

THE BOMBAY FORESTS

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FOREWORD

THIS pamphlet is issued in order that the public may understand the aims and purposes of the Forest Department and may thus be induced to lend a sympathetic hand. The Presidency is blessed with good natural forests which with careful tending and management will be of great benefit to the community as a whole for all time.

The Public need for Timber and other Forest Produce.

As the standard of living rises in the country so the demand for timber rises. Industrial progress too is often dependent on a steady supply of timber and other forest produce.

Imports of timber *via* Bombay and Karachi have long been considerable and the value amounts to over a crore a year while exports are negligible.

Timber is imported from Scandinavia, Canada, Australia, Siam, Burma, etc., and the demand in the Presidency is far in excess of the local supply. Obviously there is sound economic ground for timber growing and development of the forests.

Every village requires wood and bamboos for houses and cattle-sheds, for carts and agricultural implements, for fuel and fencing crops such as sugarcane.

Railways, cotton mills all over the country use up large quantities of timber and fuel. All the timber and fuel that the Sind forests can ever produce will not check the heavy imports into Karachi. Gujarat and Kathiawar absorb all the timber that can be produced in the forests north of Bombay, while Bombay itself depends almost entirely on foreign imports. Much of the timber supplied to the Poona and Deccan markets is imported. The supply from Kanara and the neighbouring forests is more than sufficient to meet demands south of Poona, Bijapur District and eastwards through Hubli to the Nizam's territory. It may be asked why the Kanara timber does not command a wider market and compete more with imported material in Bombay. The answer is only a limited quantity of timber can be exploited to the coast and railway freight from stations between Hubli and Londa to Bombay kills competition.

Timber can be transported by sea from Saigon and Rangoon far cheaper than by rail from the Kanara forests to Bombay. Railway sleepers even from Australian ports are often brought over at rates which are a fraction of the cost of railing from Kanara to Bombay.

Forest products are classed as major and minor : major includes wood, minor a variety of useful products such as myrobalans (the fruit of *Terminalia Chebula*) and tarwad bark from the common *Cassia* shrub with the yellow flowers used for tanning leather, lac produced by a scale insect chiefly on the twigs of *Bor* (*Zizyphus*) on *Phalas*, the tree with the wonderful velvety red flower known as the flame of the forest and on a few other trees, *babul* and *kusumb*. The cultivation of lac requires

close scientific research. Other minor products are gums and oils, for example sandalwood oil, the scented rosha oil from a coarse jungle grass. Few people stop to consider to what extent they are dependent upon forest products. Look around a room in any bungalow, the doors and most of the furniture are probably of teak, the seats of chairs are of cane, easy chairs of bamboo and cane, ornamental tables of Blackwood, the gramophone records are made from lac, paper from wood pulp, the penholder and pencil from cedar wood, the picture frames, the child's toys may be of wood and so on.

The forests which a century ago appeared to be of little value are now found to be indispensable and a source of profit to the country. The more carefully they are conserved the greater the profit to be derived from them and the less drain on the resources of the country through foreign importations.

Most of the well managed forests in Europe yield a net return of about 15 rupees an acre and there is no reason why good teak forests in this Presidency should not in time be improved till they give as good a return as European forests.

Income from Forests. Its gradual growth.

In the seventies the gross revenue from the Bombay forests was about 12 lakhs with a surplus of 4½ lakhs. In the next decade the figures increased to 30 lakhs with 13 lakhs surplus. In the nineties there was no rise and the figures remained practically stationary and it was not until the quinquennial period of 1909 to 1914 that the revenue rose to 42 lakhs with 19 lakhs surplus. During the period of the war there was a further rise to 59 lakhs with 28½ lakhs surplus and the figures for the past four financial years are as follows :—

			Lakhs Rs.		Lakhs Rs.	
1919-20	..	..	71·06	Revenue	28·93	Surplus.
1920-21	..	..	63·37	"	17·06	"
1921-22	..	..	72·97	"	25·47	"
1922-23	..	..	70·36	"	30·66	"

Though there has been a heavy fall in prices since 1920 the revenue is sustained and with any improvement in the timber trade the gross revenue will increase considerably provided funds are available for opening up the forests by light railways and by roads.

The above figures show clearly that the management of the forests is successful commercially and there is not the least doubt that further facilities of transport will lead to increased output of timber and a corresponding steady increase in revenue. The sooner valuable areas are opened up the quicker the rise in revenue.

The Retrenchment Committee in Simla recommended placing the forests under commercial management. What are the results of commercial management in other countries—America, Australia, Canada? Wholesale destruction of splendid forests with a prospect of a timber famine threatening the world. Under commercial management good forests are destroyed in a few years—forests impossible to replace in a century or more if ever.

Commercial Development.

The forests in this Presidency have been carefully conserved. Many good areas are not yet opened up and the standing timber now available is worth far more than it was a decade or two ago. On the other hand it is true that the cost of exploitation, logging, carting and railing has advanced at an extraordinarily rapid rate during the past five years. To meet this, capital expenditure is necessary, on roads especially, to reduce cost of transportation. The extraordinary rise in wages after the war followed by recent rises in railway freight, the recent fall in prices of our timber, have upset financial forecasts, nevertheless the forests have continued to pay well giving a good return on expenditure, and capital expenditure on forest is shown to be a fine investment for the country. Throughout the Presidency matters are settling down and divisions which showed a deficit are now on a sound financial basis giving a good surplus which is sure to be practically permanent. Development in such a hilly roadless country as the Surat Dangs requires time.

As soon as roads under construction are completed exploitation must be pushed on and the waste of valuable material which is evident throughout the Dangs will then cease and revenue will advance rapidly. Peint is another area which has hardly been touched, and will certainly produce many times the quantity of material exploited hitherto. Roads and sawmills are required here and mechanical traction for the long lead from Peint to Nasik.

In the Central Circle the Khandesh forests, West and North Divisions especially, have hardly been touched owing to very extensive areas under the Revenue Department being cleared for cultivation through the agency of the Forest Department.

In Kolaba a Working Plan now being drawn up will undoubtedly show that there is more to be got from this Division than has actually been taken out in recent years.

Throughout the Central Circle protection, planting, etc., have received far more attention than exploitation during the past 30 or 40 years. This was necessary as most of the forests were in poor condition owing to fires and overgrazing before the Forest Department was established.

As a matter of fact the commercial side of Forestry is developing fairly well in this Presidency with the exception of one district, namely Kanara. In Sind, Panch Mahals and throughout the Northern Circle private enterprise has developed the marketing of timber to a fine art. Much private capital is invested annually and the Sind and Gujarat timber merchants are excellent and astute business men. Similarly in the Central Circle there is little room for interference on the part of Government in the commercial side of Forestry. What is required is capital expenditure on roads and transport facilities in certain rather inaccessible areas. Money invested in opening up these areas will repay Government handsomely. The war checked all road work and since the war financial stringency has temporarily hampered development.

The Kanara forests, the finest in the Presidency, are far from being fully developed commercially. Labour difficulties and the lack of private enterprise and capital check development in this remote corner of the Presidency. Furthermore the present high railway freight which has doubled in recent years reacts unfavourably to business

development in Kanara District far from the chief markets. The latent wealth of the Kanara forests is considerable and is hardly realized. The educated public cannot appreciate the value of these forests without having opportunities to visit the country.

History of Forest Conservancy in Bombay.

In ancient times forest areas in Europe were not closed to the public for the benefit of the tree growth but were Royal or Ducal hunting grounds whereas in this Presidency practically all the forests are natural and were formerly open to the public and consist mainly of hilly tree-clad areas unsuited for permanent cultivation. Sind is an exception, for the Sind Amirs fenced in large areas as private hunting grounds and the exclusion of camels, cattle and goats resulted in tree growth. The forests along the Indus cover areas which are liable to frequent changes owing to the floods constantly washing away the land, consequently there remains no trace of ancient forest. Long before the Forest Department was firmly established in the Presidency practically all culturable land had been selected by generations of agriculturists. Kumri or shifting cultivation on hill slopes was discouraged about the middle of the last century. Shifting cultivation still continues on the Belgaum and Kanara ghâts but only to a limited extent and under the combined control of the Revenue and Forest Department.

Early in the 19th century the requirements of the Royal Naval Dockyard in Bombay drew the attention of Government to the forests of the country. Small teak spars were supplied from Thana and Kolaba while Kanara and the Surat Dangs supplied larger timber for shipbuilding.

Also material was supplied to the Bombay Arsenal Works for gun carriage wheels.

In 1847 the Superintendent, Botanical Gardens, Bombay, was appointed Conservator of Forests and he was directed to make regular tours through all the forest areas of the Presidency and advise Government.

The controlling staff was increased in 1863, Assistant Conservators being placed under Collectors. The Bombay Government awoke to the fact that owing to a growing scarcity of timber and the extensive demand for wood the reckless and wasteful fellings threatened devastation of valuable forests and failure of future supplies. About this time Government took over the North Kanara District from Madras, and the Panch Mahals were added to the Presidency.

In the year 1867 considerable attention was given to the supply of fuel for Railways and two years later the Inspector General of Forests visited Bombay and suggested a considerable increase in establishment, both in the office and protective staff. He pointed out that up to 1865 the Conservator was expressly denied control and supervision of the Forest staff.

About this time the Sind forest attracted special attention. The Indus Valley Railways required sleepers and fuel, also the Indus flotilla required fuel. Consequently the first two home-trained Forest Officers arriving in 1869-70 were sent to Sind and Dr. Schlich was transferred from Burma to Sind to make a Working Plan.

Dr. Brandis' visit in 1869 and 1870 resulted in two Conservatorships being formed in 1871 and the Conservators were given more control of the Forest staff though Divisional Officers remained Assistants to the Collectors.

In India the need for forest protection was recognised about the middle of last century and a Government of India despatch of 1862 states : 'Forest is a thing valuable in itself and in truth just as essential to the community as wheat, sugar or cotton.' The Forest Act applied to this Presidency is dated 1878 and it was not until some years later that the Forest Department was sufficiently developed to have any appreciable effect in protecting the forests of the country. However, India in this respect has a good start of the Dominions and is now reaping its forest crops which are increasing from year to year. The introduction of forest conservancy was unpopular and enthusiastic Forest Officers could not be popular with the people nor at times with the Local Government. It is interesting to note that the Secretary of State in his despatch, R. F. No. 69 dated 3rd March 1870, to the Bombay Government writes : 'It seems to me impossible to read the reports and the documents relating to the management of the forests of your Presidency for many years past and not to be struck with the evil arising from the arrangement by which the Head of the Department has been cut off from all real power and authority over his Department. I trust that the new arrangements will provide for the separation of the Forests from the Revenue Department.'

Had the Secretary of State's advice been acted upon Forestry in this Presidency would now be much further advanced than it is. Stagnation is noticeable from 1884 to 1904 when the Forest Department were denied funds required for development.

In 1892 the Department was reorganised and in 1893 three circles (Conservatorships) were formed corresponding more or less with the Revenue Divisions. Sind remained an independent charge but the Sind Conservatorship was not created until 1922. A Chief Conservator was first appointed at the end of 1917.

