel, and in Algiers at the present time wheeled vehicles can be used over the desert without the need for road-making. The same thing happens also in the desert regions of the Western United States, as well as elsewhere.

But wherever wheeled vehicles originated, they were for long confined to Southern Asia (where they extended from

China into Asia Minor) and to the basin of the Mediterranean, and only reached other regions slowly.

Their spread throughout North America meant the development of roads, and the use of horses, or sometimes oxen, as draught animals. Such wheeled vehicles, then, with the associated animals, formed one improved means of transport which the Europeans introduced into the New World.

That New World was reached by Europeans in sailing vessels, and the sail, as we have seen, was unknown to the inhabitants of North America till this time. In some parts it could not be used, but in others this replacement of human energy by that of the wind meant a great improvement, both as to speed and as to the amount which could be carried at a time.

But much more elaborate improvements than these were soon introduced. The first emigrants to the West dragged their household stuff and their families, with infinite pains, across the wide plains in waggons, hauled by horses over bad trails, or no trails, in the wilderness. Now communication between East and West is carried on over railway lines which run almost straight across the continent. The same power which drives those heavy trains across the continents, is also used to enable the huge steamers to cross the Atlantic in a few days; and thus, in his capture of the elastic force of steam, man has done much to conquer time and space.

Let us note a few points in regard to the railways first. We have seen that the Red Men of the plains found it necessary to travel swiftly, but till the Spaniards brought them horses, this swift travelling was a matter of great difficulty. In the old days the great level spaces of the plains were a danger, for they meant that shelter from the frequent storms was hard to find. But those level plains were of great use when railways came to be constructed, for across them the railway lines could be drawn almost as with a ruler. Only the crossing of the western mountain ranges and of the upland to the east presented difficulty; elsewhere the task of the engineers was simple. Compare these conditions with those prevailing in some other continents. In Asia the centre of the continent is occupied by high plateaux and deserts, across which railways cannot be driven; therefore the only transcontinental line, the Trans-Siberian, has to bend far to the north to avoid these. The

Bagdad Railway is not yet completed, and most of the communication between Eastern and Western Asia has still to be carried on by sea.

Turn, again, to Africa; it is also a continent of plateaux, and the railways as yet are chiefly near the coast, or make but slight, and as it were tentative, efforts to reach the interior. Only the great valley of the Nile allows easy penetration into a considerable part of the continent. So it is with Australia. Here, except for the one transcontinental route, most of the railways hug the coast, avoiding the desert wastes of the interior except to tap gold or silver mines.

In North America the bison made vast migrations, and hard upon its heels followed first savage and then civilized man. It is this easy communication of East with West which has been one great factor in the development of North America. But it is not sufficient that all the varied manufactured goods of the older East can be easily exchanged for the grain, the cattle, the timber, the silver and gold of the newer West; it is also necessary that the cotton, the sugar, the tobacco of the South should be exchanged for the products of the cooler North. Here, again, North America is highly favoured, for the great north-to-south river—the gigantic Mississippi—forms a natural route, though it is less used now than in pre-railway days.

Similarly, if the surface of Canada did not easily permit of railway construction, and if the estuary of the St. Lawrence and the Great Lakes did not run far into the continent and allow of the easy transport of the products of the West to the East, the development of that country would have been much more difficult than it has proved so far.

We have seen that over much of North America, the horse played a great part in preparing the way for the railway, and, till recently, was much used to convey passengers and goods to and from railway termini. Similarly in many other parts of the world, the horse and horse-drawn vehicles have played a great part in development. But useful as the horse is, it is essentially a temperate-zone animal, excluded from many parts of the globe by the heat, and from others, again, by its delicacy and great liability to parasitic, and especially insect-borne, disease. There are therefore regions where it cannot be used, or only used with great difficulty. Here a very recent triumph of human ingenuity is playing an important part. The motor-car is not only

replacing the horse, but is now extensively used in the desert regions of New Mexico and Arizona, where the heat is so great that horses and mules could not be used in the daytime, and where fodder also is hard to get.

In many other regions of the globe also motor-propelled vehicles are able to fill a great gap in means of transport. They are beginning to replace the horse and ass in the West Indies and parts of South America. In Egypt the camel is yielding place to motor transport. In Uganda and other parts of tropical Africa, human portorage, with all its difficulties and dangers, is beginning to disappear before motors in the same way. When motor-drawn vehicles come to be used extensively in Africa, where for the most part the horse cannot be used, then we may be sure that the rate of development of that continent will be increased enormously.

The rapid development of North America has thus been greatly assisted by the substitution of highly efficient means of locomotion for the more or less primitive ones used by the Red Man. The introduction of draught animals and of elaborate methods of agriculture to replace the old primitive modes of cultivation has also done much. The fact that many valuable plants have been brought to the country by Europeans is also of importance.

To generate steam, by which his manifold machines are driven, man has dug up coal from the earth. To obtain iron to make these machines he has toiled to extract the ores, and the presence of abundant coal in the earth has greatly helped him in doing this. He has known how to use the water-power of the mountain streams to light his cities, to produce power which can be transmitted great distances, and used for many purposes. It is by this process of obtaining power both from living organisms and by mechanical means that he has transformed the continent of North America, and enabled it to produce food and all the necessities of life for the overflow of Europe, and the same means are enabling him to extend his conquests to other as yet undeveloped continents.

CHAPTER VII

CULTIVATED PLANTS : PRIMARY PRODUCTS

The three regions where cultivated plants grow best—Cultivated plants of monsoon regions—Rice and its method of cultivation—Oil-seeds, tea, cotton, and the growth of the mulberry-tree for silk production—The important cultivated plants of the Mediterranean region—Chief cultivated plants in Western Europe and temperate North America.

WE have already shown indirectly how important cultivated plants are to man, and to what a large extent his prosperity depends upon them. We must now proceed to consider in more detail some of the plants which have made his progress possible, and the conditions of their growth.

Animal food is always more costly than vegetable, and, furthermore, though a few groups of men, like the Eskimo, live almost exclusively on animal food, yet, as a general rule, a certain amount of vegetable food is necessary for human well-being. This is especially true in hot countries. For reasons both of hygiene and of economy, then, man must depend largely upon the plant world for food. For textiles also, for building material, for many of the necessities of life, he must appeal largely to plants. Of the thousands of plants which exist upon the globe, relatively few are of use to him; he cultivates only a few hundreds. His problem, then, is how he may encourage the growth of those few useful plants, at the expense of the many which he does not want, either for himself or his animals.

Plants are much more dependent than animals upon the physical conditions, especially upon climate, so that there is a marked difference between those growing in parts of the world which differ from one another in the amount and season of rainfall, in the temperature, and so forth.

We have already noted that, as a general rule, man can grow plants best in countries where there is considerable seasonal variation in rainfall, or in temperature, or in both. We can distinguish three main climatic regions where he has been especially successful in growing plants on the large scale, these being also regions of dense population, because the abundant cultivated plants feed many people.

These three regions are, first, districts like Western Europe and Eastern North America, where there is no great difference in the rainfall throughout the year, but there is a marked seasonal difference of temperature. These are the regions which the geographers call cool temperate.

Second, he has been very successful in growing plants in those regions which lie at the western sides of continents, in sub-tropical latitudes, and are characterized by winter rains. The region round the Mediterranean is the best example of this type of climate ; but California, Chile, the South-East of Africa, and parts of Southern Australia, etc., show similar conditions. In these regions the temperature never falls low enough to check plant growth seriously ; but the summer is very dry, and the drought then prevents many plants from thriving. Rain falls in the colder months—sometimes abundantly—and then the earth is green, while it may become burnt and brown in summer.

The third, or monsoon, region is much hotter. In India and other parts of South-Eastern Asia, the temperature is high all the year round ; but there is a distinct dry season, the rain coming in summer when the heat is greatest. Like the others, this kind of climate is characterized by its peculiar plants, and it extends into China, although here the winter temperature may be low.

It must not be supposed that only in these regions do cultivated plants thrive. They grow, as we have already pointed out, abundantly in Egypt, where there is no rain, and its place must be taken by the rising waters of the river. They are grown, as we saw in the account of life amongst the Fans of the French Congo, in equatorial regions where there are two rainy seasons and no real drought. The point is simply that the three types of regions named have been noted for a prolonged period for their abundant growth of cultivated plants, and that in them we may find representatives of all the chief kinds of such plants.

We can arrive at the same conclusion by another route. Let us consider for a moment the chief regions of the globe as determined by their natural vegetation. In the Far North, where land surfaces are very extensive, and in elevated regions such as high mountain ranges and the plateaux of Central Asia, we have the *tundra* type of vegetation. Here no trees grow, only bushes; here the subsoil is permanently frozen, and the time during which plant growth can be carried on is very short.

Farther to the south comes the *taiga*, or coniferous forest, which covers much of the northern parts of Siberia and North America. Here the warm period is still short, the winter often very severe. Farther south than the taiga occurs the belt of *steppes and deserts*, often very hot in summer, generally cold in winter, the steppe bearing pasturage for herbivorous animals, but largely unsuited for crops, because of the scarcity of rain. Much farther south, again, we find the *tropical rain forest*, with its abundant vegetation, its hot, steamy climate.

Considering the globe at large as being covered by these four plant societies, which thus define natural regions, we may say that man has best found a footing, has forced the largest place for his plants, in the transition zones which lie between the natural zones, in the regions where the natural vegetation was easier to conquer than in the zone perfectly fitted to it.

The cold barren tundra can only be made to grow cultivated plants to a very small extent—it is nearly useless for man's purposes. The taiga also flourishes in a region where the winter climate is too severe, the summer too short, for the more valuable plants; harvests are here uncertain. But the taiga occurs in regions with quite adequate rainfall, and beyond stretches a wide belt, often with abundant rainfall, and with a higher temperature than the taiga, before we come to the dry steppes and deserts beyond. In this region lie the zones we have called temperate and Mediterranean, seats of great human activity. Here in a state of nature mixed forests and natural grasslands occurred, now replaced by man's fields and orchards.

The deserts, again, are separated from the damp equatorial regions by a zone of transition, with varying rainfall; this is the region of summer rain, where, again, man has prospered.

Of the three great zones where cultivated plants grow best, the cool temperate has been latest in developing. It has the disadvantage that the summers are short and the temperature



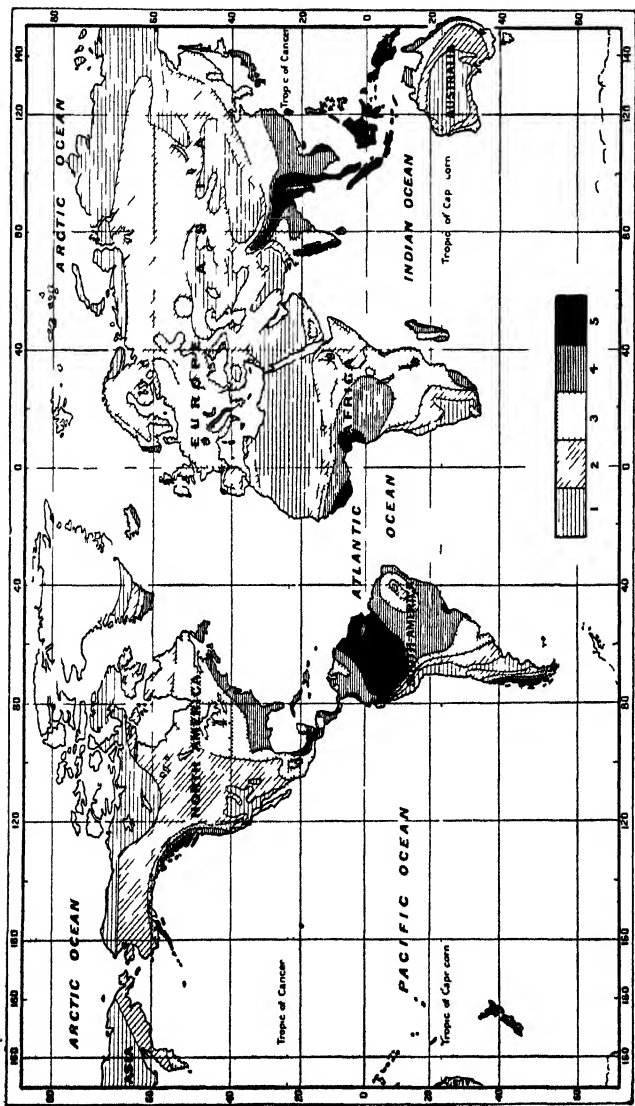
VIEW IN THE TROPICAL RAIN FOREST.

never high. It has the further peculiarity, already noted, that it has been very recently glaciated. We showed in the first chapter that it is possible that the reason why man within recent historical time has thriven best in the north temperate zone, is because that region has been becoming progressively better fitted to his needs, as the immediate effects of the glacial period, in altering drainage, and so forth, have worn off. Perhaps the Mediterranean region has during the same period been becoming progressively less suited, and the shift of the centres of civilization from Assyria and Mesopotamia to Egypt, then to Greece, then to Rome, and then to the North-Western part of Europe, has thus an explanation in the facts of physical geography. However this may be, there is no doubt that cultivated plants have flourished longer in the Mediterranean region, and in the region of summer rains, than in colder climates.

In fact, the majority of the valuable cultivated plants come from one of two regions—from the eastern end of the Mediterranean basin, including Mesopotamia under this designation, or from the Far East, notably India and China. A few—especially maize, tobacco, and potatoes—come from the warmer parts of America.

In considering some of the more important of the cultivated plants, we may conveniently begin with the region of summer rains, and especially with the monsoon regions of India and China. Monsoon countries have a regular alternation of sea-winds and land-winds, and therefore an alternation of moist seasons and dry seasons. As a general rule the temperature is high, and it is highest in the moist or growing season. From these facts we may at once deduce something about the cultivated plants. As, generally speaking, there is no severe cold at any season of the year, there is no reason why plants should die down in winter. Though there are dry seasons and moist seasons, there is no such severe drought as reigns in parts of the Mediterranean region in summer, and the drought comes in the cooler seasons of the year when the plants are not giving off a great deal of water. Therefore there is no reason why the plants should have small spiny leaves, like many Mediterranean shrubs and trees, nor need they have underground 'reservoirs' for storing moisture and food, like the bulbous plants of the Mediterranean.

They need not hurry through their life-history as so many



MEAN ANNUAL RAINFALL OF THE WORLD.

Rainfall in inches: 1, Under ten ; 2, ten to twenty ; 3, twenty to forty ; 4, forty to eighty ; 5, over eighty.

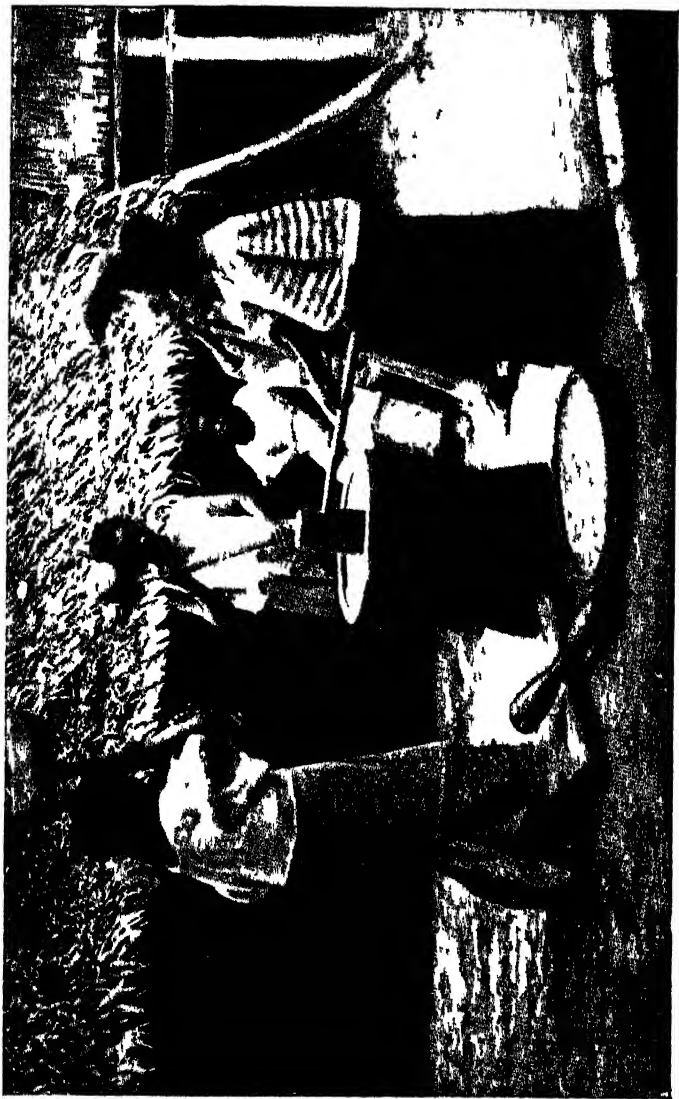
of the plants of temperate regions must, for here a great part of the year is favourable to plant growth. We should expect, then, to find many shrubby plants ; of such, tea and cotton are examples. As the rainfall is heavy at the seasons when it comes, we should expect to find plants which like a combination of warmth and moisture. Of these, rice and sugar-cane are examples.

With these general statements we may proceed to consider the plants upon which the ancient civilization of the Far East has always been based.

Here, as almost everywhere, the most important food plants are those we call cereals. These are annual plants of the grass family, producing a large quantity of seeds rich in nutritive material, but protected by husks. In parts of Africa and America semi-civilized peoples gather—or used to gather—the seeds of wild grasses ; but there are very few prosperous or stable groups which do not cultivate cereals for food, and some of the cereals are among the oldest known cultivated plants.

In the monsoon countries the typical, though not the only cereal, is rice, a plant which demands a considerable amount of warmth, and abundant water at certain stages. It is far from being confined to monsoon countries ; the Plain of Lombardy, for instance, in North Italy, owes much of its prosperity to the fact that rice is extensively grown there on irrigated land. Nevertheless, it is very characteristic of monsoon countries, and forms an important part of the food of millions of people there.

We have seen that in most monsoon countries there is no cold winter to render it necessary for plants to limit their activity to a very short period. They need not be annuals in the sense that the Indian cress of our gardens is an annual. This plant cannot tolerate freezing temperatures, and therefore it must get through all its activities between the last spring and the first autumn frost. But annuals do grow also in warm countries, and there it is possible to cultivate several generations of them in the course of one year. In monsoon countries, for example, more than one crop of rice can be reaped in a year. The fact that the plant can be made to run through its life-history rapidly makes it possible also to take more than one kind of crop off a piece of ground in a year. In that case the rice must be limited to the hottest and dampest period, or the



[Keystone View Co.]

HUSKING RICE IN LUZON.

ground must be artificially watered. The fact that the plant only requires abundant water at certain stages of its growth makes it better to water it artificially than to depend upon the rains, and therefore it is grown especially on irrigated land. But the ground on which it is grown must be level, for otherwise it is impossible to insure that all the plants are submerged to the necessary extent. Further, the soil must be fertile and light.

Where is flat land, easily watered, fertile, and not too compact, likely to be found? Obviously in delta regions, where great tropical rivers are surrounded by plains and marshes. Here, then, rice grows abundantly. These are the rice lands.

As contrasted with wheat or the other familiar cereals of temperate regions, rice is excessively difficult to grow. It demands an amount of care and labour, of which the grower of wheat has no conception. What advantages has it to set against this great disadvantage? It has many. First, it grows fast; four months will suffice from seed to harvest. Again, it needs little manure, and it will grow on those marshy river lands scorned by the other cereals. Finally, it is enormously productive. No other crop, it is said, will give so large a yield from a given area of land, and it is quite possible, as we have seen, to take two crops off the same field in one year, or to make the rice crop merely a brief interlude in the yearly cropping of a piece of land. Rice is difficult to grow, and therefore demands many hands, but it yields an abundant harvest for all, and the more hands, the more rice can be produced for the next harvest.

If we look at a population map of India, we see how the people cluster thickly round the mighty Ganges. If we turn to a map showing the products of India, we find written over those low lands near the Ganges the word *rice*. Rice is so productive that it can feed many people, and it means such severe labour that it is necessary to have a dense population before it can be grown on the large scale.

Let us follow in detail the growth of a crop. First, the land must be levelled, unless it is already level. Then each patch of level land must be surrounded by a dyke to keep in water, and the land must be flooded for the first time, or watered by rain. Then it must be ploughed. Afterwards the seed is



[Stereograph copyright, Underwood and Underwood

**PIOUGHING FLOODED GROUND FOR RICE-PLANTING, NEAR
KYOTO, JAPAN.**

sown, and the field must be flooded for three weeks or a month. But the water must not become stagnant, so that it may be necessary to drain the field and renew the water more than once. When the little plants appear above the water, each must be transplanted like a lettuce. To do this the cultivators must stand with their feet in the water, and the occupation is extremely unhealthy. It is stated that the habit of opium-taking, which is so common in rice-eating countries, takes its origin in the desire of the cultivators to soothe the rheumatic pains they get from standing all day long in water.

In any case this laborious cultivation is of great interest. The population in monsoon countries is dense, but the density is not an accident, it is directly related to the industry and care exercised by these skilful cultivators. With their methods we must compare the utter casualness of the negro's work in Tropical Africa. While the negro is content to stick in a banana slip every two years, the Eastern is toiling over his rice fields.

The rice-grower's labour does not end with the transplantation of the young seedlings. These must be flooded at stated intervals, the exact amount of water supplied being very important. Finally, the water is drained off, and the harvest is reaped laboriously with a sickle. Even after this the process of husking has to be carried out, and only then can the Hindoo obtain his curry.

As a general rule, rice is consumed in the region where it is produced, and does not figure largely in the world's commerce. It can only be grown on a large scale where labour is very cheap and very plentiful, and as this labour is commonly fed on rice, only the surplus remains for exportation. Less nutritious than wheat, it is not greatly prized in cooler climates where the richer cereal is available.

Though the most important cereal of monsoon countries, rice is not the only one. Wheat is now extensively cultivated in India, though mostly for export, and it forms an important part of the food of the people in the more northern parts of China, but it seems to have originated in the Mediterranean region. Other important cereals are the various kinds of millet and sorghum, extensively grown in India and China, as well as in Africa, but not exported to any extent.

One of the objections to rice as an article of diet is its

tastelessness and deficiency in fatty matter. The countries where it is most at home, are not those where milk-yielding animals are abundant, and therefore fat is usually supplied by some vegetable oil. The olive of the Mediterranean region does not thrive in monsoon countries, but a variety of other oils are used. Thus in India sesame oil is used as a food, while in China and Japan soya beans are extensively grown, and supply both oil and the flavouring matter so necessary when rice is the chief food. That the East is the home of spices, indeed, may be associated with the fact that it is the home of rice.

Among other important food-plants the sugar-cane may be mentioned. It probably had its original home in the moist valley of the Ganges, and thrives on the same kind of soil as rice, but is much easier to grow.

In China and Japan, as is well known, the tea-plant is extensively cultivated, and its leaves supply a stimulant greatly prized in these lands, no less than in many European countries.

We must next consider the very interesting textiles of the monsoon countries. Because of the relative deficiency in wool or hair producing animals, at least on the low grounds, woollen fabrics are little known. The important fabrics are, and have always been, cotton, silk, ramie or China grass, and jute, the last used for coarse materials. All of these present points of interest.

In China cotton is employed for clothing by the poorer people, and where, as in the north, the cold of winter is considerable, it is padded for warmth. In Japan cotton is only grown on a small scale, because of the lack of space, and both there and in China and India silk is a very important textile. This may seem strange when we think of its costliness and relative rarity from our point of view. But then we have to remember that all our modern notions of values depend upon highly artificial and very recent conditions. Silk seems to us very dear, and cotton very cheap, because cotton can be grown on the large scale, and, especially, can be very easily and very cheaply manufactured by machinery. Silk can only be produced on a small scale, and requires elaborate and detailed care at all stages.

Raw silk is now, and has been for a prolonged period,

produced in Southern Europe as well as in the East, but its true home is the East, and we may consider its production there. In the first place, a considerable amount of wild silk is obtained in the East—that is, the cocoons spun by wild caterpillars are collected. Very much more, however, is produced by silkworms living in captivity, and it was in China probably that this was first done. The caterpillars feed upon the leaves of the mulberry-tree, and should therefore theoretically live in any climate where that tree will thrive. In point of fact, they are more sensitive to cold than is the tree, and are kept under artificial conditions of warmth in regions where the tree thrives perfectly without protection.

The first point about silk, then, is that its production demands but little space—a very important point in crowded countries. Second, as the rearing of the caterpillars demands ceaseless care, this can only be done in countries where labour is abundant and cheap, and where there is a high standard of patience among the workers. A nation accustomed to the laborious growing of rice is thus suited to be also a nation of silkworm-rearers.

Another point is of importance. The whole life of the caterpillar, from the date of hatching to the formation of the cocoon, only lasts about a month ; therefore, if the climate is sufficiently warm and moist for the mulberries to yield several crops of leaves in the year, then there is no reason why several generations of silkworms should not be also raised. This is what happens in the East, and here, therefore, the raising of the silkworms becomes in itself a profession.

But in the Mediterranean region the summer climate is too dry to enable the mulberry to yield a new crop of leaves after the first is plucked, therefore here one generation of silkworms only is possible in the year. This means, again, that the workers are only occupied for a part of their time, and this busy time comes in spring, when other farm work often presses. Except, then, where there are small holdings, it is difficult in the Mediterranean region to find workers just at the right season. On the large estates the owners or farmers are not willing that the field-work should be neglected for the sake of a somewhat precarious crop. Generally it is upon the women in South France and Italy that the task of breeding and rearing the worms falls.

Even, therefore, if the climate permitted the growth of the mulberry-tree and the rearing of the worms farther north, the absence of a long tradition and of a willingness to toil continuously for small reward would make the cultivation impossible. It is quite impossible in the United States for these reasons. It is far easier to rear thousands of sheep which require but little attention, than to toil over the delicate operations of silk-worm-rearing.

Once again, the inhabitants of countries where the silkworm has been bred for countless generations, have necessarily acquired a power of taking pains, a leisureliness, absent in regions where life moves at a faster pace. If ceaseless care and patience are needed to produce a little silk yarn, there can be no great hurry in weaving it or making it up into garments. Thus we have the development of the beautiful embroideries and fabrics of the East, which appealed so strongly to the Westerns in earlier times, before the advent of machine-made goods.

The great development of the textile industries, again, meant that vegetable dyes would be sought out, and thus we have explained the growth of dye-plants, like indigo and many others, most of which are native to China and India. With these the fabrics of the world were dyed till the place of natural dyes was taken by coal-tar products (aniline dyes).

Cotton is a very widely-distributed plant, which has long been cultivated in monsoon countries. It is a shrub, but is very commonly cultivated as an annual plant, being pulled up at the close of each season and resown the next.

It is not strictly a tropical plant, but is very sensitive to frost, and as it has a long growing period—some seven months—it cannot be cultivated where the winter is long and severe. It requires abundant moisture during growth, but an excess as it approaches maturity is dangerous. Further, it requires a great deal of care while it is growing, and the process of picking is slow and laborious. Cotton, like rice, is therefore primarily a plant of crowded regions, and of those where heat and moisture are both abundant. In the United States of America it used to be grown only with negro labour, and was thus partly responsible for the slave-trade and all its horrors. Not for nothing has the civilized world of the West replaced its linen garments by cotton ones.

Of ramie, or China grass, we need only say that it is a fibre obtained from the bark of a shrubby nettle, and yields a soft and lustrous cloth, used in China for summer clothes. Like most Eastern plants, it demands a good deal of care in cultivation.

These are only a few of the chief plants of the monsoon region, but they may help us to form an idea of the kinds of plants upon which the civilization of the East has been based. The special points are that the heat and moisture, which both occur at the same period of the year, cause the land to yield abundant crops; but these crops are only obtained, especially in China, as the fruit of unremitting labour.

Let us turn now to the Mediterranean region. Here we have the great disadvantage that the rain comes in the cooler parts of the year, so that a good deal of the summer heat is wasted from the point of view of growth. In general, then, rice, cotton, sugar-cane, and tea are excluded, even though some of them may be made to thrive in special localities or with irrigation. What kind of plants will thrive here? Obviously, those which can use the time of the spring rains to make their growth and the summer suns to mature their seeds—wheat is such a crop. In the second place, trees, or plants with long roots, which can reach water at great depths, or do not require any great amount of water, will prosper. The region will then be especially one of fruit-trees—of olive, vine, fig, almond, pistachio, peach, orange, and so forth. In its flat plains and fertile river valleys, where wheat and barley grow best, such fibres as flax and hemp will also grow. Where rain is more abundant, maize will thrive. The region also contains many mountains and hills, whose slopes are still forest-covered below, while pastures occur above. We would expect, then, to find that, though cattle and horses will not be very abundant, because pastures are not plentiful, yet sheep and goats, less particular about rich grass, will be found in the upper region, and will yield wool and hair.

The people in this region, then, will eat bread made of wheat, the finest of all the cereals; they will supply the necessary fat with olive oil; they will drink wine except where religion forbids, and there will be abundant fruit and many different kinds of vegetables in addition. They will clothe themselves with linen and wool, and the silkworms and



(Canadian Pacific Railway Co.)

HARVESTING IN CANADA.

Note the scale upon which the work of cultivation is done here, as compared with the laborious methods of the East.

mulberry-tree introduced from the East will give them some silk, though this remains a luxury.

The fact that rain is absent in summer, and sometimes small in quantity at all seasons, means that their land cannot be so densely peopled as that of monsoon regions. Stretches of fertile land will be separated by regions which are almost desert, but on the whole the cultivated plants demand less laborious care than those of the East. Wheat, sown in autumn, watered by the winter rains, will grow through that mild season and ripen with the suns of early summer, without a tithe of the care which the Chinaman bestows upon his rice crops. When the wheat and barley are cut, the summer fruits ripen, ending with the vine, and finally, much later in the season, comes the olive harvest.

Again, the fact that the Mediterranean lands, in the narrow sense, fringe the great inland sea of that name, means that they were early linked together by bold navigators, while China, India, and Japan, were for long ages more or less isolated. The free intercourse in Mediterranean regions brought faster development, less blind adherence to tradition.

What contrasts do the temperate regions of Western Europe and the Eastern States of North America offer to these conditions? The essential point is that here, for the first time, we have a winter cold enough to give a decided check to vegetation. The crops, then, for the most part, must be summer crops, gathered in before the temperature falls in autumn. But no sharp division line separates these countries from those round the Mediterranean, and therefore many of the Mediterranean plants have spread northwards. Here they are grown successfully, though often under slightly different conditions. The vine comes far north, but then clings to sunny, well-drained slopes, instead of extending down to the low ground. Wheat prospers wherever the summer is sunny enough, but it must sometimes be sown in spring instead of autumn. To wheat, especially where conditions are unfavourable, must be added the less-prized cereals, tolerant of more moisture, less sun and less warmth. These are especially oats, barley, and rye. Where the summers are moist and warm, maize grows well, and proves more productive than wheat, though it is not so valuable a food. The potato, a late introduction from the plateau region of tropical South America, has proved extraordinarily

successful from its tolerance of excessive moisture and little sun. Other very important plants are the root-crops, especially valuable as food for animals—*e.g.*, the turnip and mangold, the former especially adapted to a moist climate. The sugar-beet also is another root-crop which has become of great importance in recent years. Flax grows here as in the Mediterranean, and linen was a very important textile till American cotton came into general use.

But the special peculiarity of this region in Europe is the pasturage, especially in the west and on the mountain slopes. This meant first a great production of wool, of fine quality because of the cool or cold winter climate. In later times it has meant also the great development of dairying industries, and a consequent large increase in the consumption of beef, which is not abundant and not good in either the crowded monsoon countries or in the dry Mediterranean region.

Of the minor crops, it is worth notice that fruit-trees of the hardier sorts abound, as we may realize on thinking of the cider-making of Normandy and Devonshire; but the special feature is the abundance of small fruits—those demanding a moist climate, such as strawberries, currants, gooseberries, etc.

Broadly speaking, the conditions in the Eastern United States, to the north at least, resemble those in Europe; but, as we go westwards, the climate becomes drier and drier till we reach the Great Plains (see figure on p. 71). Gradually, therefore, the temperate crops disappear, and the land is given over to cattle and sheep, which used to roam over wide areas in search of pasture.

Everywhere, in short, the cultivated plants which can be grown are controlled by the climatic conditions—controlled, but not wholly determined, for man can introduce, and has introduced large modifications, and carried plants many thousands of miles from their original homes.

CHAPTER VIII

CULTIVATED PLANTS: THOSE YIELDING LUXURIES OR SECONDARY PRODUCTS

Importance of luxuries in promoting trade—Development of the tropics as regions for the production of luxuries—Coffee—its conditions of growth, and the regions where it is cultivated—Palm oil in West Africa and 'rubber economy'—The production of rubber—Collection of wild rubber in the Amazon region—Quinine, cocoa, and sugar—The future of the tropics.

WE discussed in the last chapter the three regions of the globe where cultivated plants grow best, and showed, especially in the case of the old civilizations of the Far East and of the Mediterranean regions, that stable and prosperous communities must be based upon crops perfectly fitted for the area in which they are grown.

Man requires as food a certain amount of proteid, or nitrogen-containing matter. This, in our wasteful modern communities, is supplied very largely by meat. In older days, and in hotter countries, it was, and is, chiefly furnished by cereals or by some kind of peas and beans. In the Far East the fundamental nitrogen-containing substance is rice, or the different kinds of millet, or, less frequently, wheat. In the Mediterranean region it was first barley and then wheat.

Among other articles of food man requires heating and energy-producing substances, such as carbohydrates and fats; and, to be digestible, his food must have some flavour. In the East the rice supplies carbohydrate as well as proteid, but sugarcane is also grown, with various forms of oil-seeds for fats or flavourings. The Mediterranean area grows many kinds of fruits and nuts as well as olive oil.

We have shown how the next great necessity of life—clothing—is supplied in the East by cotton, by silk, which depends upon a cultivation of the mulberry-tree, and by China grass. The Mediterranean region obtained silk early, though it never succeeded in producing it on a very large scale, and besides growing flax for linen, was supplied with wool by the flocks which fed upon the pastures of the mountain slopes.

We have already suggested that, when trade began between West and East, it was not the necessities of life which formed its basis; it could not be, for each region produced its own necessities. Rather was it the luxuries which tempted man to brave the dangers of the sea. Pepper and spices were very important items in the medieval trade between the Indies and the Mediterranean region, and such substances as coffee, cocoa, tropical fruits, and so on, are to this day predominant articles of trade between the different climatic regions of the globe.

A little reflection will convince us that it must be so. The countries round the Mediterranean did not want the actual necessities of life from the East, because there could not have been stable communities there for countless generations unless the elementary wants of life had been amply satisfied. Food, sufficient to maintain life, obtained directly or indirectly from plants fitted for life in the region, there must always have been, and so with clothing and the other fundamental needs. But, as we have already pointed out, it is one of man's great peculiarities that he very rapidly acquires new tastes, and is very willing to make experiments on new articles of food. More than this, he is so constituted that the rare, the costly, or the little-known article of food or clothing appeals to his imagination much more strongly than the cheap and familiar. We find all sorts of curious examples of this. In Australia mutton as an article of diet is much less esteemed than beef. Why? Because, as wool is the great product of the country, mutton is cheap and easily got, while beef in a country where water is scarce, and luxuriant pasture not very frequent, must always be more difficult to obtain.

In the Highlands some thirty or forty years ago, when loaf-bread made of wheat was just beginning to replace oat-cake, the country people strove to set white bread before honoured guests as the daintier dish. The guest, if town-bred, would often fain have had the daily oat-cake, as offering to him

greater novelty. These are only two familiar examples out of many which might be given.

Now when a new substance is introduced into a particular region, and meets with great appreciation, the first thing which naturally occurs to an agricultural people is to try to produce it in the homeland. In many cases the attempt is quite successful. Every Irish potato-field, every tobacco patch in Southern Europe, every orange-tree and mulberry-tree round the Mediterranean, every orchard in North America, shows us just how successful it may be. But where the difference of climate between the country of origin and the region proposed is too great for the plant's power of adaptation, then the attempt is doomed to failure. The fact that grapes are occasionally grown out of doors without protection in parts of England, only serves to emphasize the fact that this country will not grow grapes as a rule. The peach-trees which we sometimes see against a sunny wall in an old Scottish garden, with an elaborate arrangement of blinds above, whatever the gardener may think, only suggest to the geographer that peaches do not grow in the open in Scotland.

But the peach and the vine remind us that where the difference between the climates of the two regions concerned is great, but not enormous, then man's ingenuity may overcome the difficulties connected with introduced plants. We cannot grow grapes and peaches successfully in the open, but with the protection of a glasshouse they can be grown better than in their native lands. Indeed, in the warmer parts of the British Islands—*e.g.*, in the Channel Islands, where only protection is necessary and not artificial heat—it is stated that grapes can be grown as cheaply as in countries where the summer climate is much hotter. But these are exceptional cases, and the fact that many a peasant in Spain gets his living by producing grapes for the British market, shows us that man's power of rising above the limitations imposed by geographical conditions is strictly limited.