It was not until the year 1921 that the Department by being placed directly under a Minister ceased to be a minor subservient branch of the Revenue Department.

Continuity of a fixed Forest Policy essential.

With the Government of the country undergoing radical changes every Forest Officer is beginning to ask himself what will happen to his plantations and other forest crops he is nursing so carefully ten, twenty or fifty years hence. In Forestry continuity of forest policy is essential and political changes must not be allowed to disturb the settled policy. The public are not in the least interested in forest conservancy. They have not begun to take an interest in it in this country. Fortunately Forestry has been practised long enough to demonstrate its usefulness, to the people. Its foundations are solid and it is a fairly solid structure but will it withstand political upheavals? Forest policy must be uniform for generations. The Forester sows that future generations may reap and people who have not made a special study of the subject are not likely to understand fully what he is doing or why he is so particular about keeping fires and cattle out of certain areas. Everyone in the country can realize what the cultivator is doing when he prepares his soil, sows seed and protects the crop till the harvest. But why should these tiresome forest people keep village cattle out of a certain area for ten years in succession and punish people who set fire to the forests?

So long as the people of the country are not enlightened on the subject they cannot appreciate the necessity for forest restrictions.

To ensure continuity, the object of the Forester, of the Government and of the people should be one and the same not for a short period but through successive generations. A forest crop sown to-day may not be ripe for felling till 60 or 100 years hence.

The timber producing area is small, imports of timber are considerable so it is sound economy to the country to make the most of its forests. The Forest policy of the country is to produce a sustained yield of as much marketable timber and other produce as possible, making economical use of it, also to maintain and improve climatic conditions in the interests of water supply and agriculture.

Forests a fine investment. Development impossible if funds are stinted.

As it requires many years to produce a marketable crop of trees the Forester must look years ahead and plan out his fellings, plantings, thinnings, etc., for periods of ten years or more. For this purpose he frames working plans directing the future treatment of the forest on which depends the future yield. The timber is often in inaccessible hills where it is of no value until the country is opened up by roads. Shelter and water is also needed for the men who have to work in these wild places. There is much pioneer work for the Forester. No merchant will buy timber which he cannot extract easily.

The area of working is gradually extended from year to year. All this pioneer work requires funds. For continuous development the sum annually required increases. Development has again and again been checked owing to lack of funds. Carefully drawn up Forest budgets are subject to deductions by the Finance Authorities and must be approved in the Legislative Council, so it is always a struggle to obtain sufficient money to carry on Forest works. With so few people really interested in the subject the supply of funds is much too uncertain. Continuity in forest policy demands a continuous supply of funds to carry out works framed in accordance with settled policy.

With constant changes in Government this difficulty was overcome to a certain extent in England where a fixed sum was granted to the Forestry Commission for a period of ten years, the sum to be spent being annually presented to Parliament for approval.

There are still many forest areas in the Presidency, in Kanara, Surat Dangs, Khandesh and even in the Thana District where the Forest Department must do pioneer work before private enterprise will step in, consequently an increase in the yield from the forests depends on annual votes when the budget is under discussion in Council and the Forester's hands may be tied.

The necessary means provided, the Forest Department will give a good account of the work done from year to year, show a good profit and at the same time provide for the future prosperity of the country. Well managed forests are a splendid investment for any country and teak, the main product of the Bombay forests, will compete with any timber in the world.

Area of Bombay Forests.

The Reserved Forests in charge of the Forest Department, roughly 12,000 square miles, cover less than ten per cent. of the area of the Presidency and much of the area has too scanty a rainfall to grow anything better than small trees and thorny scrub bushes.

The Revenue Department hold 1,833 square miles of land classed as Reserved Forest but these are merely pasture lands and fodder reserves. They also hold certain tree-clad areas classed as Protected Forest set aside chiefly for the exercise of lopping privileges for the supply of *tahal* leaf manure for manuring rice fields and for betel-nut gardens. The total area of these lands classed as forests but not treated as such amounts to roughly 2,500 square miles.

Of the 12,000 square miles under the Forest Department much is on rocky hills in dry districts, such as East Khandesh, East Nasik, parts of Poona, Satara, Gokak in Belgaum District, all the Bijapur forests and much of the Dharwar forests. Such forests produce material for hutting, firewood, and fencing useful to the local inhabitants, mainly cultivators. They provide no timber for export outside the district.

This type of scrub jungle covers about 40 per cent. of the total area of Reserved Forest.

Another type of forest which can hardly be worked commercially is the ever-green along the crest of the ghâts extending from Igatpuri to the southernmost limit of the Presidency. This type covers roughly 13 per cent. of the total area. Though of little use commercially its preservation is necessary as it regulates the off-flow of the heavy monsoon, checking denudation and destruction by landslips to the fields in the Konkan. It holds up much water which gradually filtering down during the dry season maintains a steady supply of water for the Konkan people.

More than half of the 12,000 square miles of Reserved Forests cannot be classed as commercial and only some 5,640 square miles or less than five per cent. of the total area of the Presidency remain for the supply of timber for the market. At least three times this area would be required to make the country self-supporting and to provide for the industrial development of a population of some twenty-six million people.

Such a small area of commercial forests necessitates its careful protection and sound scientific management to obtain the greatest possible yield of timber.

Variety in types of Forest in the Presidency.

With a rainfall varying within the Bombay Presidency and Sind from 5 inches to 300 inches and with altitudes varying from sea level to 3,000 feet or more the forest growth differs enormously.

There are trees such as *kandi* (*Prosopis spicigera*) which thrive in the hottest and driest climate in the sandy desert plains of Sind.

There are the dry Deccan forests with rainfall usually under 25 inches producing mainly thorny shrubs and small trees useful only to the local inhabitants or as firewood for mills. Every stick these forests produce is utilized either for roofing the flat topped houses, for agricultural implements, or for firewood. Forests of this type are found in the Bijapur District, in Gokak Taluka of the Belgaum District,

in parts of Satara, Poona, in East Nasik and in parts of the Khandesh Districts. Though such useful woods as babul, khair and teak grow in these areas the growth is small and stunted, suitable only for supplying the local cultivators. The forests are on rocky barren hills often incapable of producing much more than thorny scrub and frequently full of Euphorbia and prickly pear. With the exception of *tarwad* bark used for tanning, none of the produce is transported to distant markets. Though of no particular commercial value to the Forest Department the preservation of these forests is important in the interest of the agriculturist.

The third type of forests with a rainfall ranging from 25 to 50 inches includes considerable areas of teak pole forest with here and there teak large enough to produce logs of about 5 feet girth. The timber is known in the market as 'Country Teak'. These forests with moderate rainfall include the more valuable Khandesh forests near Nawapur, Taloda in West Khandesh District, West Nasik and the Surat Dangs; they contain much herbaceous undergrowth with tall coarse grasses often 10 feet high and the tree growth has in the past been greatly damaged by forest fires. Somewhat similar areas without the coarse grasses occur in the eastern portion of Khanapur Taluka in Belgaum District and along both sides of the Kanara-Dharwar District boundary. This type of forest is of commercial importance yielding good revenue.

The fourth type of forest, with an annual rainfall of over 40 inches, fully exposed to the monsoon extends along the Konkan from the northern end of the Thana District through Kolaba and a part of Kanara.

Teak, Nana, Blackwood and Ain are the chief species with Kindal and Jamba—a tree very similar to the Burma Pynkado—becoming plentiful southwards. These species increase in height and diameter in the southern end of the Presidency where in North Kanara District trees of the above named species grow to a height of 100 feet with girth from 7 to 10 feet. Bamboos form a thick undergrowth. These are by far the finest timber forests in the Presidency.

A fifth type of forest stretching along the Western ghâts from Igatpuri to the southern end of the Presidency is the evergreen forest with rainfall ranging from 100 to over 300 inches.

The hill people on the ghâts for centuries practised shifting cultivation cutting down these evergreens, burning the trees and then raising crops for a couple of seasons before moving on to a fresh area. By this exposure of the steep slopes to denudation, though shifting cultivation was stopped some years ago, much of the hills were so washed by the 300 inches of rain that little but bare rock is left. Consequently the present evergreen growth is dwarfed as at Mahabaleshwar and traces of the original forest are only to be found in the vicinity of temples where the surrounding trees formed a sacred grove. In the Kanara District there are areas of considerable extent of the original primeval forest, real virgin tropical forest of lofty trees and dense luxuriant growth. The shade in the hot weather is dense, the atmosphere is always humid and temperature very even throughout the year, springs and small streams flow throughout the hot weather. Scores of different species are crowded together from evergreen shrubs to lofty giant trees 150 feet in height. These evergreen species are in full leaf in the hot weather, palms are

abundant, dense impenetrable cane brakes are common and the trees are often festooned with graceful creepers.

Though there are valuable evergreen timbers the cost of extraction is high and with so many species all mixed together such trees as White and Red Cedar, Poon-spar and *Artocarpus hirsuta* known as *Ainee* or *Hebbalsu* and *Gurjan* (*Dipterocarpus*), are often so scattered and in such inaccessible localities that few are ever felled. It is these evergreens which provide the moisture necessary for the betel-nut gardens in Kanara. Some of the finest evergreens are on laterite soil which if exposed to the monsoon and denudation becomes hard and barren rock.

Effect of Forests on Temperature and Water Supply.

The beneficial effect of forests on temperature and moisture is well known all the world over and instances of fertile countries becoming treeless, waterless deserts are numerous, more especially along the southern coasts of the Mediterranean Sea and in Asia Minor. Traces of old irrigation works and prosperous cities are found in now waterless deserts. Where ages ago there was abundant vegetation only sandy deserts are now to be found. Religious books, the Mahabharat and the Ramayan, handed down from ancient times, prove that dense forests, abundant water with perennial streams and fertile fields existed in many extensive tracts of land, which are now woodless and almost waterless.

Rarely can an area once rendered a barren waste by denudation of its forests be made to recover its fertility. The barren rocky hills in the dry Deccan will remain barren wastes for all time but where rainfall is ample devastated areas may recover in time. In the west of France the Landes about 2 million acres were a century ago a barren desolate country of sand dunes. By planting the area up it has been converted into rich land worth Rs. 1,500 an acre. Not only is the land producing quantities of turpentine timber and fuel from the forest but also fine crops of grapes and corn. The danger of the wholesale clearance of forests on hills is seen all the world over.

The Italians ruined their forests in the Appenines and the country has in consequence had to spend large sums in protecting railways, bridges, roads, towns from the sudden rush of floods whenever there is heavy rain in the mountains. The harbour of Pisa has silted up with the sand and gravel brought down by the rivers and the trade of the town has suffered.

A recent report from Melbourne shows that landslips in several places carried away the concrete channel leading the water supply from the reservoir in the hills to the town. The Engineer reports that the damage was primarily due to the wholesale destruction of the forests above the aqueduct.