But apart from the plants from warmer climates which can be grown on a small scale, and with special care, our daily life makes claims on those which by no possible use of terms can be said to thrive in this country, whatever man does. Coffee, cocoa, quinine, rubber, bananas—for these we, like Europe generally, are necessarily dependent upon other countries.

This brings us to the next point in the development of the globe as a dwelling-place for man. When regions of the surface are not so well fitted for cultivated plants that they can give rise to an extensive, indigenous civilization, based upon local cultivated plants, they may undergo secondary development because of their power of producing some one or more plants for which there is a large demand in more favoured regions.

China and Japan have produced cotton for a long period, but when the Western world began to make large demands upon this plant, it was not they which began to produce the necessary surplus. Why? Because, as old and prosperous countries, their crops showed a certain balance, and a very large surplus of cotton could only be produced by displacing some other crop necessary for the welfare of the people at large; therefore, a great part of the Western demand for the raw material is supplied, not by these countries, but by the southern States of North America, which had the necessary climate and soil, but no large indigenous population using the greater part of the land for the production of prime necessities.

Japan, now, is beginning to enter upon the same path of industry as the Western nations. She also wishes to sell cheap cotton goods to the world, but where is she to get her raw material? Not at home, for her land is needed for other purposes. India supplies some, but she is endeavouring to make previously unutilized land in Korea and elsewhere satisfy her new needs.

If we put this in a slightly different form, we may say that, though the three regions mentioned in the last chapter are those parts of the earth's surface which are best fitted for growing *many* cultivated plants, other regions can mostly yield a few products, sufficient to ensure to them a secondary development, necessarily later in time than that of the more favoured regions.

Among such regions are the tropics generally. Perhaps this statement may seem rather absurd in view of all that we have said in regard to the Far East, but a map will show that Japan and almost the whole of China lie outside the tropics. A large portion of India also is extra-tropical, and the part within the tropics shows several exceptional features in that it is a peninsula, and this introduces considerable modifications of climate.

We have, then, to consider here in the first place certain tropical products, looked at in relation to the development of the countries in which they occur.

We may begin with coffee, which presents the peculiarity that it is grown practically everywhere as an article of trade, and not for local consumption. In other words, it is grown to enable the inhabitants of the region in which it is found to buy the produce of other lands, not because they want it for their own use.

The plant which yields coffee is a shrub or small tree, with shining leaves and white flowers. The flowers give rise to little fruits like cherries, containing two seeds, which are the coffee "beans" of commerce. The tree is a native of Abyssinia, and was introduced into Arabia by the Arabs. It is believed that the Abyssinians were the first people to cultivate the plant, and to pound its seeds to make a drink; but Arab peoples soon became exceedingly fond of coffee, and its use seems to have spread among them very rapidly, in spite of the opposition of the authorities, who classed it among the intoxicating beverages.

The plant is said to have been introduced into Arabia as late as the fifteenth century, and it was a century later before commercial coffee reached Europe, and two centuries before it got as far as London. Up to the end of the seventeenth century the tree was confined, as a cultivated plant, to Arabia, and then the Dutch carried it to Batavia. The next stage was to introduce it to the New World, which was done either by the French or the Dutch, and now it is grown very widely in the tropics, there being more than one cultivated species.

The conditions necessary for the growth of the plant help us to understand why it was so long confined to Arabia, and also some of the peculiarities of its present distribution. It will not stand frost, and needs both warmth and moisture, but is very intolerant of the direct heat of the sun. In Arabia it is grown in what used to be called Arabia Felix—that is, Yemen—the part of Arabia which fringes the Red Sea, and has lofty mountains at its back. Here the coffee-plant finds on the slopes of the hills precisely the conditions which are best suited to it. The region is within the tropics, and the fertile land forms but a narrow strip near the sea. The sun brings heat, but the heat on the slopes is tempered by a mist, which almost

every day forms round the plantations, owing to the way in which the moisture-laden air is cooled as it rises up the mountain slopes. This mist forms before midday, and shelters the plants till the greatest heat of the day is past, and then disappears. The vicinity of the heated plains prevents any excessive cooling at night.

The plant is a perennial, but demands rich soil, and a plantation will only last some thirty to forty years. As a tropical plant, coffee has no need to hurry through its flowering, like the tree of colder climates, and thus it produces fruit during a considerable part of the year. At least three gatherings of the fruits must be made. After plucking, the beans must be pulped—that is, have the fleshy covering removed. They are then dried in the sun—a process which demands great care—and are finally sent down to coffee works for the final stages in the preparation, which consist in removing the coats of the beans, and in sorting the product and putting it into bags for exportation.

From this account it will be obvious that the two difficulties which coffee-growing presents are, first of all, the obtaining of a suitable climate—one with adequate warmth and moisture, but no excessive sun heat—and second, the need of much cheap labour.

The American wheat farmer obtains his harvest by wholesale methods (see p. 98). His powerful machines reap the corn and bind it into sheaves. The sheaves are readily carried away, and the grain is thrashed by modern machinery, so that the minimum of hand labour is necessary. But the coffee-berries have to be picked individually, like strawberries, and as they are not all ripe at once, the labourer must select only those ready for picking.

This labour difficulty has been got over by one of those short cuts to which man is especially liable, though all experience shows that they are economically bad. Coffee, as we have seen, is grown in regions whose inhabitants have only used their land partially, not for the benefit of those inhabitants, but for that of alien "planters." The use of slave or forced labour, then, at once suggests itself. In Java, where coffee was first cultivated outside Arabia and Abyssinia, it was obtained by forced labour. In Brazil slave labour was long employed, and since its abolition there the planters have

suffered much from the difficulty of obtaining suitable workers.

In Central America, where the coffee is grown on unhealthy and marshy lands, labour is now obtained by importing the freed negroes of the West Indian islands. These islands in the slave days, and even down to the present time, produced, and continue to produce, a considerable amount of coffee; but in Haiti, with a fairly large export, some very curious conditions now exist. In this negro Republic agriculture has fallen on evil days, and coffee, introduced by the French, is no longer cultivated. The climate is, however, quite suitable, and the tree has run wild. The berries of these wild trees are collected by the natives, and form a considerable article of commerce. It is rather curious to find the collecting stage reappearing among these negroes, descended from an African stock which doubtless depended largely upon wild products gathered in the forest. It is further curious to notice that the plough has also disappeared from negro agriculture here, and the peasant cultivator has returned to the hoe, the implement of his ancestors.

The other difficulty—that of finding a suitable climate—is not easily got over. Where conditions of soil and moisture are suitable, but the sun's heat proves too great, the coffee is interplanted with "nurses," whose function it is to shield the young growths. The banana, which grows rapidly, is often used for this purpose, with some interesting results. It is so used in the various States which constitute Central America. Here coffee plantations have been formed, especially with American capital, on the eastern slopes, and bananas were extensively interplanted with the coffee. But coffee takes some time to come into bearing, and, as we have seen, demands a great deal of labour and of care. Now this eastern coastline is within easy reach of the ports of Mobile and New Orleans, and behind these ports, easily reached by the splendid river and railway communication of the United States, there is a dense population, largely industrial, and eager for such tropical fruits as the banana. The planters, therefore, find it more profitable to encourage the nurse-plants than the coffee bushes, and the main product is now largely neglected for the subsidiary one, which is carried by fruit-boats direct to the two ports named. The bananas have the great advantage of not requiring, like

the coffee beans, a long process of preparation, and as they are plucked green, they can be carried to their destination with but little loss.

In Brazil a coarse kind of pea is used for interplanting with coffee, and has the great merit that it enriches the soil in which it is grown—an advantage because coffee is an exhausting crop. But since the abolition of slavery the Brazilian planters have been much handicapped by scarcity of labour, and are constrained to make the maximum use possible of machinery.

The region in Brazil which produces coffee is of somewhat limited extent, comprising a strip of hilly land at the back of the ports of Rio de Janeiro and Santos, and thus not far from the sea.

Coffee was formerly extensively grown in Ceylon, but here the plantations were established in regions which were climatically not quite suited to the tree, which was in consequence attacked by various pests, especially fungi. This is very apt to occur when plants are introduced into regions remote from their natural climatic zone. As other examples, we may give the potato disease in Ireland, phylloxera in French vines, and so forth. Such outbreaks of disease are Nature's revenge for the disregard of the geographical conditions which determine the successful growth of plants. When the plant is supremely important, as in the case of the potato, it is worth while to endeavour to breed resistant stocks; but where, as in Ceylon, other crops can be grown with equal or greater profit, it is better to accept Nature's hint. In Ceylon, with the appearance of disease in the coffee plantations, that product was largely abandoned in favour of tea.

As our second example of a tropical product, we may take one which offers a considerable contrast to coffee. This is palm oil, obtained from the fruit of a palm which grows wild in tropical Africa, especially near the west coast.

The African oil-palm requires a high temperature and much moisture. It is found in the dense forests which fringe the coast from Angola to Senegal, but is especially abundant from Sierra Leone to the Kamerun. The inward limit of the forest in which it grows is about 200 miles from the coast, and the fruits occur in large bunches. The pulp contains the oil of commerce, but the seed, which is enclosed within a hard shell, is also oily, and supplies palm-kernel oil.

The fruits are prized by the natives, who boil them in water, and then skim off the oil as it rises to the surface. It is then eaten like butter, while a sort of soup is also made by boiling the nuts. In civilized lands the oil is used for making soap, candles, and margarine, and is exported largely to France and England. It is also used in the tin-plate industry; hence a large amount is sent to South Wales. Tin plates are sheets of iron covered with a thin layer of tin to prevent rusting, and the oil is used to form a thin film over the plates before the tin is laid on. In brief, then, a substance used as food by various West African peoples has important uses in industry in civilized countries.

The people of West Africa, many of whom, it will be remembered, are skilful cultivators, and have but little negro blood, want cotton goods, arms, tools, and some other European products, and for these they are willing to exchange their palm oil. The palms are so abundant that cultivation is practically not necessary, and is scarcely carried on at all, except that seedling palms are transplanted to cleared ground, where they grow more rapidly and where their fruits are more easily collected. In a general way, then, the palm-oil trade is carried on by what the Germans call "robber economy"—that is, the method of obtaining the product diminishes the probability of future supplies. The robber economy is more marked in the case of rubber, to be considered presently, but still the wholesale destruction of the fruits of the palm must have an influence on its abundance in the long run.

Meantime, however, the palms are abundant enough, and are widely distributed. The natives collect the fruits, and prepare from them small quantities of oil. This they do without machinery of any kind; the kernels, for example, are broken with a stone to get the seed, and it is calculated that often two-thirds of the oil present in the fruits is wasted during the process of preparation. The small quantities of oil so prepared are carried by the natives to the merchants, who ultimately forward it in quantity to the European ports, especially Liverpool and Marseilles. Though collected in such a casual and wasteful fashion, palm oil forms an important article of export from several of the West African colonies, notably from South Nigeria and the French Congo, and therefore it is largely with this substance that the natives

pay for the administration in these colonies, and are enabled to buy European goods.

It is worth looking at the trade for a moment in some detail. As contrasted with coffee, palm oil is a product which has a native value in the country of its origin—it is not only an article of merchandise. Further, as its collection, and such primitive cultivation as goes on, remain in the hands of the natives, there is no need for forced or slave labour; thus some grievous economic wrongs are avoided. But the method of collection is wasteful in the extreme, and a country cannot be said to be developing along right lines when it lives by destroying a product upon which its continued prosperity depends. The wastefulness could be prevented by the use of machinery, but this is too costly for the natives, and they cannot meantime be expected to bring the unprepared fruits direct to the merchants, in view of the fact that communications are very difficult. The “robber economy” could be done away with by cultivation of the trees, but this is not likely to be carried out systematically while the wild palms remain so abundant. Meantime, however, we cannot say that the African trade in palm oil, or the communities which largely depend upon it, are in a stable condition—it is not thus that the foundations of permanent States are laid.

Let us turn next to rubber, which offers some curious illustrations of a transitional condition.

Rubber was one of the substances which was made known to the Old World at the time of the discovery of America. Columbus heard of it on his second journey thither, and the Spaniards used it early in the sixteenth century to waterproof their cloaks. But it was a long time before it was used on a large scale in Europe, and the great demand for it is of so late an origin as the spread of bicycles and motor-cars.

Quite a number of plants yield a milky juice from which rubber can be obtained, but in South America the important ones are trees belonging to the spurge family, which grow in the hot damp forests that surround the Amazon and its tributaries. A map illustrating the regions where rubber is produced in Brazil would show the very curious way in which the producing regions cling round the rivers. This is not because the trees are confined to the neighbourhood of water, but because it is only near the river banks that the collectors of

the wild rubber can move about freely ; for in Brazil rubber is obtained entirely by "robber economy."

Let us note in detail how it is collected. The Amazon is a huge river system which allows of extensive navigation. The tributary streams, like the main river, run through dense tropical forest, and as the region is low, and the rainfall very heavy, the country is liable to flooding. Further, the density of the forest, the rapidity of plant growth, and the presence of many noxious insects and reptiles, make free movement impossible, except by water, even when the ground is not flooded.

Let us suppose, then, that we have acquired a rubber estate on one of the tributaries of the Amazon. We shall find that our territory extends some 50-75 miles up and down the river, forming a narrow band on both banks. Movement through the forest, as we have seen, is very difficult, so that the estate will most likely only extend some two or three miles back from the bank.

The first thing is to build the central office, and this must be placed upon the river bank about the middle of the estate. Here there must be machinery for turning the raw rubber into the cakes or moulds in which it is exported ; there must be a quay where river steamers can load and discharge, and there must further be a store where the collectors can obtain the necessities of life, including drugs to treat the fevers from which they are certain to suffer sooner or later in this unhealthy region.

Wherever the estate is situated, and it may be thousands of miles from the sea, the rubber has to be sent to Manaus, which is again in free communication with Para, from which most of the rubber is exported. From Manaus also labour must be imported and all stores.

Now let us follow the work of an individual collector. He must form a camp somewhere in the forest, taking with him his stores and a canoe. Round his camp as a basis he must wander, tapping the trees he finds, and collecting the milky juice in small vessels. As in all tropical forests, the trees are scattered, and have to be sought among many others. Each yields only a limited amount of milk, which is coagulated by the heat and smoke of a wood fire, so that it forms a hard mass. When a certain amount of rubber has been collected, the worker presents himself with it at the central office, where he



By the courtesy of]

["The Rubber Journal."]

A RUBBER TREE.

Cuts are made in the bark of the tree, and out of them flows the milky sap, which is collected in the cups shown beneath the cuts.

is paid according to its weight, less the amount of stores he has purchased.

But during many days fever will prevent him from working, and life here is not such that very steady or continuous labour is to be expected, so that the amount of rubber collected is likely to vary considerably from week to week. But there is no cultivated land anywhere near, no link with civilization except through the central office, and the workers are for the most part men very imperfectly adapted to life in the wilds. They make demands which the region cannot satisfy, and they must therefore fall back upon the resources of the official store, and this whether they have gathered much rubber or little. In other words, they fall into debt, and may receive for several weeks stores in excess of the amount of rubber collected. As the one avenue of escape is the river steamer, and this is blocked by the debt, they thus become virtually tied to the estate.

A few figures may help to explain what happens. A particular estate sold in one year rubber to the value of 200,000 dollars, and paid 60,000 dollars in wages. But of this outlay nearly 25,000 dollars were re-obtained in profits on the stores sold to workers, reducing the wages bill to 35,000 dollars. It is thus clear that not only has the supplying of stores the advantage, from the owners' point of view, of binding the workers' feet with a tremendous load of debt, but the monopoly enables the owners to charge prices which yield enormous profits. For the most part, also, the stores supplied are articles without which life here is impossible. The rubber industry here, then, is not in a condition which can be described as stable.

In many parts of tropical Africa matters are no better, and sometimes considerably worse. Here the rubber is obtained from lianes or creepers. When the various countries—*e.g.*, the Congo Free State—were first open to European commerce, the easily accessible plants were recklessly destroyed, negro fashion, in the desire to collect as much rubber as possible with the least expenditure of labour. This naturally led to a diminution of the supply, and as the demand in Europe was steadily rising, many cruelties were practised, with the object of forcing the negroes to increase their output. It is one of the curious tragedies of human life that the advent of the motor-car, which meant a new step in advance in man's eternal



C. H. Kerr & Co.]

TAPPING AND COLLECTING CULTIVATED RUBBER ON A CEYLON ESTATE.

[X.andy.

conflict with Nature, should be a factor in encouraging the shameless exploitation of certain races by others.

But this is not the whole story. It has become obvious that robber-economy is too precarious a means of obtaining a product upon which civilization is making such heavy and continuous demands. Rubber cultivation is now carried on in several parts of the world, notably in Ceylon, in the Malay region, and in tropical Africa. The plant seems to need very high temperatures, and the only successful experiments have been made in hot regions, such as those named. It is, perhaps, too soon to prophesy as to the ultimate fate of the rubber plantations, because we have to remember that chemists throughout the civilized world are striving continuously to find cheap artificial substitutes for rubber, and we do not know at what moment they may find what they seek; but the main fact that is of importance is that, so soon as the demand for a tropical substance becomes large and steady, the plant yielding it has to be cultivated, for no collection of wild products will long meet the demand.

We might go on to discuss in detail a number of other important tropical plants, such as quinine, cocoa, and the strange conflict between sugar cane and sugar-beet, but space only permits us to mention a few interesting points about these.

Quinine is obtained from the bark of trees which grow wild on the slopes of the Andes, especially in Peru ("Peruvian bark"). It is a very valuable drug, especially useful in cases of malarial fever, and was for long collected from the wild tree. As usual in such cases, the natives were subjected to much ill-treatment in order to force them to bring in supplies of the precious substance, and at one time there seemed a risk that the tree would be exterminated. It was then introduced into Java, and later by the British Government into India, where it has thrived, and it is now regularly cultivated in many tropical regions.

Cocoa is a product which, in its demands as to climate, somewhat resembles coffee, though it requires an even higher temperature and more shelter. It is an American plant, and the beans or seeds form an important part of the food of some of the natives of tropical countries there. But most of the product which finds its way into commerce is, like coffee, produced solely as an article of merchandise, and there is the same temptation to produce it by "forced" labour.

Sugar is a substance which offers many interesting peculiarities. It was late in reaching the Western world, but rapidly acquired a position of great importance. At first it was wholly a tropical product, and was especially imported by countries like Great Britain, which had much commerce with tropical regions. The fact that cane-sugar was very extensively grown in the British West Indies made Britain at one time the supplier of much of the Western world, till a determined effort was made to oust the tropical product through the development of the sugar-beet industry. This has been so far successful that, in Europe generally, beet-sugar, a temperate product, has replaced the tropical cane-sugar.

The reasons are manifold; one of them was certainly that the cane-sugar was at first grown by slave labour, an economic crime which, in the long run, brings a heavy punishment on those having recourse to it. Where the bad effects of slavery are passing away, cane-sugar can be grown as cheaply as beet-sugar, as has been proved in the United States; but it is a very curious fact that a temperate product, grown in regions where land and labour are alike dear, seems to be succeeding in pushing out a tropical product grown with cheap labour; though we must not forget that beet sugar was at first aided by the bounty system.

The object of this chapter, then, has been to suggest that those tropical regions which have not developed by their own initiative—and few have—mostly owe their development to the demand in civilized countries for products which they, and they alone, can supply. But in most cases such products are obtained by methods not in perfect harmony with the geographical conditions, and therefore not likely to be permanent. These methods range from a wasteful collection of wild produce by native races under the often harsh supervision of white peoples, through a careless and limited native cultivation, to scientific cultivation under the control of whites, by labour which is often imperfectly protected, and is mostly unable to protect itself. Obviously, then, we have not yet solved the problem of how the tropics are to be developed, and who is to do it. It is part of the interest of geography that it thus shows us where man's conquest is incomplete, as well as where he has won his great successes. It shows us also that we must not press the analogy of a conquest too far—for he mostly conquers by yielding.

CHAPTER IX

THE USEFUL MINERALS AND THE INDUSTRIAL REVOLUTION

Stone tools and the first use of minerals—The importance of iron—
✓Coal as a means of obtaining iron and energy—The contrast
between the coal towns and the older cities—The coal-fields of
Germany—Mineral oil—"White coal"—Effect of valuable minerals
in promoting settlement—The nitrate desert of Chile—Effects of
the industrial revolution.

WE have already seen that one of man's great peculiarities—
and one that has served him enormously in his struggle with
Nature—is his tendency to use tools and weapons. In the
very early stages he was content to pick up stones which might
serve his purpose. Later, he learnt to flake these roughly that
they might be more fit to accomplish his ends, and still later
again they were smoothed and polished, and doubtless became
precious heirlooms.

From early days a rigid selection was exercised as to suitable
stones. Where it could be obtained, flint was much prized
because of its hardness, and our museums contain many
examples of flint weapons shaped and polished by early man.
Where flint was not obtainable—as, for example, in the island
of Tasmania, where the natives used only stone weapons—the
hardest stone which the island yielded was carefully picked out.

But at best stones make poor weapons. To modify them
for man's ends is a tedious and thankless task, and while in
working with wood the aid of fire may be called in for various
purposes, this element does not render the ordinary pebble
more ductile or more malleable. When and where man first
learnt that certain kinds of stone when heated would yield
lumps of metal which had the stone's quality of hardness, and,
in addition, other even more useful qualities, we do not know.

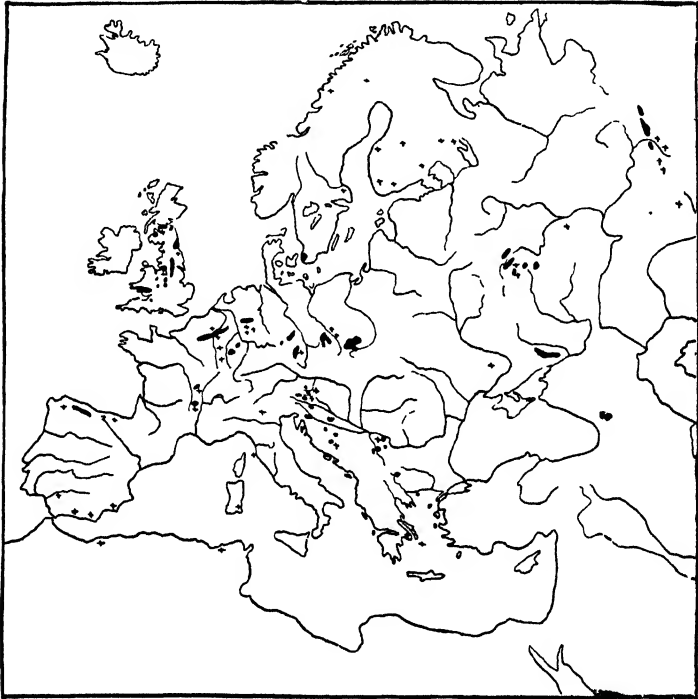
Probably the discovery was made in many places independently ; it is certain that, once made, it gave man great powers over Nature.

It seems likely that copper was the first metal of which man made much use. It occurs pure in a state of nature, and it is also easily deprived of impurities by fire. It has, however, the fatal defect of being very soft. Again, however, man's ingenuity found a means of getting over this difficulty, for he learnt that mixtures, or, as we say, alloys, could be made which would prove harder and more useful than the pure metal. Among the various alloying substances tried, the somewhat uncommon metal tin was experimented with, and found to produce a hard compound called bronze, which proved of great use in the making of tools and arms.

Bronze was used for a very long time, but man could never have conquered as he has done if he had not learnt, after long striving, to obtain that very intractable metal—iron—from its ores. Iron, on account of its hardness, its power of being tempered and welded, is to man by far the most useful of the minerals, though it is not much more than a hundred years since he learnt to use it fully.

In marked contrast to some other metals, such as tin, and even silver and gold, iron has a very wide distribution. The raw material is thus obtainable everywhere, and, except in the case of a few primitive peoples, iron tools and weapons are everywhere made and used. But the task of obtaining the pure metal from its ores is always difficult and costly, and when obtained the metal is short-lived, for it rapidly unites with oxygen, and so rusts away. It has to be obtained by the expenditure of much fuel, and the costliness of production therefore varies with the cost of fuel in the particular region. Now, until a period of little more than one hundred years ago, the only fuel obtainable on a large scale was wood. Coal was of course known to the Chinese from an early date, no less than to the Greeks and Romans ; but it was only used on a very limited scale till the time of the industrial revolution. Till that date, then, iron was a metal which was only available in relatively small amounts. When coal began to be worked on the large scale, and its use was followed, towards the close of last century, by the use of water-power to generate electricity, man became possessed of forces which enabled him

first to obtain large quantities of iron, and then to use it in the form of steel for purposes which had hitherto been largely served by wood or other less refractory substances. He began to build steel ships, steel bridges, instead of wooden



EUROPE : COAL AND IRON.

+ = Chief iron deposits. ■ = Chief coal-fields.

ones ; he laid steel rails along which his engines dragged heavy trains ; he constructed huge machines which multiplied enormously his power of doing work, and so on.

Thus coal and running water have given him power, and this power he can use, not only to do work directly, but also to

obtain iron, which increases greatly his capacity for doing work. This utilization of coal took place, as we know, at first on only a few parts of the earth's surface, especially in Western Europe and the Eastern United States. There was thus liberated an enormous amount of new energy, which enabled these regions to take a leap forward, and in their power of controlling Nature to outdistance all competitors. It is this new power which has produced the great disturbance in the old conditions which we saw when we compared a Highland village fifty or sixty years ago with a town of to-day. It is this also which has altered all our old estimates of values, and has made the conditions under which our great-grandparents lived wholly foreign to us.

The change took place so rapidly that all the old relations of life were disturbed. New towns sprang up everywhere, and everywhere attracted population from the rural districts, which are becoming more and more used as pleasure resorts rather than as places for work. Old interests were lost, and the new centred round the towns instead of round the old occupations. The latest and, in some respects, the most spectacular of man's victories over Nature has thus, in the regions where it occurred, destroyed all the old checks and balances, and has made its influence felt far over the confines of the civilized world. We who are so near to it perhaps overestimate its permanent importance, and forget, in the first flush of victory, that Nature has a way of revenging herself—that the conquest is never so great as it seems.

But its immediate effects have been great, and we can perhaps best realize them by considering the effects of coal-working on the large scale.

Let us consider, first, the uses to which coal is put. We may say that it has two great uses: it is used to generate heat, which is employed directly for various purposes; and it is used to generate steam, whose elastic force again may be used to perform work.

As already suggested, the most important use of coal as a heat-generator is in smelting iron and the other useful metals of which man has need. Compared with this its use as a domestic heat-producer is small, though we must remember that, throughout the length and breadth of Great Britain, coal is the fuel generally employed to warm our houses and cook

our food. Without it life would be very difficult in many parts of our cold and almost timberless country.

The heat of coal is employed directly in other ways also. In Great Britain we have a large glass and porcelain industry, and the large amount of fuel required in this industry is supplied by coal. In producing many chemicals also much fuel is needed, and this is furnished by coal.

As an agent in the production of steam it is even more important. By the aid of steam our ships cross and recross the seas. It drives our locomotives and all the ceaseless machines upon which our welfare as a nation depends. Even when electricity is the agent employed, the dynamos may be driven by steam-engines.

In addition, coal has various subsidiary uses. From it gas is obtained, still largely used in lighting our houses and in cooking. It gives rise to the aniline dyes so much used in manufactures, and also to ammonia, from which various artificial manures are obtained, and so on.

An important feature in regard to it is that it is relatively bulky, though far less so than peat. Thus, though it is easily carried in modern steamships, or even by canal boats, it is costly to transport it by land, even by rail. Industries in which it is extensively used, therefore, tend to cluster round the actual region of production. It is one of the great advantages which Great Britain has enjoyed that within its borders iron deposits lie close to the coal-beds, thus making it easy to smelt the iron.

Another great advantage which Great Britain possesses is the great number of natural ports, especially near the coal-fields, and the fact that the coal mostly lies near the sea, where it is easily exported. The great estuaries of the Humber, the Mersey, the Clyde, and the Forth, running up into the land close to the mines, have helped this country much in winning her present position.

As we have said, it is difficult for us to realize all that the industrial revolution has meant, and to how great an extent it has changed the distribution of the people, and the centre of gravity of the country. But it may help us to understand if we look at a map of England, and underline on it the old cathedral towns. Most of these, we shall find, occur in the southern half of the country. York and Durham are, of

course, exceptions, but they are exceptions which prove the rule. The old England, the England of history, lay to the south-east. Here the land is fertile, here the dry and sunny summers enable wheat to ripen, here crops like hops, hardly known elsewhere, flourish. Here then, in the old days, the great cathedrals rose, built as surely by the wheat of the fertile plains, and the wool of the Downs, as the splendid buildings of southern France were built by vine and mulberry, olive and fruit-tree. Now, most of those cathedral towns live upon their past, and wealth and industry cluster round the new towns on the coal-fields.

These new towns show some curious features which are worthy of note. We have already spoken briefly of the origin of cities in general, selecting some examples among the historic cities of Italy. These cities, which have been of slow growth, wherever they are situated, show a very remarkable power of preventing the growth of other large centres in their vicinity. They themselves develop slowly, in response to the needs of their neighbourhood, and they absorb all the active elements in that neighbourhood. There is usually some central point in the city where administration is carried on, and round this industry and commerce tend to cluster.

When such cities had already become great before the industrial revolution, they proved capable of drawing the coal to them, and of continuing their development despite their distance from the coal-fields. Examples are Paris, London, and Berlin, all industrial centres of importance, in spite of their distance from coal. All have shown the same power of preventing the growth of small towns in their neighbourhood, except on condition of absorption. The true city is thus a complex organism, showing the organism's power of growth at the expense of alien material, and the organism's tendency to war against possible competitors.

The new towns which owe their origin to coal illustrate very different relations. They do not show the true city's power of sterilizing the neighbourhood as a possible site for other towns. To change the metaphor, they have not its power of draining the wealth of the district into themselves. In Professor Bruhnes' picturesque analogy, they are like spots of oil, always tending to fuse together, but never forming an organic whole.

Look at any coal-field, whether one of the wealthier or one of the poorer ones. Note how its surface is dotted with towns, always tending to fuse together without forming a true unity. Paisley and Glasgow, according to the old joke, dispute continuously which is the suburb of the other, and many other towns on the same coal-field might indulge in a similar and equally fruitless discussion.

On the Northumberland and Durham coal-field, Gateshead and Newcastle, though in two different counties, form but one great city, or at least one group of dwellings. So it is with all the coal-fields—the spots of oil spread and fuse, and shift this way and that with changing conditions of trade.

The reason is obvious. Newcastle was once a bridge town, placed where first the river could be conveniently bridged, and where therefore land traffic converged. Placed also at the limit of the tides, or near it, it marked the point where goods and passengers had to change from boats to some form of conveyance over land. Its present importance is due to the fact that within a considerable radius around it coal-pits are worked. The coal is largely exported, but is also used in many minor manufactures, on both sides of the river. To all intents and purposes, then, the dwellings which cluster round the Tyne are merely groups of pit villages, or of settlements devoted to industries, and the centre of gravity shifts continually with the varying fortunes of coal-pits and of particular industries. Only the river, necessary to allow for the import of raw materials and for the export of manufactured goods or of coal, is a link between the diverse elements.

The Five Towns (now six) of the Staffordshire pottery district afford an even better example of the way coal-towns tend to cluster together, because the coal-seams to which they owe their origin occupy a considerable area, and thus no one place has very great advantages over the others.

A further examination of the map will show another point about the coal-towns, and that is the way in which they attract roads, railways, and all possible means of communication to themselves. Coal means, as we have seen, power to transport men and goods rapidly; it means also power to produce rapidly. Into the coal area, then, the labour of the surrounding country drains, and from it radiate in all directions lines of communication, by means of which it may get rid of its surplus products.

It is curious to note that while in England the development of coal has led to the growth of parts of the country which in earlier days had but little importance, in Germany, where the industrial revolution was a little later, coal was worked in the regions which had always been of historical importance. This has certainly been one of the factors in the rapid rise of that power.

Let us consider for a moment where the chief coal-fields of Germany lie, as being less familiar than the coal-fields of our own country. If we look at a map showing the relief of the surface, we may note that the northern part of that country forms a wide and flat plain, a continuation of the plains of Eastern Europe. This region is strewn with the débris left by the glacial period, its soil is often infertile, and marshes and heaths abound. To the south lies the mountain zone, but the junction between the two is one of gentle relief. Into the mountain zone there run three great bays of more level land, which have been of much importance throughout history. These form, from west to east, the bay or gulf of Cologne and Westphalia, which allows the Rhine to escape from the mountains to the sea. Next comes the gulf of Saxony, with the towns of Halle and Leipzig, which allows the Elbe and its tributaries to flow seawards. Finally, farther to the east, comes the gulf of Silesia, with the town of Breslau, allowing for the escape of the Oder. (See map, p. 120.)

All along the border-line between plains and mountains in these gulfs historic towns are situated, which have always been important centres of trade, lying as they do at the junction of two natural regions, and in one of considerable wealth. Around the margins of the gulfs fertile soils are found; the rivers give ample means of communication, and the mountains supply wood from their forests, pure water, and abundant minerals. In each of these three bays—in Westphalia, in Saxony, and in Silesia—coal occurs, and is now worked; but the fact that the regions where it was found had been regions of activity for a prolonged period, made the breach between the old and the new epoch much less sharp than in Great Britain.

Prior to the industrial revolution, advantage had been taken of a natural hollow which runs along the middle of the plain to connect the great—but originally separate—rivers by a system of navigable canals, which even before the development of

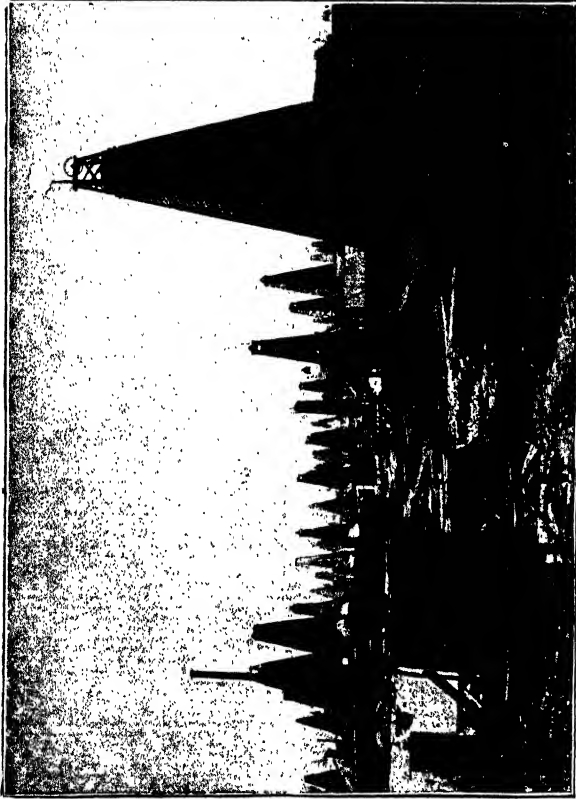
railways facilitated communication between the different parts of the country. Thus before railways were made, inter-communication between the rich towns of the junction zone and the ports became easy. Berlin owes its importance partly to its relation to this elaborate system of inland waterways.

It is to these favouring circumstances—the occurrence of coal near old-established centres, the facility of communication, the abundance of other minerals as well as of coal and iron—that Germany owes its rapid development and prosperity.

The line along which coal-beds occur in Germany is continued westwards through Belgium into England, and south-eastwards into Russia, where it may be said to end at the coal-fields of the Donetz. Throughout its extension the line is marked by the occurrence of great density of population, of wealth and of industries, the dense population here being produced at the expense of the rural districts outside the zone.

Important as coal is, it is by no means the only mineral fuel obtainable. Apart from deposits of lignite or brown coal, mostly of minor importance, we have a variety of inflammable substances, of which the most important is petroleum, a mineral oil which can be obtained by boring in many parts of the earth's surface. These mineral oils have the great advantage over coal that they are very easily transported, for, being fluid, they can be carried in pipes over distances of many miles to the regions where they are required. Petroleum can be used both as a heat-giver and as a light-giver, and the oil called petrol, obtained from it, is of great and increasing importance as a fuel for motor-carriages and aeroplanes. Indeed, the contrast between the railway-engine, with its tender of coal behind, and the motor-car, with its modest provision of tins of petrol, affords a good illustration of the value of the latter—without it the problem of the flying-machine would never have been solved.