It may be asked how can a forest have much effect on the water supply. To answer this consider the development and life of a single tree. What does a single banyan or mango tree growing by itself in the open do? The seed that gave birth to the tree may have germinated in a cleft of a rock. As the tree grows the roots exert great pressure and gradually open the cleft wider and wider. The power of roots is marvellous and instances of a banyan or pipal breaking up masonry or fort walls built up of large stones must have been observed by many. As the tree grows

its roots spread far and wide and break up the rocky ground, rootlets finding their way as tiny threads into spaces between rocks hardly thick enough to insert a slip of paper gradually grow till they may be a foot in diameter descending several feet into the ground. With many trees, bushes and herbs the growth under ground is nearly equal to the growth above ground. A Nim tree will send its roots 10 to 20 feet down. A Kandi tree (*Prosopis*) in Sind will send its main root down 50 feet deep and among herbs, e.g., the Indian vegetable 'mule' *Raphanus Sativus* the large root is often far heavier than the above ground portion of the plant. Where these trees and plants die and the roots rot much rain water can get down. Now what takes place underground when the tree dies off and its roots are rapidly eaten up by fungi, white ants, etc.? Obviously spaces are left to be filled with rain water and this water instead of rushing over solid rock down to the sea often working great damage to fields, houses, roads, bridges, etc., and carrying away much fertile soil remains on the hill sides and gradually percolates through the ground to feed some spring. To go back to the growing tree, the mango or banyan having stored up its water supply from the rains bursts out into full leaf in the hot weather. Moisture is evaporating daily from every leaf so that the tree is not dried up even though exposed to dry hot winds and the fierce heat of the sun for months in succession. This evaporation helps to cool the air and lower the temperature in the immediate vicinity of the tree. Also the soil under the tree is protected from the sun and the tree acts as a screen to check evaporation from the ground surface. The evaporation from the trees assists in the precipitation of moisture either in the form of dew or as rain. Not only this but as the old leaves fall to be replaced by a fresh flush the dead leaves on the ground act as a further check to evaporation from the soil and also retain some of the rain in the debris of leaves, twigs, bits of bark which are continually accumulating under the tree. These dead leaves as they rot off enrich the ground just as manure does and other growth, herbs, grass and tree seedlings are fed. The herbs and grass form food for worms, ants and insects which in their turn work up the ground, and increase its fertility.

By considering what a single tree does to regulate the supply of moisture both below and above ground, it is easy to realise the beneficial effects of forest on climate and water supply in a dry country periodically exposed to drought and famine.

The forests contain a hundred or more trees to the acre and where a hill side of some thousands of acres is well covered with forests the effect on the climate and water supply is considerable.

The effect of forest not only increases the rainfall but it raises the water level underground in the fields below forest clad hills. Careful experiments in Europe have proved that, whereas in open bare ground on the hills less than 5 per cent. of the rainfall percolates to a depth of two feet into the ground, over 50 per cent. may be taken down to that depth in the forests. People who have not had an opportunity to study the effect of the growth on water supply are often inclined to regard the benefit of forests as theoretical. There is nothing theoretical about the subject as the effect is a plain practical fact and failure to realize the effects of forests on climate and failure to preserve forests have rendered desert vast areas of once fertile lands.

With so many instances of fertile lands being turned to desert wastes through the destruction of forests, how is it that in past centuries wholesale devastation was indulged in all the world over?

In the first place the timber was of no value beyond local supply and the supply being far beyond local requirements the destruction of the forests was a necessity and beneficial to the local settlements whose object was the clearance of forests for cultivation and to provide pasture for their flocks. The forests could only be regarded as an obstruction. By cutting down and burning the trees the ground was in good condition for raising crops for a year or two and shifting cultivation is an easy mode of culture still in favour with the aboriginal hill tribes; in this no ploughing, no weeding is needed, the forest fire does the work. In ancient times even the finest teak tree had no value, for logs could not be transported many miles and sold at a profit, nor could people travel rapidly over the wide world and witness the effects of forest devastation. Who could foretell that the destruction of trees from Morocco eastwards to the Himalayas including many parts of Asia Minor would result in fertile lands being converted into sandy deserts for all time?

Public interest in Forestry. Need for propaganda.

In European countries where Forestry has long been practised and the public have learnt to take an interest in silviculture and understand its objects more or less, the necessity for restrictions is fully realised and the forest guard is not less popular than the cultivator but in Canada and America where the public are only just beginning to realise the value of forest to the country, at present much money and energy is being expended in forest propaganda in order to stir up public interest in Forestry.

The forests in this Presidency are generally situated where the people are uneducated, what is more unfortunate, very few educated Indians get an opportunity to see anything of Forestry, the majority passing most of their lives in towns and in the larger villages such as are seldom found near good forests. All the interest and pleasure of studying wild life in the forests is lost. No literature is so attractive to the youngster in European countries as adventures in the wilds and such books as "The High Lands of Central India" by Forsyth and Saunderson's "Among Wild Beasts" published many years ago are read again and again. What a joy "Wild Animals in Central India" by Dunbar Brander recently published will be to the school boy in England! How attractive the study of the habits of the wild beasts in company with a few Bhils, a people who are full of woodcraft and interesting jungle information.

When will the youth of India awaken to the pleasures of the study of nature in its homes in the hilly tracts and turn his attention to forests? Until such time whence is the genuine Forester to be recruited? There are far too many instances of men who have entered the Forest Department through necessity, attracted entirely by the pay list, whose whole being revolts against the life and whose desire is to serve not in the finest forest areas but in the worst as the members of a Rangers' Conference recently indicated.

With the High Schools and Colleges situated in towns rarely would the Indian student at school or college have an opportunity of entering a forest and he does not take the opportunity when he gets it. In many countries children begin to take an interest in birds, wild flowers, rabbits, etc., as soon as they can talk. Their mothers introduce them to the delights of nature. Consequently when at school they are fond of roaming through woods in search of birds' nests and many become remarkably quick at discovering a nest, they get to know all the different trees and can recognize the different birds by their notes, they know the butterflies, they join the Field Club at their school and contribute specimens to the School Museum and make collections of plants, birds' eggs, fossils for themselves. Having developed a taste for natural history in their youth it is not surprising that many later in life become interested in Forestry. Though they may be living in a town in business as a clerk, when on a holiday, a ramble in the woods is a joy to them.

Conditions in this country are such that public interest in Forestry is practically unknown. Forest Officers usually take an interest in agriculture. They like to see good crops and enquire of the cultivator how his crops are, but has any Indian Forester ever met an Indian outside the Forest Service who has enquired about the forest crops? Yet the forest crop and results of the past season's planting is the usual topic of conversation when Forest Officers meet just as among cultivators with their crops. Is it impossible to awaken public interest in Forestry in this country, a true *swadeshi* business of considerable benefit to the country in recent years and promising much greater benefit in the future? The apathy of the public is a handicap to the Department.

People are not likely to vote money for a concern in which they are not particularly interested; fortunately many are business men who know money is needed to run any commercial concern successfully and they recognize that forests do pay.

The public have as yet taken little or no interest in Forestry beyond the utilization of its products. The progress of the Department owes much to forest contractors and merchants but it must be realized that in Forestry as in Agriculture the production of the crop is of first importance. Unless the Forest Department produces good sound timber of the best species the whole Forestry business will languish and fade away. The country has an Agricultural Department which has come into existence in order to investigate means for producing good crops. Any improvement in seed, in methods of cultivation and so on adds to the wealth of the country. In the same way good management and scientific treatment of forests increases the yield per acre. Few forests in the Presidency give a net annual rental of over Rs. 3 an acre. It has however been shown that it is possible to work this figure up to Rs. 30, the return is even higher from first class soil in the Nilambur Forests planted three-fourths of a century ago by Conolly who was murdered in a Moplah rising nearly 70 years ago. Just as a really good field crop rewards the agriculturist's labours so a fine crop of teak seedlings and saplings gives unbounded joy to the Forester who sowed the seed and attended to the seedlings. In his loneliness away in the hills rarely can he find anyone to appreciate and admire his work and only too frequently his work is partly destroyed by intentional firing of the forests by villagers. After several seasons' hard work in scorching sun in the hot weather he may succeed

in keeping out those devastating forest fires with the result that the stock of trees improves rapidly but not a single individual he meets outside his own service is in the least interested in his success.

Canadian and American interest in Forestry.

It is interesting to watch the progress in public concern in forests in a country like Canada where Forestry Associations are growing rapidly and the rising generation including over 120,000 boys, not one per cent. of whom will ultimately take up tree-growing as a profession, are keenly interested. Even school girls have followed the example of their brothers and the following is a sample of many essays on Forests written by Canadian school girls :—

"In the following paragraphs I will try to describe what Forestry is and how necessary it is for the present and for the future.

"Forestry is the name given to a scientific system of handling woodlands. The work of the forestry service includes the preservation of woodlands, the reforestation of areas which have been cut over ; the planting of regions which have been treeless ; the setting aside of forest reserves, the prevention of fires, and reformation of wasteful methods of lumbering.

"The value of the forest is very great. In Canada, lumbering is second in importance only to agriculture. Everyone recognizes the beauty and charm of the forest and we all realize the protection and shelter which the trees give to birds, to flowers and to animals. One of the most important uses of the forest is in preventing rapid evaporation. In open country the water is carried off by the streams as soon as it falls but where forests are present the water is held by the thick bed of moss and leaves and is let go gradually. When the forests are cut the water flows off quickly and great floods are the result. Forests prevent streams from flowing too quickly and thus wearing away the land. In some countries millions of acres of land have been destroyed by rushing rivers. Trees are a protection against wind, and the wood is used as fuel. Forests give rise to many industries.

"The industries resulting from the forests give employment to many. Among these are the cutting of the trees, the making of dressed lumber and of paper, the manufacturing of matches, boxes and furniture, and the building of houses. All of these help to fill the pay envelopes of many, so our forests should be regarded as a great gift.

"Every year large forests are destroyed by fires which are often caused by campers leaving their camp fires burning and by careless smokers throwing away lighted matches. Settlers, clearing their land, are often the cause of forest fires when they carelessly set fire to the brush they have cleared off the land. The earliest settlers burned much valuable timber simply to get rid of it. These fires not only destroy the forests, but often destroy towns and villages resulting in a loss of life. When the trees are burned there is no protection from the wind and instead of beautiful trees we see large areas of burned logs and stumps. There is also no home for the birds and consequently the crops suffer from the insect pests. Forest fires help to destroy the industries at which so many are employed at the present time, and if it were not for the work of the forest service the supply of timber would soon become limited and there would be scarcely any for use in the future.

"In order to prevent forest fires the forestry service has placed fire rangers throughout the country. These men patrol the huge forest districts, and by reporting and fighting the fires considerable timber is saved. Notices have been placed throughout the forests warning people about leaving fires burning. In the prevention of fire the forestry service has done remarkable work.

"Our forests being so useful in providing necessities and comforts, it should be the aim of every citizen to do his utmost to conserve this wonderful wealth of our country and every boy and girl should endeavour to become a junior Forest Guard, pledged to do his or her utmost to prevent forest fires from starting."

In spite of fire-lines and other precautions the Indian villager, interested only in the grazing, is often quite unconscious of the damage to the tree-growth. Fires may be caused by shikar parties hunting hares, small deer, etc., by men smoking out bees to obtain honey and wax or while smoking out a Ghorpad, a large lizard considered a great dainty by hill Marathas, by carelessly leaving embers burning after cooking food by the wayside; many forest fires however are undoubtedly intentional. Not only is the young tree-growth damaged but forest contractors often lose heavily, as much as 10 to 20 thousand rupees worth of teak logs being destroyed in a few hours.

Probably some scores of hot weathers will pass and crores of rupees worth of teak trees will be destroyed by fire before the rising generation in the Indian villages will produce essays of this merit.

The Forestry Association in Canada formed mainly to check damage by forest fires is supported to a large extent by subscriptions from private firms and individuals who subscribe about Rs. 60,000 a year.

It would be a great benefit to Bombay if the educated public would interest themselves in forest protection.

In Canada forest protection has been taken up in comparatively recent times only. Obviously school teachers have taken an interest in the matter and are educating the young in the fundamental importance of fire protection. Even aircraft and wireless telegraphy are freely used to detect outbreaks of fire and to obtain assistance as quickly as possible. Patrols also are provided with instruments for signalling and telephoning for help. Evidently the Canadian public are readily realising the importance of fire-protecting their forests.

Timber a Crop and not a Mine.

Some interesting statistics are to be found in the year book for 1922 of the United States Department of Agriculture.

It is here stated that much of their industry has developed upon cheap and abundant timber supplies and that timber has been mined from the forests much as coal from the ground, that is to say all the best timber is cut out and the forests left uncared for and frequently completely destroyed by fires, leaving the land unproductive.

The rich virgin forests of the United States, some 13 lakhs of square miles in extent, about 100 times the total area of the forests of this Presidency and originally containing more than ten times as much have been reduced to one-sixth of their

original area. Up to the year 1880 the forest land cleared was taken up for agriculture, later as the demand for timber developed, forests were logged off far faster than agriculture spread and by 1920 many of the States had vast areas of idle waste land constantly increasing in area, the rate of cutting over forests being about 10 million acres annually.

The coal districts have been practically denuded of timber. Many paper pulp industries which represent hundreds of crores of capital have to import wood from Canada or bring it from distant areas. Consequently the average cost of wood at the mills has quadrupled in 20 years and the huge sum of 84 crores is spent annually on transport of timber alone. The States Pennsylvania and Michigan which formerly exported huge quantities of timber now have to import largely. Many States are now confronted with the problem of providing for their future timber requirements.

Some 5 million acres formerly under splendid forests in the centre of Pennsylvania is now referred to as "Pennsylvania's desert." Since 1921 over 2½ crores of rupees have been spent by this State in taking over some of this land for reafforesting it and a bill is before the Legislative Council proposing a loan of 8½ crores to carry on the work. Virgin forest in the United States of America is taxed (assessed) at about Rs. 100 to 200 an acre. While the hill areas cleared by lumbering and fires are taxed at Rs. 5 to 10 or even less, and in some States the land has to be taken over by the State and money found for restoring it. Think what this means to the future generation. Truly the reckless lumbering of the past 50 years has proved a calamity to the country. Many years will be required to reclothe these idle lands with forests and the State will be paying out money instead of receiving assessment from the lands.

With the exhaustion of their forests, paper pulp factories, hemlock tanneries, cooperage plants, furniture factories, sawmills, etc., have in many places disappeared, water supply has been impaired. Consequently branch railway lines have been abandoned and the local farmers losing their markets and transport facilities have been forced to give up cultivation.

The lesson learnt from America is that forests must be so worked that the yield of the produce required in the country must be continuous, otherwise prosperity will not be permanent. Continuity in sound forest policy is essential. A good forest destroyed in a year often cannot be reproduced in a century while with good management not only will a good natural forest produce a steady yield but the yield can gradually and surely be increased. The public should realize this and look upon the preservation of forests from fires as every man's duty.

In the Bombay Presidency the Kumriwalla by shifting cultivation in the hills has rendered many hills barren and has to the detriment of the surrounding country caused springs to dry up all along the Western Ghâts. Traces of the virgin evergreen forest which is undoubtedly the natural forest of the Ghâts from Thana District down to Kanara may be seen here and there. Whence were those great beams let into the rock roof in the Karla caves obtained? Probably at no great distance from the caves as traces of virgin forests are still to be found not far distant.

Changes noticeable in this Presidency.

Changes through wholesale destruction of forests have taken place so rapidly in America that the loss to the country's economy is evident. Similar changes must have taken place centuries ago in this country. Take for example the Navapur Taluka in West Khandesh where the lands were some three or four centuries ago famous for the rice they produced. Traces of very ancient masonry dams are found where now water is too scanty for the dams to be of any use. The cultivations were no doubt abandoned owing to wars followed by plundering and continual dacoity by hill tribes. Up to quite recent years the Bhils were in the habit of burning all the forests in the hills and this would naturally lessen the steady supply of water in the plains below.

These plains were abandoned as no cultivation was safe from the Bhil dacoits. The area remained an idle waste for about three centuries and has only recently been opened up for cultivation extensively but when brought back to cultivation rice cannot be grown to any extent and the fields are almost entirely cotton, jawari, etc. If fires are kept out of the surrounding hills the run-off of the monsoon rains will be checked and water supply will improve little by little.

The area of cultivation in Navapur has increased in 20 years from 15,227 acres in 1902-03 to 180,922 acres in 1921-22.

The yield of timber and fuel, etc., from the forest is rapidly increasing.

In Sind, the Northern and Central Circles the inhabitants are gradually getting the better of their natural enemies, malaria, man's greatest enemy, and pig the chief destroyer of crops.

The condition of the people and of their crops has improved considerably in the Khandesh Districts and in the Surat Dangs.

It is the very reverse in certain forest areas in the southern end of the Presidency.

In the Southern Circle in thinly populated areas of Kanara, Supa, Yellapur, Mundgod and adjoining areas in the Dharwar District, where there are no hardy indigenous hill tribes, malaria and pig keep down the population and cropped areas. These very localities suffered severely from the influenza epidemic in 1918. Since then cultivation has been going rapidly downhill.

Solid permanent fencing of large culturable areas is absolutely necessary and this should begin in Kanara rather than in Dharwar District. If the Dharwar ryots fence off their fields before the Kanara above ghât cultivations are protected the damage to crops in Kanara will increase and cultivation may become impossible.

Already the cultivated areas in Yellapur Taluka with Mundgod Petha have fallen from 32,000 acres in 1902-03 to 19,000 acres in 1921-22 and in Haliyal Taluka with Supa Petha from 47,000 to 23,000 acres.

While areas under cultivation are increasing rapidly in forest districts in other parts of the Presidency, they are decreasing in the heavy forest areas above ghâts in Kanara.

In Bengal the Forest Department have found it possible to fence forest crops against deer and pig and it pays to do so. How much more necessary must it be to fence field crops? The return in the case of field crops will be far higher than in the case of forest crops.

Forest Settlements.

The Forest Settlement work was generally carried out by officers of the Revenue Department who visited each village and made exhaustive enquiries into the requirements of the villagers. The consequence is the area set aside for forests rarely includes lands fit for permanent cultivation. In parts of West Khandesh and the Panch Mahals districts which at the time of settlement were in a very backward condition, so backward that frequently over extensive tracts there were no settled villagers to consult, there still are a few areas which could with advantage to the country be disforested and brought under the plough. The Forest Department is doing its best to bring cultivators on to these lands and immediately there is a fair prospect of these areas being brought under permanent cultivation, they will be transferred to the Revenue Department. The total area of arable lands at present in the hands of the Forest Department is, however, small and the forests are almost entirely restricted to rocky hills.

Villagers' Privileges in the Forests.

The conservation of the forests and reproduction of timber is rendered difficult in many localities as the management of the forests has to be conducted in such a manner that the people may enjoy certain privileges. Considerations of revenue and sound forestry frequently take a subordinate position to the wants of the local villagers.

The privileges vary considerably in the different districts. In some the forest villages get free grazing and in others grazing is permitted on payment of a small fee, usually 4 annas a year per head of cattle.

All forest privileges are liable to revision by Government at any time should necessity arise. At the same time rarely are privileges once granted curtailed or discontinued and the claims of agriculture and the requirements of the cultivators always receive careful consideration. Privileges are usually recorded in the Forest Settlements.

In many ways Forestry and Cultivation are indirectly interdependent, the one helps on the other in most countries. Good forests attract capital, just as productive fields do. In some localities field crops are directly dependent upon forest produce. This is especially so in the Thana and Kolaba below ghât talukas where without *tahal*, crops are seldom raised. In the Kanara coastal areas few fields would produce a crop without leaf manure and the *supari* gardens above ghâts in Kanara require all the yield of green branches from nine acres of forest for one acre of garden.

The collection of dead firewood is generally allowed for domestic use but not for sale. Where bamboos are abundant the ryots are allowed to remove them for their hutting and for fencing their crops.

In the Konkan there are *tahal* and *rab* privileges under which the cultivators lop green branches and collect grass and leaves which they burn in the fields for preparation of seed beds.

Under these and various other privileges very large quantities of material are gleaned from the forests annually and the supply of this material is of great importance in the production of good crops.

Forests beneficial to local population.

In most districts there are long periods when the villager has not much work and during the intervals between tillage and harvesting and again after harvesting till the hot weather showers he can earn good wages on forest works. Forest contractors pay out many lakhs of rupees annually to woodcutters and cartmen.

As the forests are developed more money is circulated especially among the hill people who are generally very poor. It is estimated that more than 50 lakhs rupees are spent annually on felling and transport in the forests. To the Mavchis in Nawapur about Rs. 1,50,000, to the Bhils in the Surat Dangs 2 lakhs, to the Kolis, Warlis, Katkaris and others in Thana District 8 lakhs and so on in other localities. All these payments improve the condition of the people and soften the severity of years of scarcity when their field crops fail. Wages paid to forest labour increase from year to year. What could be better for the country than development of wealth from rocky hills quite unfit for cultivation, hills which not many years ago were mainly useless waste lands. Not only are these hills becoming more and more productive but as the forest crop thickens year by year more and more of the heavy rainfall along the ghâts is held up and gradually released to the benefit of the fields below.

Forest Fires.

After centuries of neglect and constant damage by forest fires raging through practically every acre each hot weather the Forest Department took over the forests in a wretched condition. The stock of timber was sparse and much damaged, fine teak trees being hollowed out by successive fires.

In many areas the value of the timber standing on the ground is a fraction of what nature could produce but for man destroying the natural growth by constantly burning the forests. Many large teak trees are hollowed right out by fire and few teak trees of more than 20 years of age have not suffered severely. Crooked, unsound, hollow timber is not wanted on the market, yet in many localities persistent firing results in a crop of timber mainly unsound.

The future yield of the forests depends largely on fire protection. The Forester's efforts to produce a valuable crop by sowing, planting, cutting back creepers, eradicating noxious weeds, thinning and by improvement fellings to prevent suppression of valuable species by inferior woods may be completely neutralised by fires. The whole-hearted support and co-operation of the public is required to prevent the damage. In countries where the importance of the forests is fully recognized by the public forest fires are almost unknown. In this Presidency protection from fire has been successful where the Forest Officer is in position to control the people as in the Surat Dangs where he has special influence over them owing to the fact that he is the Political Assistant. The Bhils do not like to go far for work and earn little or nothing except on forest works. Though the Surat Dang forests are dry and very inflammable, fires are kept under control with the result that the whole 640 square miles is better stocked with sound young teak saplings than any other forests in the Presidency.