Petroleum deposits were known to the ancients, but the working of them on a large scale is recent, much more so than coal-working. Of the two deposits first utilized, those of Pennsylvania and of the Trans-Caucasian region, the former only began to be exploited seriously in 1859, and the latter some years later. The district round Baku on the Caspian is especially rich, and used to supply the greater part of the



PETROLEUM WELLS AT BAKU.

To obtain the petroleum a hole is bored by machinery into the ground until it reaches the stratum in which the oil is found. Then an explosive is lowered to the bottom of the well and there discharged. The oil which is thus set free comes rushing up at first like a geyser ; but soon the flow diminishes, and the oil has to be pumped up artificially.

European market. In Pennsylvania not only is the oil exported for use as a fuel, an illuminant, and a lubricator, but it is also employed in the region instead of coal for various industrial purposes—*e.g.*, iron-smelting, glass-making, and so forth.

We have already alluded in a very general fashion to what the French call "white coal"—*i.e.*, water-power; but as the great importance of coal and petroleum is as producers of power, we may note here for the sake of completeness that, later than either, we have the use of streams in mountain regions as still another source of power. Great Britain, Germany, and to a less degree France, owe their recent development to their coal and iron fields. The United States owes its development to these, among other causes, as well as to its deposits of mineral oils and its natural gas. But Switzerland and the northern part of Italy, despite the absence of coal, have also undergone marked development, largely owing to the use of the water-power of their mountain valleys, which is readily converted into electricity.

One great advantage of electric power, which it shares with petroleum, is that it can be easily transmitted to a distance from its place of origin. It is interesting to note that electric power is also employed to smelt iron, suggesting once again that industrial progress may be largely measured by man's capacity to deal with this refractory metal.

In the chapters on cultivated plants we saw that such plants were in the first instance only grown on a large scale in three parts of the earth's surface, and that in each case they formed the basis of a stable and advanced civilization. With the industrial revolution and the working of coal and smelting of iron on a large scale in the northern parts of the Western hemisphere, this region took a sudden leap forward, for ~~now~~ for the first time it obtained abundant power. Proportionate to its development, then, the Mediterranean region and the Far East seemed to stand still or to go back. The Mediterranean region is greatly handicapped by the absence of coal and the paucity of iron deposits, even if the mountains on its margin give it the possibility of much electrical power. In the Far East coal is far from absent, but it has not yet been worked on a large scale. Japan is already opening out its mines, but China meantime lags behind, and the East as a whole thus seems

backward to a world which has substituted industry under the control of steam for agriculture as the occupation of most of its peoples.

In other parts of the world coal mines have not been greatly developed, but it is interesting to note the part which has been played by some of the less useful, in the strict sense, but more valuable because rarer metals.

In speaking of economic plants we saw that not a few regions of the earth's surface owed their development, partial though this often is, to the fact that they, and they alone, produced much prized plants. Central Africa and tropical America are valuable in the eyes of the civilized world largely because they produce rubber, together with some other useful substances. Now it is interesting to note that certain other regions of the surface, often very barren regions, owe their peopling and development to the occurrence there of important minerals. The most important of such minerals is undoubtedly gold. Gold first peopled Australia and California; it has drawn population to the Klondyke and neighbouring regions; together with silver it first drew men across the stormy Atlantic to the New World; it would even people the icy wastes of the Antarctic continent if we could imagine considerable deposits being found there.

In most of these cases, notably in California and in the more fertile parts of Australia, the region would have developed without the gold, but its presence, by attracting population, made the development more rapid and less chequered, for the minerals supported the population till other industries and occupations had time to establish themselves. The presence of considerable deposits of such minerals, then, is certainly a factor in enabling man to extend and to strengthen his hold over the surface of the globe.

The fact that valuable minerals may cause the establishment of human settlements in a region where no other human need whatever can be satisfied, is curiously illustrated by the conditions which obtain in the desert of Chile, in the region where nitrate of soda is found.

Here absolute drought reigns, for without such drought the very soluble deposit would be washed away. The ground on which the deposit of nitrate lies is at an elevation of 3,500 feet, and is an utter desert, with no water and no plant life. There

is no timber, no herbage for cattle, no wild animals, no food of any kind. In addition to the nitrate the region produces small quantities of iodine, borax, guano, and ores such as silver, gold, copper, iron, and manganese. But as everything necessary for life has to be conveyed to the workers, the deposits can only be worked by large companies with much capital, who have steamers of their own, and lines of rail leading from the ports to the regions where the nitrate is worked.

At one time these steamers, in addition to bringing all other necessities, brought drinking-water in tanks. Now the more important settlements obtain their water from the distant Andes, great lengths of pipes being sometimes necessary for this purpose. Thus the pipes which bring water to Iquique are 80 miles long, and those supplying Antofagasta 180 miles.

Some of the smaller settlements are more fortunately situated. Thus Central Lagunas need only bring its water from a distance of eighteen miles. It can get fruit from the oases of Pica and Matilla, and fish from the sea at Iquique, ninety miles by rail. Except for these supplies everything must be imported from a distance—food and clothing, building material, machinery, draught animals, labourers, and so forth.

All this is necessary in order that British farmers may be supplied with nitrate of soda for manure. Curiously enough, however, despite all the difficulties with which the industry has to contend, the barren nitrate grounds produce five-sixths of the revenue of Chile, which may thus be said to depend for its existence upon this mineral deposit. The central region of the country is agriculturally rich, and though the rainfall is low, yet irrigation is easy, owing to the many streams which come from the Andes. But this region, despite its natural advantages, is not well developed, and does little more than supply the necessary food and animals for the nitrate region. The country is thus practically dependent upon its monopoly of nitrate.

This example is a particularly striking one, but similar cases are not unknown, and they show that there are few parts of the world where there is nothing which man can turn to account, though his hold on regions with very limited products must necessarily be precarious.

Summing up, we may say that of all minerals the most useful

to man is the widely-distributed one called iron, and coal, mineral oils, electric power, and so on, are chiefly significant in that they increase man's power in dealing with this mineral. When, as at the time of the industrial revolution, the power of dealing with iron on a large scale comes suddenly, it brings with it a complete break up of the old conditions, and an enormous access of wealth to certain countries. With this wealth all the necessities of life can be bought, so that it seems as if all the old needs had gone for ever. In this country, for example, we are apt to assume that so long as we can produce cotton goods enough and machines enough, so long will the world be content to grow food for us, to produce the raw material necessary for our manufactures.

We have noted briefly the curious conditions which exist in the nitrate region of Chile, where the greater part of the wealth of the country is produced in an absolute desert; but strictly speaking, the fact that Chile depends upon its natural desert is scarcely more remarkable than the fact that we depend upon the artificial deserts which we have made round our coal-fields.

Reclus, in his famous geography, describes the curious town of Cerro de Pasco in Peru, which is one of the most elevated settlements in the world, for it stands at a height of 14,200 feet above sea-level. Though it lies only some ten degrees south of the equator, the climate is so severe that all the ordinary phenomena of life cease. No child is born in that city, though it has 14,000 inhabitants. The llamas, or native "sheep," will not bear young; even hens will not lay eggs, and pure-bred dogs cannot live. But here occur rich silver mines, and they attract a considerable population, which comes and goes, increases and diminishes, as the price of the metal and the fortunes of the mines fluctuate.

These are extraordinary conditions, but, save for the climate, are they not at least suggested in many mining districts in Great Britain? There are villages where one may scarcely see a green leaf. It is not, as in Pasco, that no child is born, but of those born, many die in early infancy, so unfavourable are the conditions. In regions where human settlements develop slowly and in harmony with the natural conditions, there is, as we have seen, always a natural fitness in the dwellings, built with the material at hand, beautiful in some sense at least,

because they have grown out of the experience of the ages. But the houses in the pit villages are all run up at once, and are constructed to satisfy the one condition of cheapness. Their end is not to serve as homes, but merely as places where the pitmen may sleep in their intervals of toil. In short, those villages show in every part the artificiality, the want of permanence, which every geographer has noted in the shanties put up round a newly-discovered deposit of gold. This is not to conquer Nature, this is to enslave her temporarily, and we can hardly doubt that sooner or later she will free herself from such chains, and take a bitter revenge for her period of captivity.

CHAPTER X

SOME COMMUNITIES OUTSIDE THE COAL ZONE

The Mountain of Limousin and the life of its inhabitants—The relation of the crops and domesticated animals to the natural conditions—Temporary emigration and its causes—'Land hunger'—Life in Lower Brittany.

IN the last chapter we spoke of the wide-spreading effects which have resulted from the working of coal on a large scale, and its use as a means of generating steam, and as fuel in the smelting of iron. We showed that these effects constitute what is known as the industrial revolution, which brought in its train an almost complete alteration of the old ways of life and the old methods of thought. But great as the alteration has been, especially in Great Britain, which was the first country to work its coal on the large scale, and the first to feel the effects of the change, it would give a false idea of present conditions if we were to assume that the old passion for agriculture, the old hunger for land, had gone for ever. If it were so, the end would be near, for without that sacred, primeval passion man's tenure of the earth would be brief. Neither his "white coal" nor his black will save him from extinction when the many cease to hear the call of Mother Earth. Let us, then, correct the impression left by the preceding chapter by considering one or two groups which have been little affected by the industrial revolution.

In France, perhaps because coal is less plentiful and less easily worked than in Great Britain and Germany, agriculture has kept its hold more firmly than elsewhere, and the rise of new towns, and the drift to the towns, have not been so marked as in the other two countries. The French geogra-

phers also are very fond of local studies, so that a good deal of detailed information about the life of particular regions of their country is available. We may consider in detail one of these regions, which presents many features of interest.

This is an upland district in the old province of the Limousin, in South-western France, a province which now forms the department of Corrèze and part of that of Haute Vienne. The particular region is called by its inhabitants, and by the people of the neighbouring, more fertile, regions, "The Mountain," as if no other mountain existed. It is an elevated region, the altitude being always above about 2,500 feet, and sometimes nearly 3,350 feet. Farther, the soil is poor and infertile, little adapted, one would suppose, to arouse patriotic emotions in the heart of the people.

Though the region is some six degrees south of London, and slightly south of the Italian lakes, the elevation and the exposure to the Atlantic winds make the climate severe. In winter snow often lies on the ground for months, and there are fearful storms, which prevent the growth of such trees as the sweet chestnut, which is very abundant on the low ground. Rain also is frequent, and feeds many springs and streams, and the poor shallow soil turns a large part of the region into those curious heaths which the French call "landes."

But, perhaps because of the poverty of the soil, and its fitness over considerable areas for nothing but pasturing sheep, the land is usually divided up into a multitude of small properties, and this insures the maximum utilization of the surface.

To the east of the Limousin Mountain extend the mountains of the Auvergne, also regions of pasturage. But here volcanic rocks have made the soil more fertile, and, though the Auvergne hills are higher, they are richer, grow fine grass instead of heather, and feed cattle instead of the thrifty sheep. From their barren hill slopes the inhabitants of the Limousin Mountain cast many an envious glance at this better endowed region. Envious glances are cast also at the low ground, especially at the sunny plains round Brive, where wheat, maize, fruits, and early vegetables replace the poor crops of the uplands.

The contrast between mountain and plain is expressed here, as elsewhere, by the arrangements of the towns. Round the

margin of the uplands these towns and villages cluster, for here the products of the mountain and the plain are interchanged.

Passing now to details, we must note that the rocks of the mountain are very ancient, and have been exposed to the action of wind and weather through long ages. No sharp peaks or needles here, as in the Alps, break the monotony of the relief. No moraines show the paths of old glaciers. Everywhere are smoothed and rounded contours, indications of the effect of an age-long wearing down of the land. Everywhere the slopes are gradual, so that no water-power increases the resources of the region. With the wearing down of the surface the force of the streams has diminished, and many of these wander through marshes and bogs. No recent ice, as in Scotland, has swept away the products of decomposition, and these tend to accumulate in thick masses in regions of gentle slope, but the resultant soil is poor and sandy.

The nature of the relief enables us to divide the land under three headings. On the rounded summits and over the slopes only the coarser parts of the disintegrated rocks remain, the finer and more clay-like particles having been carried away by the action of water. The soil here, then, is coarse and gravelly, dry and burnt up in summer, damp in winter in regions where the impermeable rock lies close beneath it. Over this kind of land heather and various bushes grow, and here for the most part man only finds pasturage for his sheep. Where, by infinite care, he has converted such regions into arable land, the soil is shallow, and will not grow root crops, nor peas nor beans; but if the season be not too dry, rye and buckwheat may thrive.

The finer particles of soil have been washed down the slopes and accumulate in the hollows, where they form richer soils. These are the good lands, devoted to crops, and very precious, because uncommon.

Unfortunately, however, the valleys in which this kind of soil accumulates have only slight slopes, and often the natural drainage is bad, and the fertile land is invaded by marsh vegetation, turning the valley floor into a poor pasture. Such regions require draining and dressings of chalk to be of any use, and chalk is hard to get. Thus the useful lands lie between the barren heights and the damp valley floors, and

the villages resemble oases in the surrounding desert of heath plants.

The length of the winter diminishes the time which can be given to agricultural pursuits, and sometimes for months at a time the snow makes communication difficult or impossible. Wheeled vehicles can then no longer be used, and sledges or riding horses have to be substituted. But this winter isolation has existed for long ages, and the villagers have learnt to find resources among themselves when outside communication is cut off. As in the Highlands of Scotland in the old days, the winter evenings are devoted to village reunions, often held in the barns where the sheep are folded, for the warmth of their bodies does away with the need for a stove. Here, by the light of a paraffin-lamp, or even by the smoky flame of a wick immersed in tallow, the illumination of an earlier age, the company meets; the women with distaff or spindle, in order that they may spin wool or hemp, the men with straw plait, from which they make baskets, beehives, and so forth. The old women, the natural depositaries of tradition, tell tales of old days, and so the long evening passes.

In summer the field-work has to be got through in the shortest space of time possible. Rye, the most important cereal, must be sown by the end of August or the beginning of September, for the plants must be strong before the winter comes. In some districts the rye harvest does not take place till the beginning of August, so that the plant may be eleven months in the ground. As the springs are cold, potatoes are not planted till April, and oats are not sown till later still. Because the warm season is so short, a good exposure counts for much, and the fields so far as possible face south or south-east, the northern exposures being reserved for pastures or pine-woods.

On account of the climate and the relief, communication with other parts of France used to be difficult. For centuries no main road traversed the region, for the great routes swept north or south of the Mountain, to avoid its elevation and its winter snows. Not till 1786 was the first main road constructed through the district, and not till 1883 did a railway reach it. Now it is crossed by two lines of rail, which permit of the cheap introduction of the necessary manures, etc., and allow the products of the region to be readily carried away.

The crops of the Mountain are interesting, for they are those typical of poor lands in most parts of Western Europe. Wheat will not grow, and as the bread-producing plant, it is here, as in the Alps, replaced by rye. Rye over much of Europe preceded wheat, and it still lingers in the poorer regions, and in those whose soil or climate renders them unsuitable for wheat. For example, in Russia the peasants make their bread, for the most part, of rye ("black bread"), and the more valuable wheat is reserved for export. In many parts of Germany, also, rye remains an important cereal, because the manufacturing industries do not yet permit, as in Great Britain, the whole community to buy wheaten bread, and in both cases wheat is not the natural cereal of the country. In France, with a sunnier climate and more fertile soil, the use of wheat is much more widely spread, and rye is the cereal of the poorer regions only. In the Mountain, then, about half the arable land is, year by year, devoted to rye.

Next comes buckwheat, not a cereal at all, but a species of knot-grass. This is another crop of poor lands, though it is scarcely known in Great Britain. Like rye, it demands but little care, and, like it also, makes small demands on the soil, a poor sandy medium being quite suitable. In the Mountain it is largely used to feed pigs, but also furnishes a kind of pancake, which enters largely into the peasants' diet. The two other important crops are potatoes and oats, both also suitable for poor sandy soils, and both tolerant of much moisture and little sun. The oats are specially used for the farm animals, the potatoes for both man and beast.

Practically no crops are sold, and the growth of turnips and similar crops for the sole use of the animals is foreign to the peasants' habits.

As in Ireland, the pig is a very important farm animal, but here, at least till very recently, each family only reared one animal per annum, and this for domestic use exclusively. Now the more enterprising are beginning to raise pigs for market, and to use for fattening purposes the locally-produced grains, including rye and oats. But this is an innovation; formerly these fundamental cereals were too precious as human food to be squandered on animals.

As the isolation of the region made it for long impossible to obtain fertilizers, the methods of cultivation are exceedingly

primitive, and recall those practised from time immemorial in India and elsewhere. To reclaim new lands for the plough the peasants gather from its surface the heather bushes and turves which cover it. These are collected into heaps and burnt, the ashes being ploughed in. From such land two successive annual crops are taken ; then it is allowed to revert to pasture, and is not again ploughed for many years.

The burning of plant rubbish and the digging in of the ashes is of course still practised by every gardener, who fires his weed heap in the autumn as part of the regular routine. But the peasant of the Mountain does more than this, and it is rather interesting to note that, quite recently, a scientific justification of his practice has been discovered. In brief, his method means, or meant, that heat is applied to a considerable part of the surface of the land. Now it has been shown that the soil, to a very much greater extent than was supposed formerly, is the seat of organic changes, of a conflict between various kinds of organisms ; on the one hand there are the minute bacteria, which play a large part in rendering the soil a fit habitation for the roots of the higher plants. On the other hand there are organisms, higher in the scale of existence, which prey upon the bacteria, and so check their beneficent activity. It has been shown that by heating the soil, or by poisoning it with certain kinds of drugs, these more complex organisms can be in large part destroyed. The bacteria, though their activity is temporarily checked, speedily revive, and, saved for some time from the attacks of their enemies, continue their useful work, and give, temporarily, great fertility to the soil. The peasant's weed-burning, then, though it seemed primitive and outlandish to an earlier generation of farmers whose animals give them abundant supplies of manure, has a real justification from the scientific standpoint.

Other means of adding fertility to the lands were, till the development of roads and railways, hard to get. Heather and ferns were collected on the moors and used as litter for the farm beasts, and were even spread in the streets that they might be trodden under foot, and thus nothing wasted.

The land is fortunately easily worked, so that no elaborate machinery is necessary. A simple form of plough is used, drawn by two oxen, and even to the present day mechanical

threshing machines are rare. As in the Alps, the grain is threshed out with a flail during the long winter. In some places even the threshing is only carried on as the stock of flour diminishes, and the threshed grain is taken to a common mill, where it is ground by the owner. As he departs with his flour, he merely turns the key in the door and leaves it there for the next comer.