Successful fire control is the fundamental requirement in all the teak forests, without protection from fire proper management is impossible and the natural yield from the forests cannot be realised.

Take for example the Satpura hills in East Khandesh District, a compact block of rugged rocky hills over 400 square miles in area, useless for any form of cultivation but capable of yielding teak and other useful natural products. At present the yield is almost negligible and these hills are little better than barren deserts. This unsatisfactory condition is entirely due to the constantly recurring forest fires. An enlightened public could at once check this devastation. At present people going up into these hills to bring down a load of grass, bamboos or firewood carelessly leave burning embers, whenever they light a fire to cook their food.

Necessity for Periodical Closure to Grazing.

Where the village cattle have large areas to graze over they are generally neglected and of poor quality. Frequently a herd of 100 animals consist of such small weakly beasts that hardly two or three good pairs for ploughing can be selected. Also the milk produced by the cows is often practically nil.

Where the ryot has to produce fodder crops for his cattle and stall-feed most of the year as in Gujarat the type of cattle improves.

Many cattle graze in the forests free of charge but the usual fee is 4 annas a year.

The average revenue of the past two years from this source for the whole Presidency is just under 4 lakhs or 5·6 per cent. of the total forest revenue. This is no compensation for the damage done to young tree seedlings in the forests. To bring a forest area into good tith a long period of closure to cattle is essential. Grass, dead leaves and other litter covering the ground is the natural manure without which the productive character of the forest deteriorates rapidly. If all the herbs and grass are grazed down and the ground is trampled the bacterial activity of the soil is lessened. The porosity of the soil essential for aeration is lost and its permeability for water is badly affected, the rain rushing over the hard bare surface. Without the natural cover of herbage which springs up after felling an area earth-worms cannot thrive. The amount of work the earth-worm does by opening up and working up soil is extraordinary and it has been shown that earth-worms will throw up 100 tons an acre within a year.

Not only do cattle render the soil infertile by keeping down vegetation but they also break up the surface with their feet loosening the earth so that much fine earth is carried down to the rivers during heavy rains. Millions of tons of soil and gravel are carried down the rivers into the sea and every pound so carried down reduces the fertility of the country. All the world over the bad effects of removal of herbage by grazing after felling trees on hills are well known.

In many parts of this Presidency cattle are turned into the forests without anyone in attendance. The grazing is of special value during the rains when the cattle have to be kept out of the young crops. At the same period there are young forest crops springing up on the recently felled areas requiring protection from cattle. The cultivator has no interest in the protection of the latter and he becomes annoyed when his cattle are impounded for trespass in areas closed to grazing. With some 2½ million animals grazing in the forests it is not surprising to find that perhaps 5 per cent. are impounded for trespass during the course of the year. However he gets his grazing absurdly cheap at 4 annas per head and many villages get free grazing and in most forests they can cut and take the grass free of charge. In many localities

the grazing is worth over Rs. 10 a head. Even on the rather bare hills near Poona private owners recently valued their annual crops of grass at Rs. 50 per acre, probably an exaggerated valuation. In Bengal the Beharias pay one rupee a month per head of cattle. In the Central Provinces the grazing revenue amounts to Rs. 10,68,783 and instances of Malguzars making considerable profit on the grazing are common. In one case last year a Malguzar paying the Forest Department 3 annas per head let the grazing at Rs. 3 per head. Similarly in Madras where the grazing revenue is Rs. 7,91,074 instances of ryots paying as much as Rs. 4 per head are recorded.

Forest grazing is of great value to the ryots and in all Forest Working Plans fellings are so arranged that grazing is always available and never more than one-fourth of the forest area is closed to grazing.

Damage by Man.

Besides intentional firing of the forests constant damage is going on all over the Presidency by people hacking down trees. The tendency is to cut the straightest and to cut young growth which requires no effort in cutting.

Photograph No. 1 shows a 12-year old forest which up to the age of ten years had grown well and promised to develop into a valuable stand of timber.



FIG. 1.—Promising young Teak Forest ruined by an outbreak of illicit hacking.



FIG. 2.—Mischievous damage to Sandalwood. Vigorous young trees hacked down before heartwood has formed.

The area was closed for ten years to allow the crop to get up without damage by cattle. On opening the area to grazing the cattle did no exceptional damage but the villagers ruined quite half the teak over an area of 150 acres.

The final yield of the damaged forest will not have one-fourth the value it ought to have.

Photographs 2 and 3 show mischievous damage to sandalwood and this too is over an extensive area. The trees felled are too young to give any sandalwood and are useless. The same area was wantonly burnt so that all the seedlings were killed. This area was in 1919 estimated to give an annual return of Rs. 30 an acre; now it is doubtful if it will yield material worth Re. 1 an acre.

In this neighbourhood there were about 10,000 acres of excellent young sandalwood which if given its natural course of development would have supplied sufficient sandalwood to bring in an annual revenue of three lakhs of rupees. It is doubtful now if the area will give a revenue of much over 10,000 rupees. The local villagers say that they were encouraged to destroy the forest by people from the neighbouring town.

Generally speaking damage is limited to occasional thefts of material for hutting and domestic use. Hill people requiring large teak leaves for roofing their huts find it easier to collect this by cutting down a few young teak saplings than by climbing bigger trees to cut off branches and collect the leaves. Saplings and vigorous young coppice growth have larger leaves than the mature trees.

Forest Restrictions.

Forest restrictions such as closure for regeneration of recently felled areas are often regarded by the public as unnecessary in this country. Closure is irksome to the neighbouring villagers. Even educated men will remark 'all this closure to cattle, protection from fire and so on is all very well in theory but really quite unnecessary. The villagers have been letting their cattle loose in the forests and all the hills have been on fire every year for centuries past and yet there are plenty of trees. Trees there were before protection but of little value. The crop of young teak seedlings or coppice shoots requires protection just as any agricultural crop does. Let a herd of cattle wander daily through a young crop of wheat or a cotton field, let a stray buffalo or two into young sugarcane and the cultivator at the end of the monsoon will find nothing but weeds of no value. It is much the same with a forest crop. If



FIG. 3.—Young Sandalwood killed by intentional firing of jungles. Bark of stems burnt completely away.

cattle get in before the young growth of teak is sufficiently developed the resulting crop will be worthless and full of forest weeds, that is, softwood trees, thorny bushes, creepers, mainly valueless. Forest cultivation is in many respects very similar to field crop cultivation. The crop of tree seedlings may fail owing to ill-distributed rainfall in one season and in the next a fine crop of seedlings may be obtained. In any case in this Presidency a good crop cannot be obtained whether of teak, babul or any other valuable species without much labour and attention. The ground has to be prepared in the hot weather and the forester watches anxiously for the rain. The work of the Forester which benefits future generations is as worthy of sympathetic consideration from the public as that of the cultivator. The forest guard Rama is quite a decent chap though he does wear boots and a khaki uniform. With good rains he raises a nice crop of seedlings in his coupe. Govind who cultivates a bit of rice and nagli near by grumbles about grazing restrictions and damage by pig but Rama is just as keen to destroy the wild pig as Govind.

It is a bit hard on Rama when some land-owner offers him a few seers of rice if he will allow cattle in his young teak crop. His pay is not much for himself and family and if he be tempted to fall in with the proposal he gets into trouble with the Ranger.

Working Plans and Sylviculture.

Working plans and Sylviculture are still in a backward condition throughout the Presidency. The reasons for this is that the Forest Department has had a long struggle to protect the forests from destructive hacking, from overgrazing and from fires.

Forests that are recklessly hacked, overgrazed and burnt will yield little or nothing and the Forest Department in this Presidency has been faced with the task of restoring ruined forests. By careful conservation valuable forests are being gradually built up and considerable progress has in recent years been made in sylviculture. Rangers, Foresters and Guards show far more interest in raising a good crop of seedlings than they did ten years ago.

The yield from an acre of forest increases under effective protection and skilled technical management so that the ground ultimately becomes well stocked with valuable trees. Neglect of sylviculture leaves the forest full of useless material, trees of various species which yield no marketable timber, just as neglect of a field in agriculture leaves the ground covered with weeds.

Sylviculture, the creation and tending of forest crops, is a subject in which the public have taken no interest in this country.

The taxpayer merely looks to the present financial return and every one wants to take something out of the forests regardless of the future yield.

Though the forest crop may not be ripe for felling for 50 or 100 years hence, the care of the crop from the seedling stage on is as necessary in forestry as in agriculture.

As in agriculture the forest crop should be managed to give the highest possible return from the soil not only for the present but for all time.

To get the best return from the land a close study of the locality, soil, rainfall and climate and of the growth of various species is necessary. Every acre should be closely inspected by observant trained forest officers. As much data as is required is

collected by the Working Plans parties who are out all day for months enumerating the trees and examining the rate of growth and so on.

Figures are tabulated and from these tables the rotation, that is, the age at which the trees should be cut is determined.

The technical management to ensure rapid growth of the more valuable species by cleanings, thinnings, etc., is prescribed.

The amount of money to be spent per acre on planting and cleaning must be carefully regulated. The value of ten rupees at five per cent. compound interest fifty years hence will be Rs. 114·67, consequently the trees produced by spending Rs. 10 an acre on planting and cleaning a crop which will not mature till 50 years old must return Rs. 114·67 or more.

The statistics should not only show the increase in the volume of timber at different ages but also the probable market value. While a teak pole of two feet girth may not be worth more than 8 annas a c.ft. a log of six feet girth may be worth Rs. 2 a c.ft. This may be termed quality increment.

To calculate the best possible return per acre the volume increment and quality increment for different ages must be worked out.

The trees represent the capital and the total capital value of the forests in this Presidency represents some crores of rupees. Decades of careful conservation has increased the capital considerably but nearly all the forests are still undercapitalised and care must be taken not to diminish the capital by overfelling. At the same time underfelling would be unsound forestry and care is taken to make full legitimate use of the forests by developing extraction of timber.

All working plans need revision from time to time to adjust them to market requirements and to introduce improvements in their technical handling as indicated by research work and knowledge gained by experience.

The importance of working plans can be realised when it is understood that these plans lay down the prescriptions not only for obtaining the greatest possible sustained return from the capital value of the forests but also for increasing by sound silviculture the capital stock. The best financial results possible can only be obtained by sound scientific forestry.

It is hardly to be expected that the public should recognise the importance of working plans when it is only too obvious to Forest officers that Local Governments never have realised their extreme importance. Recommendation to appoint a Utilization officer receives ready consideration as the appointment may lead to an immediate rise in revenue but any suggestion to appoint a Silviculturist meets with no response.

Forest improving wherever Fire Protection is successful.

The struggle to check damage by fires is as yet by no means entirely successful. However in many localities the suppression of fires has already resulted in a marked improvement of the growing stock. The old hollow crooked trees are replaced by sound straight growth little of which is yet ripe for felling. Generally the teak tree in this Presidency does not reach maturity till 60 to 120 years of age, the age of maturity varying with soil, rainfall, etc. Provided past efforts are sustained the forests

from Sind to the southern limit of the Presidency are sure to increase in value rapidly.

Improvement in the growing stock is noticeable everywhere.

In Sind the forests are improving and the regeneration of babul in felled coupes is very good.

In the Northern Circle the Panch Mahal forests are well stocked with young teak wherever the soil is suitable. In the Dangs and throughout Thana there are more straight sound teak per acre in the felled areas than stood on the ground at the time of felling and regeneration by seedlings is further increasing the stock. The area exploited annually is on an 80-year rotation whereas this is certainly on the cautious side and will probably be reduced to 60 years at the next working plan revision. Also there are considerable areas not exploited at present owing to want of roads. It is obvious that the possibility is not yet worked up to in the Thana Divisions. In the Mandvi forests (Surat) where strict protection was introduced more than 20 years ago a mass of dense growth of young teak and khair is found where a decade or two ago there was nothing of any value. In the Dangs fire protection work has produced excellent results, the whole country, an extensive area, is now covered with promising young growth of teak, khair and tiwas.

Regeneration.

Nature's laws appear extravagant in all that pertains to regeneration. Millions of seed produced annually in the forest develop into a few hundreds of seedlings and a small percentage of these succeed in developing into a tree.

An acre of rice giving perhaps 1,500 to 2,000 lbs. would be resown with 72 lbs. so that the yield of seed is about 25 times the quantity required to reproduce the crop. Similarly a fish will lay over a million ova (eggs) and perhaps all but one or two will be devoured or destroyed by natural enemies. Again in a bee-hive the queen will be mother of thousands of workers, females, and hundreds of males from whom one pair is destined to reproduce the next year's swarm.

The prolific seeding of trees and herbs seem a great waste of effort. On one acre of forest there may be fifty different species of woody plants, trees, shrubs and creepers (there are altogether over 600 woody species in the forests of this Presidency). Besides these fifty species one finds an undergrowth of many species of herbs, grasses (including bamboos), and perhaps over 100 different species of plants exist in a coupe, many of these producing enough seed annually to sow up the whole area and, if all the seed of any one species were to germinate there would be no space for the other 99 species.

Among the 100 species there may be only two or three trees worth growing.

What becomes of the millions of seed? Insects especially beetle weevils eat many, birds and rodents are daily busy searching out the seed they prefer. Fortunately teak seeds are enclosed in a very hard case nearly as hard as the shell of a coconut. The seed is not destroyed by fire and will retain its power of germination for two or three years and when once a teak tree is established it reproduces itself by coppice shoots.

If man keeps cutting out the valuable timber trees, worthless softwoods will increase in numbers and the better trees will disappear. The Forester is confronted with the problem of helping nature artificially to increase the proportion of teak and other valuable species to the exclusion of worthless material.

Sowing, planting, cleaning, that is, cutting back softwoods, creepers, etc., which grow over and continually threaten to crowd out the teak costs money and as the crop may not mature for many years expenditure must be kept down to a minimum or the finance of the forest will suffer. Thinnings and improvement fellings may give an immediate return but the earlier silvicultural operations are capital expenditure on the forest and in their execution experience and judgment are needed. Herein lies the art of successful forestry based upon years of close observation and study. Different localities require special treatment.

The crop of seed varies from year to year and occasionally the very tree which is to be cultivated fails to produce any seed. A heavy seeding often follows unfavourable climatic conditions or damage to a tree suddenly checking its normal growth. The Bhils hack round the trunk of the Mowhra tree to make it produce more flowers from which they distil liquor. This response to stimulus is nature's insurance policy for the continuity of the species if the tree dies.

A severe winter or a severe drought is often followed by profuse seeding of trees.

Sowing and Planting.

In Sind on the rich alluvial soil along the banks of the Indus regeneration by sowing is a simple work.

In the majority of the teak forests from the Panch Mahals to the border of Kanara the teak crop is raised from coppice supplemented by sowings in patches. About 20 patches or more per acre are required to obtain a good stock of seedlings.

Though the teak has wonderful coppicing vitality it is necessary to renew the stock gradually with seedling plants.

Natural seedlings of teak and other species appear after a few years' closure to cattle and fire. The establishment of the natural teak seedling is however a slow process and frequently other less valuable and faster growing trees fill up the area to the exclusion or suppression of the teak. A stunted, branchy ill-grown teak is not wanted and to obtain good straight clean material nature must be given artificial assistance. The process is as follows :—

Immediately after felling an area and removal of the timber all inflammable material, branches, leaves and so on, is collected and closely stacked in heaps. These stacks are fairly evenly distributed throughout the coupe. They must be well stacked to obtain a thorough burning. The fire not only produces plenty of ash manure but also kills off weeds right down to the roots. These patches, temporarily sterilized as regards weed growth, are sown with teak seed which has been soaked and steamed by the sun in heaps to hasten germination. The seed should be sown in May and by the end of the monsoon each patch should contain a dozen or two strong seedlings. In the cold weather the soil is worked up round the seedlings to protect them against drying up.

Many lakhs of teak seedlings are raised in this manner every year.



FIG. 4.—A clearing planted up with Teak in Kanara.

If the burning of the patches is thorough little or no weeding is necessary during the first year but the two-year old plants require attention or they may be smothered by weeds and creepers. By the time the crop is five or six years old weeding and cleaning is probably needed. Rank growth of useless species interfering with the teak and other valuable species must be cut back.

Planting is expensive but years of experience show that it is necessary in the Kanara forests where teak is mixed with several less valuable trees and where quick growing valueless species and bamboos constantly threaten to overwhelm the naturally produced teak seedling. It is the only method which has produced crops of teak worth many times the value of the original natural stand of timber. Without planting continual felling of teak would in time result in a serious reduction of the supply, natural regeneration being insufficient. In Burma the difficulty is to a certain extent surmounted by the taungya system, a shifting cultivation under which the rice crops are grown together with teak, the teak coming up immediately after the rice is harvested.

In an oak forest in Europe natural seedlings are obtained by gradually thinning out the mature trees, so opening the ground little by little to the sun. The process however usually requires a period of 30 years before the area is sufficiently stocked with seedlings to warrant the final felling of the mother trees. A similar system cannot be adopted in the teak forests as there are so many other trees in competition with the teak which in the best forests rarely forms more than 5 per cent. to 10 per cent. of the growing stock. Most of the forests too are full of bamboos.



FIG. 5.—View of four-year old plants in Kanara plantations.

The large thorny bamboo cannot be cut back except at a prohibitive expenditure. It sends up a few new culms every rains and these grow at the rate of a foot or more in a day in favourable weather. A shoot just budding at ground level about the end of June may be 60 feet or more in height by the end of September. The big bamboo seeds once only and then dies. It lives about 50 years and when the seeding period arrives all the clumps seed over vast areas. A seeding was recorded in 1864 and the last seeding was in 1913-14. It spread right through the Presidency with the rapidity of a virulent influenza epidemic. While it was seeding in Kanara it was seeding in Thana, Surat Dangs, etc.

At the end of the first rains after seeding the forest is carpeted with a dense mass of seedlings much resembling a crop of grass. It is difficult to deal with a weed which grows so rapidly and only flowers once in 50 years seeding so prolifically over very extensive areas. The cause of this gregarious seeding at 50-year intervals remains an unsolved mystery. Fortunately this particular species of bamboo gives way in some localities to other species which seed and die off in small patches at more frequent intervals giving the Forester an opportunity to get teak seedlings established in groups.

The process adopted is to select an area comparatively free of the large bamboo and covered with timber ripe for felling. The valuable timber is taken out and what remains is cut over and left to dry. In the hot weather the area is burnt and the ash provides a manure for the plants put in as soon as the rains have set in.

Photograph No. 4 shows a clearing planted up and photographs Nos. 5 and 6 give a near view of the 3 and 4-year old plants.

The process entails much labour and it is essential to get in the teak seedlings as soon as the rains have set in after the burning. Delay or failure to plant at the right time lets in weeds and the growth of weeds on areas cleared and burnt in Kanara is luxuriant. Any attempt to plant after the weeds have got in generally results in a poor crop which on maturity would hardly cover the cost of the work calculated at

4 per cent. compound interest. Though intermediate thinnings will produce revenue the final crop may be 100 years old before it is ready for felling.

Thinning.

Where the growth is rapid as in the babul forests in Sind and in Kanara forests thinning becomes necessary about the seventh year.

In other forests the first thinning may be at the age of 15 and perhaps again at the age of 25 or 30 years.

Clumps of teak coppice, where often four or five shoots develop from one stump, require thinning as well as the seedling trees.

The early thinnings produce no material of much value but most of it is useful to the villagers. The second and later thinnings bring in revenue but they must be carried out solely for the benefit of the remaining growth. Too heavy a thinning



FIG. 6.—View of three-year old plants coming into leaf.

will spoil a promising crop and revenue from thinnings is a matter of secondary importance. The whole object of the thinning is to give the best grown stems of valuable species room for development.

Improvement Fellings.

In all the naturally-grown woods there are many trees which give timber of no value interfering with the valuable kinds. The object of improvement fellings is to remove the inferior species and to clear overhead shade suppressing younger valuable trees.

Very branchy trees with large spreading crowns and unsound crooked trees are cut out so that well shaped teak and other valuable species may develop into marketable dimensions as rapidly as possible.

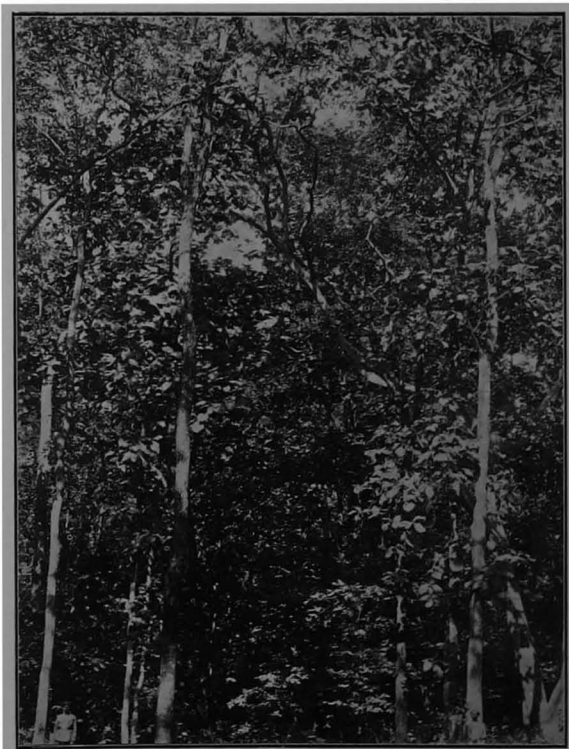


FIG. 7.—Natural Forest with the Teak, the trees with the big leaves, much overtopped and suppressed by less valuable species.

Large trees of inferior species are either felled or girdled to death.

Frequently the crowns of promising teak poles may be freed from overhead cover by lopping branches of inferior species.

Marking for improvement fellings requires care and discriminating intelligence. The leaf canopy of the forest must be preserved as far as possible.

Skilled woodcraft in this work will increase the value of the timber in the final felling considerably while a man who is unobservant and a bad silviculturist may do more harm than good.