But the grain fields only serve to make the mountaineers independent of outside aid; the real wealth of the Mountain lies in its flocks. To keep these alive through the winter, hay-elds are necessary, and these are the most precious possession of the peasant, to whom his meadows are worth twice as much as the ploughed land. One reason why the soil is poor is that the numerous springs which issue from the granitic rocks contain much dissolved food, which is thus carried away from the land. These are captured as they issue forth, and are carefully led to the meadows. From March to May the fertilizing streams must be thus carried to the fields, and in them the grasses spring rich and thick. If the natural water tends to stagnate, the fields must be drained. Every spring, all the manure that can be spared must be spread out, the irrigation channels repaired, and everything done that can be done to insure a free growth of grass.

In summer the moors produce sufficient pasturage for a considerable number of animals, far more than the hay of the meadows will carry through the winter. The mountaineer then must either sell some of his young stock towards autumn, in order that there may be enough hay for the remainder, or, if his total stock be small, he may buy in young animals in the spring, which feed upon the natural pasturage all the summer, and are sold as autumn brings scarcity.

Cattle are few in number, but are of importance mainly because the ox is the only draught animal employed. The region will not support the natural increase of the herds, and therefore the calves must be got rid of. The males are kept as long as possible, and are then sold to the low ground, where they are used for drawing ploughs and carts. The others are mostly sacrificed at a very early age, for veal is the chief butcher's meat obtainable throughout the whole region. This is doubtless because the female calves are less valuable as draught animals than the males, and therefore it is more

economical to sacrifice them early than to use the precious fodder in keeping them alive through the winter.

The real domestic animal of the Mountain is the sheep. So much is this the case that the people of the low ground say that the Mountain folk live on sheep. In summer the sheep find food enough on the moors. In winter they are allowed out to browse upon the bushes whenever the snow is not too deep, and at other times are fed upon the stored hay. A certain proportion are fattened for the Paris and other markets, where, like Welsh mutton in our own country, the flesh is prized for its fine flavour. Others are sold in October, to be fattened on the low grounds, and still others only pass the summer six months on the uplands.

One other method of utilizing the moors is now being added to the sheep. This is the planting of the pine, which has proved so useful a plant in the swampy, low-lying region near the Bay of Biscay. Natural trees are few in the Mountain, for the winds are too strong for oak and beech, so common lower down. But the pine does well on the poor soil, and is very tolerant of wind. It has been planted to a considerable extent in the last fifty years, and already the forests are bringing in profit. More and more common lands are being broken up in order that each individual proprietor may form his own woods.

The population of the region is not dense ; it could scarcely be so in this barren region, but the figure is still respectable when compared with that of many Highland counties in Scotland. Some ninety persons dwell on every square mile of land. But even this number could not be maintained without some outside aid. This is obtained by temporary emigration on the part of the men, especially the young men, who then return home with their gains.

At one time, throughout the province of Limousin generally, the men used to migrate in this way in search of work, but now the practice is diminishing, and is confined to the highest and poorest regions. A document dating from the end of the seventeenth century describes these migrations in the following terms : "As the lands here are infertile, almost all the inhabitants who are able to work leave their homes in the month of March and go into Spain and to all the provinces of the kingdom, some as labourers and masons, others as sawyers, leaving

to their wives and to the infirm the task of gathering in their meagre harvests and maintaining the children. Towards the end of November they return with all the money they have amassed. It is stated that nearly 6,000 men go off every year."

From the low grounds this periodic migration has practically ceased, but it still lingers on the Mountain. Here the temporary migrants fall into two classes. The one group includes navvies and builders' labourers, this being part of an old tradition. Another group, of more recent origin, includes coachmen and motor-car drivers, these having replaced the sawyers of old days. A third type is curious, for it includes wine-merchants, though no vines occur on the Mountain.

As already stated, the region has furnished labourers for a prolonged period, especially to the building trade. Spain no longer attracts many of these, for they prefer the great cities of France. The numerous public works which were carried on in Paris at the time when Baron Haussmann was making his improvements, created a tradition which leads many still to seek that city. Of these a considerable number return when the first frosts of winter diminish the demand for their labour; others manage to find work even in the slack season, and return with a larger nest-egg.

In the old days they were engaged by contractors before they left home, and went off to their work in bands, travelling on foot. Now they travel by rail, and are engaged upon the spot. Their countrymen call them "white swallows," for, like the swallows, they go north in spring, and return south with the autumn.

Another group of emigrants for a long time used to leave their homes at the first frosts to act as wood-sawyers in the Pyrenees, the Jura, and the Cantal. The work lasted them till the early summer of the following year, when they returned in time for the hay harvest at home. But machine-driven saws have largely done away with the need for this labour, and, curiously enough, the regions which formerly supplied it now send many cab-drivers and motor-drivers to Paris. These also work in town during winter, and when the wealthier Parisians begin to disperse to the seaside and the mountains, the cabmen return home for the summer work on the farm.

The third group, that of the wine-merchants, is even more curious. Wine is no doubt highly prized among the Mountain

folk, who cannot produce it themselves, and many of them have acquired the power of so far communicating their own enthusiasm to others that they have created a market for the wines of the Limousin even among the beer-drinking peoples of Belgium, Holland and the far north of France. Twice a year some hundreds of these wandering merchants depart from their country, and they have brought back with them traditions of comfort, and even luxury, foreign to earlier generations.

But this annual loss, for a longer or shorter period, of the best and most energetic of its labourers is not without its effects upon the economy of the Mountain. During the busy summer season labour is scarce, and the larger proprietors are obliged to import harvesters from the low ground, who, owing to the colder climate in the uplands, have time to reap the harvests below, and then travel slowly upwards, assisting to gather in the rye as it ripens at the different elevations. In the small properties the greater part of the farm work must be carried on by the women.

Another very marked, though indirect, effect is produced by the habit of emigration. As the world outside the Mountain represents a great sea, in which each youth must capture what he can to bring back to his home, interest in this outer world is widespread. As in Scotland, the passion for knowledge as a weapon in the struggle for existence is a dominant one. Nowhere else in the province is the school attendance better. Starting on their travels with their curiosity awakened and their powers of observation developed, the wanderers get more than gold from their journeying. On their return they can thus suggest new methods, new means of winning a livelihood from the barren soil. For in all his travels the mountaineer has but one ambition—to return with money in his pocket and to buy land with it, to create a tiny estate, or to add to the existing one. Emigration takes place especially from regions where the estates are large, and the small holding is thus excluded. It takes place also in order to avoid the division of the paternal estate. This division is less common here than in other parts of France, the eldest son often receiving the whole or the greater part of the family land. But he must pay off the claims of his brothers and sisters, and he goes out to seek in Paris or elsewhere the means of doing this.

So keen is the hunger for land that many competitors

instantly make their appearance if a small area, worth a few hundred pounds, is put on the market. Larger estates, partly from the difficulty of obtaining hired labour, are more difficult to dispose of, and are often bought up by speculators, who subsequently divide them up. Thus, despite its barrenness, the land fetches a high price, and it is noted that when the labourers of Paris strike for higher wages, it is often the hunger for land in the Limousin Mountain that is the impelling motive at the back of their action.

The net result is that more and more the land is passing from the hands of large proprietors to those of small ones, and more and more the common lands, necessary in the pastoral days, are being broken up among the proprietors, who feel that they can do more with them as individuals than as members of a group of commoners.

This breaking up of the common pasture-lands has some curious effects, which help us to understand some general points about pastoral industries. The pastures, it will be remembered, are relatively poor. Where an individual has no great floating capital, then the number of animals which he can send to the common pastures in summer must depend upon the amount of hay his cherished meadows will produce, or the sown fodder his arable lands yield. The larger proprietors, other things being equal, will have more sheep and cattle, and therefore gain more from the common lands. The difficulty of labour makes them less keen to reclaim any of those poor pastures for the plough than are the smaller proprietors who themselves supply the necessary labour. As, however, the smaller proprietors have equal rights over the common lands, and are more numerous than the larger, their desire to divide up the commons has prevailed, to a large extent, over that of the others to retain them as pastures. Once accomplished, this division increases the difficulties of the larger proprietors, who are often willing to sell their land rather than to try to develop it. From their estates, then, as the author of the article quoted from says picturesquely, the peasants tear fragments at the price of gold—gold which they have themselves wrested, by one mode or another, from the hands of townfolk.

Thus the region is becoming to an increasing extent one of small properties, consisting of some twelve to seventy-five acres, made up of arable land, meadow, and pastures. The pro-

prietor and his family work the land, and there are practically no lands without their accompanying farm-buildings.

When we look at the map of modern Europe then, and note the multiplication of towns on the coal-fields; when we note also on a population map how the rural folk are being drawn into the towns, being drawn away from the old ways, and the old joy in Mother Earth, we must not forget that this is not quite the whole story; that here and there, in many forms, and in connection with many different groups of people, we see the old passion burning, the old willingness to toil continuously even over barren land, and to find reward enough in the bounty of Nature.

Coal-mining is, after all, at base but another form of "robber economy." Its sudden development, like the sudden development of many other variants of the short method of forcing Nature instead of wooing her, has intoxicated whole communities, who are tearing the precious mineral from the ground as the negroes in the earlier days of the rubber boom tore down the creepers to get the much-prized sap within. But, fortunately for mankind, in these and all similar cases there are always individuals or groups whose heads are too steady to be turned by the new wine, whose tastes are too fastidious, or, perhaps, too undeveloped, to drink of it to excess. In the wildest moments of the gold fever in California, we are told, individuals were to be found who preferred, even on the gold-fields, the older and more familiar methods of earning a living to the risks and excitements of digging. It is well for us, still in the middle of the coal fever, to realize that such kinds of people also exist even in Western Europe.

We may add here a few words about another group in France, also scarcely touched by the effects of coal, also still bound closely to the land.

The peninsula of Lower Brittany is another of those relatively infertile regions which lie intermingled with the golden wheatfields of France, and it is alike remarkable for its dense population and its natural poverty. As in the Mountain of the Limousin, and as in the Highlands of Scotland, the rocks are of ancient types, and decompose to form a poor soil, deficient in lime. But the coastal belt, like parts of the Highlands, has the advantage of being washed by a sea rich in fish, and this fish adds greatly to the resources of the people.

Further, the climate is relatively mild, as it is also in some parts of the Highlands, though the fact that Brittany is much farther south makes the region warmer. Also, the shore is fringed with abundant seaweed which, as manure, adds to the soil especially those ingredients in which it is naturally lacking. The mild climate and the seaweed enable the people to grow many early vegetables, and the proximity of the English market is important for this industry. A proportion of these vegetables are sold direct, without the intervention of a middleman, by means of the wandering peasants who carry, *e.g.*, their onions in person over a considerable part of England and even Scotland. This trade, primitive though it seems, is well organized and prosperous, and each wandering merchant may bring back with him at the end of his five or six months' campaign so much as £24 to his household.

The people who live inland from the coast are less prosperous. The climate is here more severe, the soil is poorer, and the difficulties of communication and the perishable nature of the seaweed make it difficult to carry this valuable manure to the fields. But, as in the Limousin, the bond between the peasants and their native land is strong, and they show themselves very unwilling to emigrate permanently. As in the Mountain, temporary emigration is resorted to, the adult males going forth to seek labour, especially agricultural labour, in the more prosperous regions, and returning with a sum large enough to enable the family to tide through the winter, the time of scarcity. The point here is simply that the love of the land is strong, even among those to whom it gives but little, and this love is fundamentally Western Europe's only protection against an entire dependence upon her coal, a dependence which would be short-sighted and dangerous.

CHAPTER XI

THE HARVEST OF THE SEA

Prolongation of the collecting stage in the case of fisheries—Reasons for this—Natural regions of the ocean—Conditions of life in the littoral zone—Reason for limitation of important fisheries to north temperate zone—Characteristics of fisher-folk—The important fisheries of the world—Whale and seal fisheries.

WE have spoken in successive chapters of the various resources which man finds on the earth, and in the earth, and have shown how he strives to utilize all, and in what measure he has succeeded. But we have still to speak of the harvest of the sea, which offers in some respects peculiar features.

We have shown, both in the general chapter on the collecting stage, and more in detail with regard to particular substances—*e.g.*, rubber—that so far as plants or animals found on land are concerned, no natural reproduction will keep pace with man's destructiveness. The bison lived, a very short time ago, literally in myriads on the American prairies, but in a few short years man's insane lust for slaughter drove it as a wild animal for ever off the face of the earth. Africa, but a few years ago, swarmed with many kinds of great herbivores; many of these are already verging on extinction, and others will soon follow. If man had not early learnt to domesticate certain kinds of hoofed animals, it would have gone hard with him later.

So it is also with plants. Not all the luxuriance of tropical Nature will enable a valuable plant to keep its hold if once man begins his career of destruction. Everywhere careful cultivation must be practised if the useful plant is not to disappear for ever.

But with some, at least, of the inhabitants of the ocean matters are different, and that for an obvious reason. Senseless

though man's destruction of wild plants and animals often seems, sense and logic are at the back of it. The surface of the land must be his if he is to prosper. A certain part of it must be artificially sterilized to allow room for his houses, his roads, his factories, and so forth. Another part is necessarily sterilized as he begins to exploit the minerals of the soil. Still other wide areas are wanted for his cultivated plants or for pastures for his animals. Necessarily, then, many wild animals and plants must disappear as he advances.

Once again, all wild animals ultimately depend upon the earth's covering of plants as food, and man must also everywhere to a large extent depend directly upon the plant world. The bison must go, then, for the prairies over which it roamed are wanted for wheat-growing, the drier plains for cattle-raising. The net result is that everywhere all variants of the collecting stage and of "robber economy" on land must have a very limited duration in time.

It is otherwise with the sea. Man does not make any great demands on the plant life of the sea. Here and there he eats various kinds of seaweed, or he burns it to get iodine, or he collects it as manure for his fields; but on the whole it is of no great use to him. Now ultimately every living animal in the sea depends upon marine plants, and the fact that man does not seriously contest their monopoly of this food supply, as he does in the case of land animals and their pastures, has meant that the collecting stage in regard to marine animals has lasted much longer than in the case of land ones.

It is true that now many governments are beginning to study fishery questions scientifically, and are endeavouring to breed fish on a considerable scale; but as yet these efforts are small when contrasted with the size of the fisheries, and hardly affect the fact that many stable communities are still on the Tasmanian level in regard to one great part of their food supply.

Further, the reasons already given make fish a very cheap source of food. When we eat beef or mutton, we know that the animal from which the meat came was fed on grass, probably mingled with some other food. Now, the grass meant that an area of land, capable of bearing crops for man's use, had to be set aside for another purpose. The turnips which were given

to the animals meant even more. In this case not only was land used, but human labour, fertilizers, and so forth had to be employed, and all this must be paid for in the price of the meat. But the humble herring grew plump and oily, not only without man's aid, but without robbing him of an inch of land or a fragment of possible food. The major part of the cost of the herring then lies in the catching.

It would be cheaper even than it is, if it were not that, like fish in general, it keeps very badly, perhaps because the arrangements for draining away waste products from the muscles are much less perfect than in warm-blooded animals like sheep and cattle. Some of the cost of fish, then, lies in the fact that there is a certain amount of waste in getting it to market, and, except where some method of preservation is adopted, the market must be a near one. Even with these drawbacks, fish, in the fishmonger's rather than the zoologist's sense, is a very important article of food in many parts of the world.

Before we can understand the limitation of food-fishes to certain parts of the ocean, we must consider more in detail how they in their turn feed.

Zoologists regard the ocean as being divided into three natural regions: (1) The shore or littoral zone, (2) the pelagic, and (3) the abyssal. In the first region light is present, and there is also a substratum. This region covers the Continental Shelf, that area which projects outward from the margin of continents. Beyond the edge of this shelf the ocean bed steepens more or less suddenly down to the great abysses, while over it the water does not exceed 100 fathoms or 600 feet in depth. In this littoral region, but chiefly in the shallow water near shore, seaweeds grow fixed to rocks on the bottom. Here also the waste of the land is spread out, much of it being capable of supporting the lower forms of life.

The pelagic region includes the layers of water which lie over the great abysses, and pelagic plants and animals are those which differ alike from littoral and abyssal forms in their indifference to the presence of a solid substratum. No fixed seaweeds can grow here as in the shore waters; no stalked sea-lilies and sponges as in the great ocean depths. Like the shore animals, however, the pelagic ones find more or less light a necessity.

The great depths, cold and plantless, do not seem to contain



NORWEGIAN COD FISHERMEN.

The huge cod seen here are caught especially near the Lofoten Islands, off the north-west coast of Norway. An ordinary day's catch is 500 cod, and sometimes nearly double that number are taken.

many animals. Here no light penetrates, but a solid substratum is present as on the shore.

Now, of these regions it is the littoral which contains most fish, and therefore, other things being equal, the best fishing-grounds will be found where the Continental Shelf is widest. It stretches, for example, right across the North Sea, and here fishing-grounds are abundant; it stretches round Newfoundland, especially to the south, where the famous Banks lie. The reason for this abundance of fish in shallow waters is that here food is most abundant. In the great abysses no plants occur, and therefore life must necessarily be scarce. But even if it were plentiful, the mechanical difficulties would make this region useless to man. The reason why fish are relatively less abundant in the open water over the great depths than where the bottom is within relatively easy reach demands a little more thought.

We may more easily reach the solution by thinking of the line-fisherman and his bait. Where does he seek for this? We know that he digs in the sand, the muddy sand near river mouths, for worms, and he also hunts the shore-rocks for mussels and limpets and similar shell-fish. Often he even lays down bait on parts of the shore-rocks so that it may be accessible at his need. Now he would not use these animals as bait unless they were prized as food by the fish, and they cannot live unless there is sand or rocks—some firm surface—on or in which they live. They are especially abundant near the mouths of streams—that is, near the points where the waste of the land is brought to the sea. One reason, then, why fish are most abundant in relatively shallow water is that there they can feed upon the bottom-living animals, necessarily absent in the open ocean, far from land.

Once again, near the shore in shallow water grow many seaweeds, which must fix themselves to the bottom, and must also live in shallow water where they can get the light of the sun. These feed many scores of kinds of small animals, which in their turn feed fish. When the tide ebbs, these shore-feeding fish go seawards; as it flows, they come landwards and find abundant food in the worms, the little shell-fish, the small shrimps, etc., which clamber over the great tangles. On a still summer evening, if we watch the visitors to seaside places going out fishing, we note how they row to stations

off the rocks, for there, they well know, the fish will be clustering.

But even this is not the whole story. The shore water receives abundant light; it is also loaded with plant food derived from the land—the precious manure which the farmer spreads on his fields is to a considerable extent leached out by the rain and carried seawards to feed the sea-plants; the drains and sewers of a great city carry much plant food also to the sea.