Well conducted improvement fellings increase the annual increment of marketable timber on the ground and trees in-

stead of taking say 100 years to reach the dimensions required by the market, say, 6 feet girth, may attain that size in 80 years.

Photographs Nos. 7 and 8 show an area before and after an improvement felling. In the first picture the forest is a tangled mass and the straight young teak have no space for development, whereas the area after making the improvement felling is well stocked with good species straight and sound and with space for rapid development.

The object of these silvicultural operations is to obtain the greatest possible return in timber in the shortest possible time. The natural growth, the soil and the climate need careful scientific study. The Forester has to determine the expectation value of the area, that is, he has to find out what return is possible. The assessment of agricultural lands is a comparatively simple matter as only a few months are required to raise and harvest the crop whereas in Forestry fifty to one hundred years may be required to raise a crop ripe for the market and mistakes at the beginning of the period must be reckoned at compound interest for very long periods.

The utmost economy is necessary in sowing and planting and lack of scientific knowledge and practical experience make a serious difference in forest finance. A rupee at five per cent. compound interest amounts to Rs. 131½ in one hundred years.

'Let Nature be your Teacher.'

It may readily be understood that operations such as sowing, planting, thinning and improvement fellings may make or mar the financial return from any forest. The Forester must be a close observer of nature and must be endowed with physical



FIG. 8.—The same Forest as in Fig. 7 after improvement felling freeing the Teak, which can now develop into fine timber.

energy and activity to enable him to go through and through his forests day after day. Constant close observation of what nature is doing enables him to decide correctly upon the extent and nature of artificial help that must be given to get the best return. Assume for instance that the market value of a natural forest is Rs. 1,500 an acre and that 100 years is required to produce this forest. Good management and correct treatment may easily quadruple the capital value. This is an obvious and indisputable fact to anyone who has made a study of the subject and has compared private woods, where skilled Forestry has not been practised, with woods which have been under skilled treatment for say a century. No amount of lecturing in the class room can make a genuine Forester and Forestry has not been practised long enough in this country to demonstrate fully the results of sound treatment. For this reason men under training tour in France and Germany where woodcraft during past centuries has produced really fine forests and where the financial results of scientific treatment are on record. The Black Forests in Germany have been worked for production of timber for 700 years and they now produce more timber annually than previously. Compare this with the American forests, millions of acres of which have been cut over and destroyed under commercial management. The companies' sole object was to work out all the valuable timber in the quickest possible time and then move on to the next area. All the capital provided by nature is robbed and forests which under sound treatment would have given a fine revenue to the State for all time are rendered barren wastes; forests whose capital value was reckoned in millions of dollars are now not worth five per cent. of their original value.

The man who is endowed with a natural aptitude for Forestry is a great asset to the Department and to the country. His work may be worth a lakh of rupees a year to the tax-payer while the man who enters the service without any natural aptitude and is unable to develop the qualities needed is a mere obstruction and loss to the country. Every precaution should be taken by Government to enlist the right material and the best possible training should be given in countries where sound Forestry has been practised for generations past.

Transport.

The accompanying illustrations show the present methods of timber and fuel extraction. Elephants are remarkably clever with logs and it is always interesting to watch them dragging logs down the rocky bed of a nullah with the help of a fibre rope (bast) which they pick up with the trunk and place in their mouth between their huge Molars. Their movements are slow but with their weight of 3 tons or more the log moves and is deftly guided to avoid rocks and other obstacles. They dam the river shallows and guide the logs cleverly through a small opening in the dam. Figs. 9 and 10 illustrate them at work. Most of the elephant work is along the Kalinadi River which flows through a deep valley. In some places logs are dragged to the edge of the precipitous slopes to the top of a straight trench down which the logs go rumbling louder and louder as their speed accelerates until they dive into a pool and the valley echoes with a noise resembling field guns in the far distance. As the elephant brings the log to the very edge of the precipitous slope just balancing it at the top of the trench he turns about and walking to the other end of the log gives it a



FIG. 9.—Constructing dam for floating timber with help of elephants in the Kaneri River.

final kick which starts it on its headlong journey of some 2,500 feet before it reaches the river below. While watching the floating operations from a lofty rock logs each containing one to two tons of timber accumulated in the pool below look no bigger than matches and the elephants attending the floating operations appear to be little bigger than rats. Unfortunately elephants are expensive in Kanara. There is not much natural good food in the forests and besides collection of fodder by attendants a cook is busy boiling large quantities of paddy for the Hatti's midday meal. The owner of a well trained logging elephant expects Rs. 20 a day for its hire and a powerful male who works well is worth Rs. 7,500. It is obvious that the use of elephants in the forests is limited to areas where buffaloes cannot work and to timber of considerable value. An elephant while working requires several attendants, two mahouts and coolies for collecting fodder of which he consumes large quantities. In the natural state he feeds most of the day and most of the night, only sleeping 2 or 3 hours out of the 24. Mahouts are brought from Malabar and the contractors working with elephants at times have trouble with these men who know they cannot be readily displaced. On one occasion in the absence of a contractor all the mahouts went on strike demanding higher pay, the contractor sent a message refusing any rise in wages. The mahouts let the elephants loose. One elephant went into a supari garden and

commenced demolishing the supari trees, plantains, etc. The gardeners soon fetched a mahout and told him to chain the elephant up to a tree. The mahouts who were still on strike left the poor beast to starve to death. Such cruel treatment of one of these splendid animals sounds incredible and this disaster is recorded as a warning to contractors never to leave their elephants without making sure some responsible



FIG. 10.—Elephants passing logs through the dam on the Kalinadi River.

persons are watching them. In ninety-nine cases out of a hundred the professional mahout is devoted to his charge and sickness among the establishment was probably more or less the cause of the disaster.

Exploitation in Kanara.

From 1884 to 1888 the revenue in the Southern Circle derived almost entirely from the Kanara and Belgaum forests was equal to that of the rest of the Presidency including Sind. All the logging work was carried out by Waddars, a fine sturdy hardy people, who in other parts of the Presidency are well known as the best labourers available for stone quarrying and heavy earth works. With the construction of the Southern Mahratta Railway and development of Hubli as an industrial centre these Kanara Waddars who lived mainly along the Kanara-Dharwar borders deserted

their hamlets and moved into the open country. It has proved difficult to obtain sufficient logging carts and axemen since, but timber contractors managed to bring in sufficient carts and woodmen until the rise of wages towards the end of the war and the severe outbreak of influenza in 1918. This outbreak was disastrous in the above ghât areas of Haliyal, Supa, Yellapur and Mundgod and it spread with extraordinary rapidity in spite of the sparse population scattered in small villages and hamlets often some miles apart. Many of the best workmen were carried off by this scourge in the prime of life. This thinly populated country has never recovered and many villages have remained unoccupied ever since the outbreak. Acres and acres of good well-watered rice lands still remain as grassy wastes, a depressing sight to those who have seen year after year fine crops of rice and sugarcane occupying these same wastes.

Some of the Kanara logging contractors, who in most cases owned some of these lands have never recovered and though most of them have struggled on with their forest work scarcely any have been able to command sufficient labour and capital to carry out more than a fraction of the work undertaken. This has prevented any development in forest exploitation during subsequent years in Kanara, what is worse it has resulted in the contractors falling into debt and in some instances to their inability to work off advances made to them for logging work. The Divisional Forest Officers have found it difficult to carry out the usual logging operations and depôts are rapidly becoming depleted of stock for the annual sales. In recent years little more than 25 per cent. of the quantity of timber which should be exploited has been delivered at the depôts.

To remedy matters a special exploitation staff of Forest officials has recently been sanctioned by Government and the Engineering branch is preparing to assist in the logging work. Special hauling machinery has been purchased from America and it is interesting to see in the 'Indian Forester' for December 1923 an account of successful logging operations at Sukna in the Kurseong Division of Bengal where mechanical methods of extraction on American lines was successfully carried out last season by the Forest Engineer and Divisional Forest Officer.

Labour saving methods are badly required in Kanara without which the quantity of timber exploited must remain far short of the possible yield of the forests.

An American winch worked by a Fordson tractor engine promises to be useful for hauling logs out of difficult places.

It is encouraging to learn that in Bengal mechanical methods have proved financially successful. Sal forests which gave a return of Rs. 750 per acre worked by the bullock cart now give a return of Rs. 1,280 per acre using a steam skidder.

With the rise in wages labourers are more independent, more difficult to secure and work for shorter hours than formerly. The logging work is not so well done. The standard of living is perhaps a little higher and where the Forest Department set up a sawmill shops may be found with a considerable variety of articles. During the heavy monsoon little work can be done in the forests and in the fair season the demand for carts and woodcutters is generally far in excess of the supply. In Kanara the lack of labour is a permanent obstacle to progress. Here the population is sparse and in the adjoining districts, Belgaum and Dharwar, the cultivators are better off than formerly and can afford to enjoy an easy time after the harvesting. From Goa too less labour is available than formerly.

Cartmen who do come on hire are mainly from the poorer hilly areas where cotton and jawari are not grown and the lands cultivated yield chiefly nagli and sawa (wari) crops that give a poor return quite insufficient for the maintenance of the ryot and his family.

Sawmills.

With the completion of survey of several roads and the construction of important bridges the Engineering staff is now able to devote more attention to sawmills and logging engineering.

The main object of setting up sawmills in the forests is the prevention of waste of timber in the fellings. Practically every mature teak tree has at some time in its life of perhaps 100 or 150 years suffered damage by fire and the butt ends and tops could not be placed on the market without conversion in the forest. Transport charges of material worth in the sale depôt perhaps only Rs. 40 a ton would often leave no profit but when converted in the forest sawmills perhaps 50 per cent. of the material is worth transporting a long distance.

Small transportable sawmills help materially in making the best of the timber felled. Sound logs are usually taken to the railways and sea-ports for sale in the log.

Seven Government sawmills are working in the forests, four in Kanara, two in the Surat Dangs and one in Peint (Nasik). The main product from the mills is railway sleepers for which there is of course a constant demand. The mill hands are recruited locally and considerable difficulty is found in maintaining the full staff. Trained benchmen fall sick and leave; fresh men have to be trained. Progress under such conditions is difficult. Saw sharpening, tempering and tensioning is another obstacle as good sawing is impossible unless the saws are kept in order and failing proper treatment expenditure on saws becomes very heavy. Since a Saw Doctor (why isn't he called a Saw Dentist) from England has been employed, the condition of the saws and the sawing is much improved. Even Bhils have been trained in the art of saw sharpening. From time to time private persons have started sawmills in the forest but usually without success and the outturn of these private mills compares unfavourably with the Forest Department mills, though the plant laid down is in no way inferior. The contractor's sawmill at Waghai in the Surat Dangs has been better equipped than the Government mills; the outturn however is inferior.

It is hoped that all these Government sawmills will in the near future be taken over and run by private agencies who will undertake the felling and collection of material to feed the mills. With good management there is money in the business and the Forest Department should merely be the pioneers in it. It may be asked if the Forest Department has for years been running sawmills in the forests and there is good money in it, why has private enterprise not stepped in long ago. The answer to this is that the men who have attempted the business do not live in the forests but try to manage the mill from the nearest town perhaps 40 miles distant. This is another instance of the innate dislike of the educated Indian to real forest life. Wild nature so attractive to educated people in many countries has no attractions to young men in this country but rather the reverse.