The shore waters then swarm with tiny plants, floating invisibly in the water, but feeding other animals, which in their turn feed the fish. Such minute plants, together with minute animals, are especially abundant in shallow water, more so than in the open sea, and they also help to account for the abundance of shore-fish.

But we must not suppose that free-swimming and powerful animals like many fish, are rigorously confined to one particular region. Many perform vast migrations, and it is while they are performing these migrations that such forms as herring, pilchards, sardines, and so forth are caught. One curious little fact which throws some light on these migrations has been discovered recently, and helps us to understand something of the way in which fish feed.

Small floating plants occur in the shore-waters as well as in the open, though generally speaking there is a difference between the two kinds. But the shore-waters are swept by tides and currents, and these minute plants are not fixed. Why are the shore-forms not swept seawards? Apparently they are so swept, though many find the conditions of life, as to food, temperature, amount of salt in the water, and so on, very different in the open, and can only survive a limited time there. All are more or less sensitive to sudden changes in the temperature and density of sea-water, and it is found that one of the effects of ocean currents is to cause stratification in the sea-water, an upper, warmer, lighter layer sometimes floating on a colder, saltier layer. Between the two a layer of high density is found, which forms as it were a false bottom. Shore-plants are swept seawards by currents, and find themselves in a layer of water differing in several respects from that in which they have been living. They sink down through it because of its lightness, and come, sooner or later, to a layer

too dense for them to sink through. Here, therefore, they rest, as a mussel dropped from a boat in shallow water would come to rest on the bottom. Here, therefore, perhaps far out in the ocean, there is a layer which has the shore characteristic of allowing an accumulation of food. Along this line, this false shoreline, the fish swim out, finding here as abundant a supply of food as occurs near the true shore. Thus the littoral conditions are continued seawards.

Apart from such exceptional conditions, however, fish are generally abundant only in shallow water, and the best fishing-grounds occur in shallow seas in temperate latitudes off submarine banks where land waste is accumulating, and bringing with it food for plants and so for fish—the Dogger Bank and the Newfoundland Banks are good examples.

The next point is that valuable fisheries depend much more upon the individual abundance of a few kinds of fish than upon the multiplicity of kinds. The careful study of the habits of fish which has been made recently by Fishery Commissions has shown that each kind of fish, at all stages of life, has its particular habitat. Each kind is very sensitive to the amount of salt in the water, to the temperature, the density, and so on, perhaps less on account of the direct effect of these than on account of their influence on the simpler organisms serving as food. Now, obviously, if each kind of fish has its own particular region, it will be much easier to catch one kind of fish in large numbers—if it occurs in large numbers—than it would be to catch an equal number of many different kinds, for in the latter case the fisherman would have to be continually altering his methods to harmonize with the differences in the fishes' mode of life.

But in connection with useful plants we have already suggested a reason why numbers of individuals tend to occur in temperate or cold climates, and numbers of species in tropical climates. In the rain forest of the Amazon, the physical conditions are very favourable to plant life. Almost any species of plant introduced there would find food, water, and heat enough for continual existence, and in the forest very many different kinds of plants exist. Contrast with this the conditions on a moor in Scotland. Here there is little sun, much wind, heavy rainfall, and a sour, infertile soil. Few kinds of plants can tolerate these conditions, and therefore the

heather has it almost all its own way over acres and acres. So it is with animals. The place in Nature which, in a favourable environment, is filled with many species, in unfavourable ones is occupied by many individuals of a single species or of few. Of course, in the case of plants, we must not say that all tropical climates are favourable, and all temperate ones relatively unfavourable. A tropical desert is very unfavourable to all life, and may, as in the case of that of Chile, be quite barren. But this is because one necessary condition of life—water—is absent.

In the case of fish, the warmth of tropical waters seems to favour the multiplicity of species, and round coral reefs we find many kinds of brightly-coloured fish. But many of these are poisonous or inedible, and food-fishes do not occur in the numbers in which we find them in colder climates.

It seems probable, also, that for those fish that can tolerate cold water, life in cold seas is somewhat easier than in warm, because food is somewhat more abundant than it is for tropical fish. In cold waters the minute plants called diatoms are very abundant, and they seem to afford very nutritious food to many fish.

What is at least certain is that no tropical fisheries, even when we add such accessories as pearls and pearl shell, have nearly the same importance as temperate ones.

A second point of interest is that the most important fishing grounds of the globe occur in the northern, as contrasted with the southern, hemisphere. For this there seems to be more than one reason. In the first place, the way the land masses taper off in the southern hemisphere prevents the development there of great areas of shallow water off continents, or near them, and deep ocean in the south covers many of the areas which, in the north, form rich fishing-grounds. Again, northern seas are notably richer than southern in the forms which are especially valuable as food. For example, the cod and the herring, so important a part of the catch of European fisheries, are absent from the southern seas.

Before proceeding to consider some of the fisheries in detail, we may note one point of great interest in connection with human life. The occurrence of abundant fish in the shallow seas off, *e.g.*, Eastern England and Scotland, and the coast of Norway has enabled, as we have seen, the inhabitants of these

coastal regions to carry an occupation belonging to the collecting stage far on into civilized life. This primitive form of occupation has deeply stamped the character of the people of the regions, and produced a curious form of social polity.

As we have already seen, in the primitive collecting stage the parts played respectively by man and woman are very well defined. The man is the hunter and fisher, as well as the warrior. He makes and owns his weapons, whether rude or finely wrought; he often possesses as a domestic animal the dog; he often prepares animal food, but seldom vegetable. It is the woman's business to collect, prepare and cook vegetable food; the vessels to collect it are also of her making, and therefore she plait the baskets and moulds the pots; the early crafts are thus hers. When cultivation is begun, it is upon her that the labour falls. Upon her also comes, as a general rule, the work of preparing clothes, whether these are made from vegetable fibres or from the skins of animals, and also the providing for fire and light. This division of labour is necessary for the continued existence of the group. The hunter must be ready to follow his prey whenever it appears; the warrior must always have his arms at hand. In order, then, that the man may be ready to undertake exhausting toil at uncertain intervals, the woman must be content to carry out all the pieces of work which are certain to recur at regular intervals—*i.e.*, the more continuous but less arduous forms of labour. Travellers from other countries often exclaim against the laziness of the men in communities which have remained at this stage, but that is because they do not perceive clearly enough that at bottom the division of labour is sound for a particular stage of development.

When the increase in numbers of a particular group, and the consequent reduction in the numbers of wild animals, make it necessary to depend more and more upon cultivated plants or domesticated animals, and when, at the same time, one possible cause of strife—the division of the hunting-grounds—is removed, so that war ceases to be the natural condition of the group, then a change in the distribution of work must take place. As the work of cultivation becomes heavier, it is largely taken over by the men. Probably it must be so, for the woman's strength cannot suffice to win all the food of the community. As she begins to lose her garden,

and as her primitive plantation grows beyond her strength, she tends to concentrate herself more and more upon the minor crafts and occupations, and becomes spinster and weaver, as well as enlarging her work as cook and maker of simples and drugs. With further advances even these occupations may be taken from her, until we have stages when her activities are checked at almost every point, and only idleness on the one hand, or the least remunerative and least interesting kinds of work remain open to her. She then acts as a drag on the whole community, slackening its natural growth and development, till perhaps the whole social fabric totters and falls, or else a new distribution of labour is found, and the women once more become independent workers.

Now, the fact that fishing communities remain at the collecting stage ensures to the women much of their primitive field of labour, with the result that in them fine types, both physically and mentally, occur. In England and Scotland the use of steam trawlers is gradually exterminating the coastal fishermen, but enough remain to enable us to picture the earlier conditions. In all the little villages which sprinkle the east coasts of both countries we find, generally speaking, the same conditions. The men fish, often being out all night on the sea. Arrived on the beach, they hand over the catch to the waiting women, and their task is over. Much of the time on shore is spent in resting, when to the outsider they seem mere idlers, or in mending or preparing the nets for new expeditions, or in attending to the boats.

To the women falls the task of selling the fish. They still often carry it long distances to market in their creels, supported in primitive fashion by a band round the forehead. (see p. 159).

If the catch is too great for an immediate sale, it is upon them that the task of cleaning and smoking or salting the surplus falls. Further, as it is into their hands that the money is paid, they naturally do all the business of the household, and as the husbands and fathers may be away for weeks at a time in the herring boats, they must learn to suffice to themselves in most of the minor contingencies of life. "Men must work and women must weep," the poet sang of the fisher's life, but he was an outsider. The painter, Josef Israels, gives us a truer picture when he shows us the new-made widow turning away from the beach with her children by her side, and calm

resolve on her face. Her place is not to weep, but to pick up the broken threads, to strive to continue alone the task she faced before with her husband's aid. It is not only in the fisherman or sailor that the sea begets courage.

The same splendid types of men and women, the same resourcefulness, appear everywhere with the fishing industry. In Norway, where the land yields so little and the sea so much, it is upon the women that most of the burden of life on shore falls. They must carry on the little farm while the men are away at the cod-fis'ing. They must learn to drive, because only by driving can easy communication be carried on apart from the sea. They keep the post-offices and do the work which elsewhere is man's work, and just because of their manifold activities, they are capable and managing. Their countryman, Ibsen, studied from the life those strong women whom he has made known to the civilized world as types of revolt.

Once again, it was in the shallow waters and in search of food-fish that the inhabitants of all those countries which fringe the North Sea, learnt boldness in navigating. It was because the women at home had kept so much in their own hands that the bold Vikings were able to roam the sea and yet return to find that all had gone well. Thus it is not only fish that the fisherman find, but also those virtues which alone enable him to make his conquest of Nature permanent.

Let us add a few words about the fisheries in detail. Off Scotland and the North of England it is especially the herring fisheries which are important. The herring feed upon little shrimp-like creatures whose bodies are full of oil, and these give to the fish its characteristic oily taste, which makes it a savoury article of food even when dried or salted. As herring occur in enormous numbers, their importance as food can hardly be over-estimated. Even in these days of cheap foreign and colonial meat they constitute a large part of the food of the poorer people, and they were formerly much more important.

After the herring, the cod and haddock are very important fish caught in Scottish waters, and both, like herring, are extensively preserved by smoking or salting for use at a distance from the ports. Cod and herring are similarly very



A BELGIAN FISHERWOMAN.

[A. Forestier.]

important fish off the coast of Norway, where herring are caught especially near Bergen, and cod in the shallow waters off the Lofoten Islands.

Off the coasts of England generally the products may be described as less democratic, for a considerable part takes the form of luxuries—*e.g.*, pilchards, oysters, turbot, and so on—instead of yielding cheap food.

The salt and tideless Mediterranean is very much poorer in fish than the North Sea. "Seas without fish, mountains without trees, men without honour," is a rude remark which used to be made of Genoa by her neighbours, the Tuscans, and so far as the first statement goes, the saying is true of the Mediterranean throughout its greater part. A large fish called the tunny occurs, and sardines and anchovies, both luxuries rather than foods, are caught; but otherwise there is little of value in the way of fish. This fact has considerable economic importance, especially when we realize that the countries round the Mediterranean are Roman Catholic, and must therefore abstain from meat at certain seasons. The consequence is that large quantities of dried and salted cod are sent to the chief countries of the Mediterranean, especially from Norway and Newfoundland. The cod-fisheries of Newfoundland are its greatest asset, and it is curious to note that the prosperity of the island suffered severely from the great Italian earthquake of 1908, because this diminished the purchasing power of the people of the region affected, who are the great customers for Newfoundland fish.

Off the coasts of North America the most important fish caught are cod, mackerel, hake, and herring, but oysters are also of great importance, and, in the west, salmon. The fisheries of Japan, which are very important in the north, chiefly yield herring, cod, and salmon, so that it is obvious that these fish, and especially cod and herring, are among the most important marine forms.

Fresh-water fish, with the exception of the salmon—which only spends part of its life in fresh water—and the various kinds of trout, are not greatly prized by those who can obtain marine fish. They are, however, of importance in countries where marine fish are not easily got. In Russia, for example, the abundance of the sturgeon makes the river fisheries, and also those of the Caspian Sea, of great importance. As a general



A NEWHAVEN FISHWIFE.

rule, however, fresh-water fishes do not maintain considerable populations, as is the case with the more plentiful sea fish.

The abundance of fish in the shallow seas of North-Western Europe has certainly been important in attracting population to their shores, and the arrangement of the towns and settlements to this day shows the influence of this factor. Thus, all up the east coast of Scotland there are towns which form, and have always formed, small fishing-ports, often adding to the fish of the sea proper the salmon which travel up and down the streams on which the towns are placed. Some of these towns—*e.g.*, Aberdeen and Dundee—have added other industries to the original fishing one, but this still remains to suggest the origin of the settlement.

In this short account of fisheries we have said nothing of the valuable seal and whale fisheries. Both of these kinds of animals show the same tendency to suffer severely from the persecution of civilized man as land mammals do. In the case of the fur seals, only elaborate international conventions have saved the animals so far from total extermination, and their numbers are now sadly diminished. The fact that all seals must come on shore to breed exposes them to especially severe pursuit. It is interesting to note that the Eskimo, armed with relatively ineffective weapons, could base their whole social polity permanently upon seals, while civilized man, who want much less from the animals—he does not eat their flesh as the Eskimo do—but is armed with much more powerful weapons, succeeded in reducing their numbers enormously in a very short space of time.

Whales do not come on shore to breed, like seals, but they also have suffered very severely from man's persecution. Like most mammals, they reproduce themselves very slowly, and the natural reproduction is not sufficient to enable them to resist the destructiveness of man when armed with modern weapons. Further, in the case of all the marine mammals, the mother's devotion to her young proves a danger to the species when it is confronted with man's greed. The improvident cod sheds her eggs in the water in thousands, and leaves them to their fate; the mother whale, or seal, is often a victim to her devotion, and yet does not succeed in saving her young.

CHAPTER XII

REGIONS WHERE MAN HAS THRIVEN

"Kitchen middens" and the shore as a place of settlement—Natural clearings in the temperate forest—Mediterranean civilization—The Far East: resemblances and contrasts—The oasis in the desert: Suf and Mزاب, and their inhabitants—Conclusion.

IN the first chapter we looked at some of the broad characteristics of the earth's surface, and suggested ways in which, at various points of this surface, man has found it possible to make room for himself, by displacing here wild animals, there useless plants, and elsewhere bringing the water whose absence made all life impossible. Now that we have considered the aids which he has found to his hand, the animals and plants which have fed and clothed him, the minerals which have enabled him to forge tools and machines, the emotions which have sustained him in his long fight, at this stage we may turn again to consider in a little more detail how the varying climates and relief of the surface have influenced him.

We spoke in the last chapter of the rich harvest of the sea, especially of the seas to the north-west of Europe, and suggested that this harvest had helped to feed countless generations of human beings. It is, however, worth noting more precisely that what are called "kitchen middens" are widely distributed round the shores of these seas, notably in Denmark, North Scotland, etc., and prove at how early an age the utilization of these food supplies took place. Now the shore lines on which these accumulations lie, are at the junctions between two natural areas, the sea and the land, and show certain peculiarities of such junction zones. In the first place, on the shore the climate differs a little from that which obtains even a short distance farther inland. These shores are swept by

westerly winds, and when the coast itself faces west, the violence of the wind may be very great, and may prohibit tree growth. Even in a thickly wooded region, then, the forests retreat from the coast, and leave a strip of land where man may find greater freedom of movement, more room for the development of his settlements, than in the forest itself. The climate at the same time is somewhat milder, and rain is likely to be more abundant than farther inland, unless the relief exercises a modifying influence.

We may suppose, then, that primitive man was attracted to the shore in the first instance by the abundance of shell-fish and other edible marine animals. With increasing skill he learnt to catch fish, in the limited sense, in addition to collecting mussels and oysters. On the shore also he found convenient places to construct his shelters. That he made excursions into the forest in search of game is suggested by the fact that the bones of reindeer and birds occur mixed with shells in the "middens."

But farther "up" in the heaps we find bones of sheep, goats, horses, pigs, and so on, suggesting that, as the group became sedentary owing to the abundant food, it began to domesticate animals, as well as doubtless to cultivate land. In other words, the absence of the forest near the shore line in a densely forested country, made this region specially suitable for human settlement. As the absence of forest is due to climatic reasons, settlements here were determined by climate, and by the fact that the products of two regions, sea and land, were simultaneously available.

We have already suggested, in speaking of the origin of towns, that these tend to cluster round the junction zone between two regions, owing to the necessity for exchanging the products of the two regions. But we might add to this another reason also. Junction zones, as a general rule, are peculiarly suitable for human settlements, for they give those varying conditions of which man has always shown himself so quick to take advantage, and often yield also two sources of food. As an illustration, let us consider the origin of that Germanic civilization of Western Europe, which in many respects is so markedly contrasted with Mediterranean civilization.

This civilization is a product of the forest region, of the generally deciduous forest of the north-central part of

Europe. To the south-east the region passes into dry steppes, to the south generally it grades into the Mediterranean region of dry summers and winter rains. To the north, apart from the coniferous forest of the mountains of Scandinavia, etc., we have a region of plains, strewn with glacial débris, often taking the form of fine clays. The climate of the whole region is more or less favourable to trees, but here and there, especially where the soil is fine clay, and the ground consequently marshy, there must always have been gaps, natural clearings in the forest. Such natural clearings were doubtless determined by different causes in different localities, but in all cases the result was that gaps existed by means of which man could insinuate himself into the forest proper, and it was in these clearings that he made his first settlements.

The composition of the primitive European forest, according to Professor Vidal de la Blache, has varied greatly, even within historic times, but the general conditions are favourable to deciduous species. Probably oak, hazel, beech, ash, lime, maple, etc., were common. As contrasted with the coniferous woods, now so much prized for yielding pitprops and paper pulp, the deciduous trees, when they do not grow too close together, allow vegetation to flourish about their bases, to some extent at least, and they yield such products as nuts and beechmast, of great importance as food for pigs. Further, the varying nature of the timber of these trees doubtless helped to promote carpentry and the allied crafts.

It seems likely then that the first settlements in the forest would occupy natural clearings, whether these occurred on plains, on local fragments of the steppe, or on plateaux where, from one cause or another, the trees did not thrive. Each settlement would be surrounded by a ring of forest, where the pigs browsed on the acorns, and grass-eating animals also found pasture. In the clearings the land would be ploughed, and cereals raised. Thus from the first the community had a double source of food supply in its fields and in its flocks, and the necessity for clearing the land and keeping it cleared made for the early development of strong family life, for here the family became the unit. The double food supply, also, depended on the fact that this region was a junction zone of two climates, that favouring the development of grasslands and that favouring forest growth.

In the Mediterranean area the summer drought excluded the deciduous type of forest, and the extraordinary rapidity of growth after the winter rains limited the work on the ploughed lands to a short period of the year. The summer was thus left free for the cultivation of fruit-trees, an art which was carried to a high degree of perfection in the region. Where irrigation had to be practised, the necessity for co-operation on a large scale made the social unit a larger one than the family.

The upland regions, or the barren areas round the cultivated land, allowed pastora^l industries to be carried on, though there was always a certain amount of rivalry between the settled agriculturists and the wandering herdsmen. The conflict was sometimes carried on in space and sometimes in time; for in regions where progressive desiccation was going on, water for irrigation must have become scarcer and scarcer, and gradually a scattered population of shepherds would take the place of the agriculturists. Finally the desiccation might proceed so far that even the pastures disappeared, and masses of reeds only remained to show where once water had spread fertility. Such changes have taken place within the human period both in Western Asia and in Northern Africa.

On a small scale the typical mode of life in Mediterranean regions is suggested in parts of that specially favoured coast known as the Riviera. Here, in the winter and early spring, abundant crops of early flowers are obtained, the scanty soil being laboriously banked up and terraced in little patches for the purpose. Among the beds of flowers the fruit-trees may be seen, and when summer brings heat and drought, the peaches, almonds, figs and grapes ripen, the oranges and lemons swell, and the olives grow large on the trees. The roots of all these trees are taking water from the depths, where it has sunk beyond the reach of shallow-rooted plants. On the other hand, the rains of winter moisten the soil sufficiently for such plants to be grown then. It is this capacity for yielding two sets of crops that has made it possible for man to thrive on those apparently barren hillsides, where communication is excessively difficult, and where only the mouths of the streams afford patches of level ground on which human settlements can be established. But all along that

coastline vestiges of ancient towns and buildings are visible, showing that the sun, and man's skill in cultivating fruit-trees, have enabled him to triumph over conditions which seem wholly adverse to his characteristic forms of activity. Here we have a junction zone between the moist temperate climate and the desert one. The first prevails in the winter half year, and enables the region to yield cereals and similar crops; in the summer desert conditions occur, and then only plants resistant to drought are grown.

The Far East, with all its teeming populations, with all its prolific lands, has, apparently because of the climatic and other conditions, been less successful in multiplying food resources. The Chinese, so skilful in regard to the ordinary occupations of agriculture, have not, as Professor de la Blache points out, been successful with the delicate operations demanded by fruit-trees; pruning and grafting remain to them more or less of mysteries still. Again, in Japan, though the country is hilly, the mountain pastures remain unutilized, and domesticated animals are all but unknown. The coincidence in these countries of the maximum heat with the rain induces a summer luxuriance which perhaps withdraws attention from the minor occupations of agriculture, so necessary in less productive lands. Here the fertile zone is that which lies on the banks of great rivers, between the water and the land.

The three great kinds of regions where man has found a foothold, then, have been first monsoon lands where the great river valleys gave him broad alluvial plains, on which he might grow crops like rice, sugar and cotton; where the climate brought rain at the time when it was most needed; where the rivers brought the possibility of irrigation if rains were scanty locally. The second great region was that where luxuriant forest growth was checked by the drought of summer, but the winter climate was favourable to certain crops, and fruit-trees could be grown in spite of the drought of the hot season. Here the varied relief, or the proximity of steppe regions, allowed cattle and sheep to be kept as it were upon the margin of cultivation, and thus added one more item to the list of possible sources of food.

Finally, in the deciduous forest region of mid-Europe minor variations of climate and relief produced natural

clearings in the forest. Here the Germanic civilizations arose, and here each unit added to its small area of ploughed land pigs and cattle and sheep, which fed in the forest or on the uplands. In this region, then, from the first the farming was "mixed." The difficulties of the combat with the encroaching forest, also, tended to produce small groups rather than great Empires; it tended to make the social unit small. Only slowly was the forest conquered on a large scale, so that the separate clearings, originally separated by a forest girdle, were joined up to each other.

This brings us to another point about man's conquests, the question of the origin of civilization, a point already alluded to in an earlier chapter. Civilization probably always arose in small areas, whose special characters gave early man some trifling advantage. Only much later did such "islands" of prosperity fuse together to found States or kingdoms. In our account of the Swiss peasants of the Val d'Anniviers, and also, to a less extent, in the account of the Mountain of the Limousin, we have described such islands of culture, which remain more or less isolated from surrounding conditions. Let us describe some other examples, in regions where the isolating medium is better marked, where once again we may see how favourable to human activities are junction zones with their double food supplies.

Right across Asia and into Northern Africa, as we have seen, there sweeps a belt of steppes passing into deserts, which seems to have been becoming drier throughout all the human period. This steppe and desert region, the natural habitat of migratory herbivores, is from the human point of view the home of the pastoral nomad. Here and there rain falls, giving a local abundance of pasture. In some places the presence of impermeable rocks detains the water within reach of the surface, and deep-rooted desert plants grow. The drier regions are the natural home of the camel; where pasturage is more abundant, goats and sheep can be made to thrive. Over the region, then, roam pastoral nomads, carrying with them their tents and all the necessaries of life, driving their flocks from one area of pasturage to another.

The Kirghiz of the Russian steppes, in which grass is locally very abundant, remain permanently at this stage, their prosperity being greatly aided by the high relief of the regions which they

haunt ; for they frequent mountain pastures and plain pastures, according to the season. In North Africa the influence of the Mediterranean traditions of cultivation begins to make itself felt, and the nomads cultivate when they can, finding oases in the desert where permanent settlement is possible, but keeping, as it were, their hold upon the desert which feeds their flocks. Here again then we have a junction zone, a region where two courses of food can be tapped. To the oases the nomads were doubtless attracted, in the first instance, by wild palm-trees, whose presence shows that water is present, though it may be deep down. It is upon the date-palm that the permanent settlements are based, and this fruit-tree prolongs, as it were, the plenty of the Mediterranean region into the desert. It is by means of these settlements that some of the culture of the Mediterranean has trickled across the desert, and so aided the negroes of tropical Africa to develop their country.

As an example of such an oasis, let us take that of Suf, placed among the dunes of the Algerian Sahara, though we must not forget that Egypt is just such an oasis in the desert, on a larger scale, and exemplifies the same conditions. The oasis Suf is placed at a distance of some days' march across the sand from any other, and lies in a natural depression, surrounded on all sides by sand hills. No running water is visible, and the date-palm plantations lie in hollows of the surface. The life of the oasis is based upon the fact that, beneath thick layers of sand, there lies a water-holding layer of soil. To make a plantation, then, it is necessary to dig away the sand to the depth of several yards, until the vicinity of the water table is reached. The palms are then planted, and the surrounding rim forms a kind of wall, so that the trees lie, as it were, in a natural hothouse. From a distance the tops of the palms can just be perceived, rising from the hollows in which they are placed.

But the sand banked round the garden continually tends to fall back, and only by constant labour can the owners prevent their trees from being overwhelmed. The poorer people are constrained to carry out the shifting sand themselves in baskets upon their heads ; the richer load the baskets upon their donkeys ; but rich and poor must alike carry on the ceaseless toil. As almost any part of the region can be made to bear palms, if the necessary excavation is carried out, there is no

property in land. Anyone is free to start a plantation on his own account. On the other hand, palm-trees form valuable property, and are sold at prices which sometimes range as high as £20 to £24 per tree. No new tree may be planted nearer than a certain fixed distance to another, and therefore a tree on the margin of a plantation fetches a higher price than one near the centre. The former position allows the owner to extend his plantation outwards, but no new trees can be introduced at the centre.

As the trees themselves obtain water from the depths of the soil, the inhabitants of the Suf oasis are spared the labour of watering. On the other hand, all water for personal use, and for that of the animals, must be hauled up from wells. Accessory plants also can only be cultivated with the aid of water, artificially supplied. Neither wheat nor barley is grown, but onions, water-melons, henna, and so forth, are cultivated on a small scale. To and fro from the wells, then, the women, and girls go, carrying jars and leather bottles, and obtaining the water either with the aid of a chain or by an arrangement which recalls the shadoof of Egypt. But it is the date plantations which constitute the great wealth of the oases.

The nomads of the desert are tent-dwellers, but the inhabitants of the oasis build elaborate and carefully constructed houses of stone. The only stones to be found are very curiously shaped masses, found buried in the sand of the dunes. These consist of sulphate of lime, mingled with sand, and have the property of setting like plaster, so that the same stone makes both building material and mortar. The walls are very solidly built, and the roofs are cupola-shaped, built in a very ingenious fashion. But these domed houses are not the only habitations which one sees in the oasis, for very curious conditions exist here, where the Desert touches the Sown.

At certain seasons, rows of tents are observable near some of the date gardens, and, beside the tents, constructions like the ordinary stone houses of the permanent inhabitants. The tents are the habitations of certain desert nomads, who have bought palm gardens, but cannot bring themselves to adopt the sedentary man's habit of living in a stone house. They come to gather the fruits of their gardens, and live meantime either in tents or in huts made of palm leaves. But while a tent is an admirable habitation for a wanderer, it is far from being suitable



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AN OASIS IN THE DESERT.

Note the tall date-palms, beneath which smaller plants grow.

for the storing of an agricultural crop. The nomads then must build a "granary." But the domed dwelling is the natural building of a country where only one kind of permanent building material is available. Therefore the date-house takes this form, but the nomad remains in his tent.

A further stage is also represented—the transitional condition. Here the people are at once cultivators—not mere purchasers of made plantations—and herdsman. They contrive to combine both modes of life.

The next stage is the purely sedentary one, when the flocks become small, and the palm gardens are the main resource. But as cultivation does not occupy the whole time, crafts, especially carpet-making, from the products of the nomads' flocks, begin to develop. Thus the oasis shows all stages in the transition from the pastoral to the agricultural life. We must not forget, also, that evolution may take place in either direction. If the agriculturist's life means a better utilization of the surface, its continued existence depends upon the presence of much subterranean water. The reduction in amount of this water may cause a reversion to the pastoral life, just as an increase might cause a wider-spread abandonment of the pastoral life.

A neighbouring oasis, that of Mزاب, offers in some respects some curious contrasts with the Suf oasis, but shows us again that the "oasis" is largely artificial, made by man for his own use, not found ready-made, as we are apt to suppose. The desert here differs considerably in appearance, for the sand dunes are absent, and the region is stony, much barer of vegetation than the sandy desert, and cut up by numerous ravines, due to the former action of water. The district stands high, over 2,000 feet above sea-level, and presents an appearance of great desolation. But the surface rocks, which are permeable, lie over impermeable marls, and it is possible to obtain water by sinking deep wells. Such wells are sunk especially in the wadis, or dry stream beds, and have sometimes a depth of 175 feet. The water does not flow, and it has therefore to be drawn up from depths which vary from 25 feet or so to the great depth just stated. Only from these wells, also, can the water be obtained to supply the gardens.

The inhabitants, the Beni-Mزاب, are Mohamedans, who were driven into the desert on account of their unorthodox

opinions, and they have shown extraordinary tenacity of purpose in fighting against the unfavourable conditions in which they find themselves.

The principle of the shadoof—that is, of a swinging beam suspended at one point—cannot be applied here to reach the water on account of the depth of the wells. A cord is therefore attached over a pulley, and by means of it a leathern bottle, which holds some ten gallons, can be raised and lowered. By an ingenious arrangement another cord, working also on a pulley, opens and closes the spout of this great sack. As the leather sack reaches the water, the spout is opened, and the bag thus filled. The spout is then closed, and the bag is pulled up. The depth of the well would make it very laborious to pull up the slack of the cord directly, and therefore from the margin of the well a slightly inclined path leads downwards. Along this, walks the man or animal who is engaged in raising the water. As he pulls the filled bag up to the lip of the well, he once more opens the spout by the other cord, and the water pours into a basin, whence it is led to the crops. Then the patient ass or camel remounts the path, the empty sack sinking downwards as the rope slackens, and so the process is begun over again. The length of the path which leads away from the well thus affords an exact measure of its depth. The process is necessarily both slow and laborious, and, where the wells are few, their proprietors let out the right of raising water by the hour, and the simple apparatus is worked night and day.

Water so obtained is naturally very precious, and the utmost care is exercised, by the careful construction of the irrigation channels, and so forth, that as little as possible be lost by evaporation before it reaches the plants.

Natural water is rare, but at long intervals water flows in the wadis, though not every year. But rare as this water is, it is too valuable for the chance of it to be lost. Barrages are therefore built across the stream-beds, so that, if water should appear it can be kept back. It is characteristic of the people that, though the reservoirs so formed are more often empty than full, they are as carefully constructed and as systematically kept in repair as if they were always in use. Even on the bare hillsides, little barrages have been constructed to catch the product of the rare and local showers.

The result of all this labour is said to be extraordinary. The gardens are not mere means of existence, they represent an ideal, they are the objects of art on which the Mzabite is willing to expend endless toil, and not a little wealth. As the Eskimo is not content that the weapons with which he obtains the indispensable seal should be merely useful, but devotes to them all the treasure of his ingenuity: as the Swiss peasant is not content that his house be wind and water proof, but must have it beautifully decorated also; as man everywhere, once the prime needs are satisfied, will multiply his toil a thousandfold to satisfy some deeper and more insatiable desire, so the Mzabite toils over his garden. The economic geographer has shown by careful figures that those gardens do not "pay," that, reckoned by any test we please, the labour which is put into them is not counterbalanced by the produce they yield. But we may be sure that if the Beni Mzab heard these calculations, they would laugh in our faces. Does Milan Cathedral pay? Did the pyramids pay? Did those often fruitless efforts in which great artists have spent their lives pay? We might perhaps add that if man had always measured his efforts by this standard, he would have remained permanently a hunter and a fisher, a wanderer and a vagabond.

Despite the fearful difficulty in obtaining water, the garden are said to display the same luxuriance as a tropical rain forest. High above all tower the palm-trees (see p. 169), and between them are many-stemmed fig bushes, with their enormous leaves. Pomegranate, apricot, and peach trees form a kind of undergrowth to the palms, and over all clamber the sprays of the vine, clinging to the trunks of the palms like lianes. Round the margin of all grow beans and barley, forming a green fringe to the enclosed forest. But in the midst of all this luxuriance, the steady creak of the well-pulley reminds the traveller that all is artificial, won by man's energy from reluctant Nature, and only maintained by his patience.

As in the Suf oasis, the houses are well built, for building material is abundant. Here stones are strewn all round, and a rock containing lime and gypsum occurs, which, after heating, yields a good mortar, with some of the qualities of cement. But the fact that burning is required makes building more costly and more difficult than in the Suf, for the desert does

not produce much fuel, and long journeys have to be made to find desert bushes for this purpose. In construction, arches and arcades are much employed, and the whole village has a most picturesque appearance, with its tall minarets.

The fact that the gardens represent a luxury as well as a necessity, is shown by the fact that every family has a dwelling among them, as well as in the village. The hottest months are spent in the shade of the garden, and each family then largely depends for food upon its products.

In the Mzab oasis, as in the Suf, semi-nomads dwell upon the margin, living in tents, but owning plantations as well as flocks and herds.

But the Mzabites, despite their laborious lives, are aristocrats among the dwellers in the desert. They export nothing, and yet import a good deal, a phenomenon which is explained by the fact that, something like the inhabitants of the Limousin Mountain, they expatriate themselves in their youth in order that their prime may be spent among their beloved gardens. They are irresistibly drawn to the Algerian Tell by the fact that there, and there alone, can commerce, impossible save on a minute scale in the desert, be profitably carried on. It is almost a disgrace not to have visited this region in youth, and the returning emigrants often bring with them wealth which may be expended on the gardens. As the London merchant seeks to acquire a country mansion for his later years, so the shopkeeper of the Tell has his eyes always turned towards the gardens in the midst of the distant desert, with their cucumbers and their garlic, their vines and their dates.

We have thus not only looked at various aspects of man's age-long struggle with Nature, but have also tried to show in what diverse ways he strives to satisfy his soul, to render permanent his hold upon shifting Nature. In all cases the elemental needs must first be satisfied; food to eat at regular intervals, clothes to wear, a shelter in which he may rest from his exhausting activities—these are man's first wants. But these once obtained, he cannot, as the animals can, rest peacefully in the sunshine. The struggle for these has given him qualities which spur him to ceaseless activity, and he strives always to leave his impress deeper and deeper upon Nature, to make life more certain for future generations.

His modes of attack upon Nature have been as manifold as is Nature herself, and everywhere the fortunes of the fight have varied with the natural conditions.

But, as we have tried to show here, with the spread of man over the earth, the conflict has not been with Nature alone. Different modes of utilizing the earth, different methods of attacking difficulties, have led to ceaseless conflicts between the various groups of men. Such conflicts, whether armed or peaceful, are still going on, must probably always go on. As we have suggested, the fortunes of the ancient conflict between agriculturist and shepherd are profoundly influenced by secular climatic changes, and all the historic struggles have probably at base been similarly influenced. In modes of moulding Nature to serve man's ends, then, we cannot speak of absolute good or absolute evil. The old notion that the nomad shepherd was but a stage in the evolution of the husbandmen, and must necessarily disappear with "progress," has lost its validity since we have learnt that climatic changes are even now occurring, and that over parts of the earth's surface the agriculturist must probably disappear before the shepherd, whose methods may represent the only possible means of utilizing certain regions.

But this notion of the necessarily "primitive" nature of the nomad shepherd was ruthlessly applied to justify the displacement of the Kirghiz from the steppes where his fathers roamed, and similar, and as ill-founded generalizations are being used to-day to justify similarly ill-advised actions. It is no part of the work of Geography to lay down rules as to the best solutions of particular problems of land utilization, but it is her work to set forth as clearly as may be the conditions which reign at different parts of the earth's surface, for a consideration of these furnishes the raw material upon which all political and social judgments must be based. It has been the object of this book to try to fill in the gaps which the ordinary school-book leaves, and to show how people live, and what desires and ideals sway them in those manifold countries which the atlas depicts impartially in red, or blue, or green. Each of these gaily-coloured regions represents a fragment of land where human beings have worked out some sort of balance between their prime needs and the natural conditions of existence, and we have tried to show here some of the ways in which they

have attained that condition of balance, and some of the reasons why it is here more or less stable, here perpetually swayed by the least breath of the outer world; in one place strong to resist outside interference, in another so precarious that it is destroyed almost at the first contact of another civilization.

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