Forest Engineering.

The Forest Engineering Branch is in its infancy. Development of much of the finest forests is dependent on the efforts of the Forest Engineer. As yet the time of the staff has been fully occupied with road construction, often in difficult hilly country where mountain torrents are to be crossed and the roadway has to be hewn out of solid rock along the precipitous hill sides. The rainfall in these hills is often very heavy and at times it amounts to 10 to 15 inches a day for two or three days in succession and occasionally 100 inches fall in one month. Road construction under such conditions needs experienced Engineers or bridges constructed will be constantly carried away and landslips will render the roads impassable. So far the works carried out under the advice of the Engineering Branch have proved eminently successful. Houses for the Forest staff are now built of solid lasting material and are of good workmanship considering the difficulty of obtaining artisans in the wild remote areas. The construction of most of these works is carried out by the Divisional Forest Officer and his staff with surveys, plans and estimates provided by the Forest Engineer.

Among the roads recently opened to timber traffic the Subir road in the Surat Dangs leading to Nawapur Station is a heavy bit of work carried out mainly with the help of Bhil labour requiring close supervision, patience and tact on the part of the supervising officers.

This road which leads to Nawapur Station on the Tapti Valley Railway enhances the value of the Dang timber enormously and the money spent on the road will be more than covered within two or three years of its construction. Where roads have been opened in this rugged Dang country teak has been sold for over Rs. 100 a ton standing in the forests while not many years ago contractors would not pay more than Re. 1 a tree and even in Nawapur taluka contractors years ago paid only 4 annas a tree for conversion into railway sleepers which they sold to the Railway at Rs. 4 each, Government getting about 1 per cent. of what the trees would be worth now.

Sind Forests.

The area of forests in Sind is 1,119·4 square miles and the chief species are babul, lye (Tamarix), kandi (Prosopis), bahan (the Poplar) and tali or shisham. Areas which are inundated by the river annually are generally under lye and babul and the Forest Department are gradually extending the area under babul.

Extensive areas in Upper Sind get little or no rain and no inundation, and kandi is practically the only tree that survives.

Cultivation of the babul commenced about 1858. The seedlings suffer much from frost but with careful cultivation dense crops are raised. There is not much demand for babul timber; the market for fuel and charcoal however is constant and the forests are fully worked.

The timber is used in local buildings, for country carts, agricultural implements and a small quantity is taken for the Gun Carriage Factory at Jubbulpore. The fuel and charcoal which is of good quality is exported to the Persian Gulf and considerable quantities go to Cutch, Kathiawar, Quetta and the Punjab.



FIGS. 11 and 12.—Methods of transport in Sind.

The babul forests are worked on a 30-year rotation. The bark is used for dyeing and tanning, the pods and seed are a valuable cattle food, the leaves also are eaten by cattle. The gum serves various purposes and the root bark is used in the preparation of country spirit. The babul is the host plant of the lac insect. It is in fact a tree of considerable economic importance.

Wherever fellings are in progress the sound of the axe is the signal for goats to collect for browsing the leaves from the felled trees. Cattle and camels also browse on the green leaves and a felled tree is soon stripped of all its leaves.

A babul felling entails much labour. Axemen, sawyers, charcoal burners, cartmen, camelmen, donkey boys are busy all over the coupe and boats are employed in carrying the material across the Indus. A contractor paying Rs. 1,000 for a coupe must spend more than Rs. 3,000 on labour. Every available source is tapped and

it is a surprise to hear people talking Kanarese, imported all the way from South Kanara District. Figures 11 and 12 show the means of transport, camels doing most of the work, even children ply their donkeys.

Nothing remains in a coupe but small branches which are heaped up and burnt. Occasionally the area is given out for cultivation of field crops for one year and the babul is sown as soon as the crop is harvested. Figure 13 is an area cleared and ready for sowing, in the background is a two-year old plantation. A dense thorn fence round the coupe protects the young seedlings from damage by cattle and goats. Only a short period of closure, two or three years, is necessary so far as horned cattle and goats are concerned, but camelmen and their beasts must be excluded for longer periods.

The sowing is done in May just before the floods and the seed may remain under water a fortnight to six weeks.

Figure 14 shows a portion of a coupe in which the seed has failed to produce any crop with a 17-year old plantation in the background. In such places the ground is lightly ploughed in strips after the floods have receded and the drills are sown with babul. The small seedlings in the drills show only an inch or two above ground in February and escape damage from frosts.

Figure 15 shows a babul plantation, 20 feet in height, 2½ years old, partly cleaned. This cleaning gives the young growth space to develop rapidly so that at 7 years of age the trees are about 26 feet in height and a thinning yields 225 c. ft. of fuel an acre giving a net return of Rs. 7 to Rs. 8.



FIG. 13.—An area clear felled and ready for sowing in Sind.



FIG. 14.—Area drilled for sowing Babul seed. Seventeen-year old Babul Forest in background.

The second thinning is carried out at ten years and yields 250 to 300 c. ft., net value about 12 rupees per acre. Further thinnings at the age of 15, 20, and 25 years give about 15 to 20 rupees an acre, net royalty, and the final felling at 30 years yields 160 rupees an acre.

The net annual return from the babul forests of Karachi and Hyderabad Divisions including minor produce, pods, seeds, lac, etc., averages about Rs. 8-4-0 an acre.

The lye forests at Sukkur are cut over at about 15 years of age and poplar which coppice freely and grows very fast could be cut over at 7 or 8 years of age for rafters and for matches. Young poplar appears to be a more promising wood for a match factory than any found in the Presidency proper. There is a local industry at Khanote and Halla where cots and other articles are made from bahan and are lacquered.

The cotton mills in Larkana and other parts of Sind use babul and lye fuel.

Satpuras in East and West Khandesh Divisions.

The Khandesh forests cover a large area of the Satpura hills. In East Khandesh about 400 square miles form one solid block in the Satpuras and in West Khandesh 873 square miles.

In both districts the forests were until recently given up more or less to the Bhils. Not until 1911 was the privilege of bringing down cartloads of wood for sale stopped. The Tadvi Bhils in East Khandesh cleared most of the valuable material and in West Khandesh where there are a very large number of Bhils the forests were also pretty well exhausted. With the advent of the G. I. P. Railway in the sixties there arose a demand for timber and Railway contractors were allowed to get the wood, mainly for railway sleepers, free from the Satpuras. Special privileges were allowed the Bhils to keep these turbulent people quiet. Their means of livelihood was the supply of timber and firewood to the inhabitants in the Tapti Valley plain. If deprived of this, robbery was their only means of support and they were only too ready to resort to it. Gradually the inhabitants in the hills in East Khandesh found work in the plain and in West Khandesh also where cultivation is extending many now work in the fields, cotton presses, etc. The forests at last have some rest and are in West Khandesh rapidly recovering. The Nawapur and Taloda forests are beginning to attract the attention of Gujarat timber merchants. Owing to constant fires which rage over the hills when the hot dry winds are blowing the recovery of the East Khandesh area is checked and the yield of useful timber is extremely small.



FIG. 15.—Two and half year old Babul showing portion cleaned and portion to be cleaned

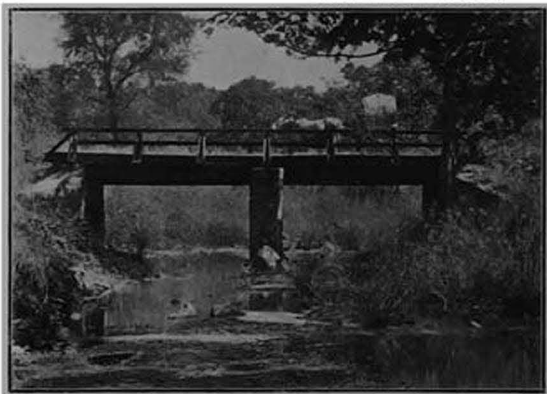


FIG. 16.—Lime masonry culvert with Teak timber top in the Surat Dangs. Spans 14 ft., clear headway 8 ft., road width 16 ft. Cost Rs. 1,700.

Forest Development in the Surat Dangs.

The Dangs forests are not State forests but are leased to Government under a treaty with the Dang Chiefs made in 1844, by virtue of which Government own the right to the forest produce. This area of 660 square miles of rugged mountain and valley is situated between the South Gujarat plain and the crest of the Western Ghats in Nasik and Khandesh. Inaccessibility and the malarial climate have been the

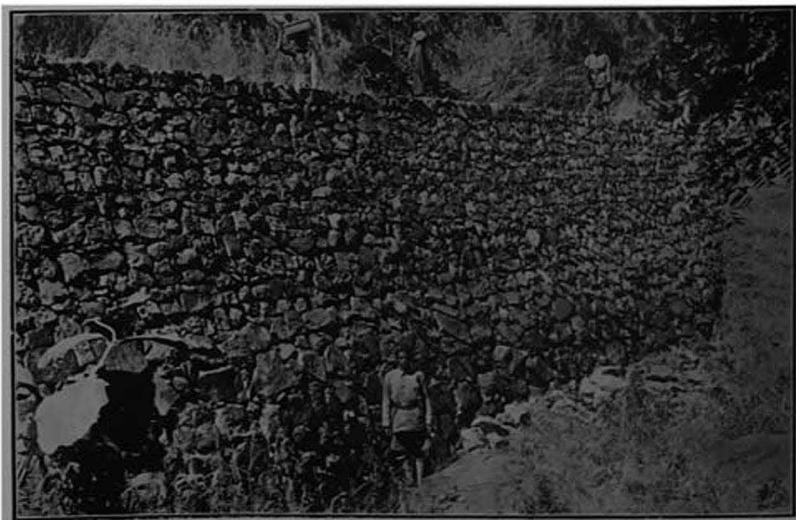


FIG. 17.—Retaining wall on the Subir-Nawapur Road (Surat Dangs). Constructed with Bhil labour. Length 103 ft., height $17\frac{1}{2}$ ft., and top width of wall $2\frac{1}{2}$ ft. Cost Rs. 1,121.

chief obstacles to the development of the forest industry, but from about 1820 to near the end of the century was carried on an almost continuous extraction for the Navy of the fine large teak for which this tract was famous and the high value of which compensated for the great expense and difficulty of its removal. All the time that the forests were being depleted of their picked timber with no measures for its reproduction, they were also being burned over annually by the Bhil aborigines who practised the destructive system of cultivation known as *Kumri*, i.e., cutting down and burning the jungle and sowing their crops in the ashes, by which practice the older trees even if not hacked over were scorched and hollowed out by the fire. It will not then be wondered at that the later decades of last century which saw the introduction of systematic conservancy found the forests more or less a wreck, from which they are now steadily recovering.

The following extracts from old forest administration reports of 1860—70 may be of interest as shewing the difficulties of the country:—

"The Dangs are little known, the deadly effect the climate has on the European constitution deters anyone resorting to it except on duty. At the end of February it is tolerably safe from fever and continues so till the end of



FIG. 18.—Road constructed along precipitous rocky hill side. The entire width of the road is carried on a stone construction length 110 ft., height 12½ ft.. Cost Rs. 711.

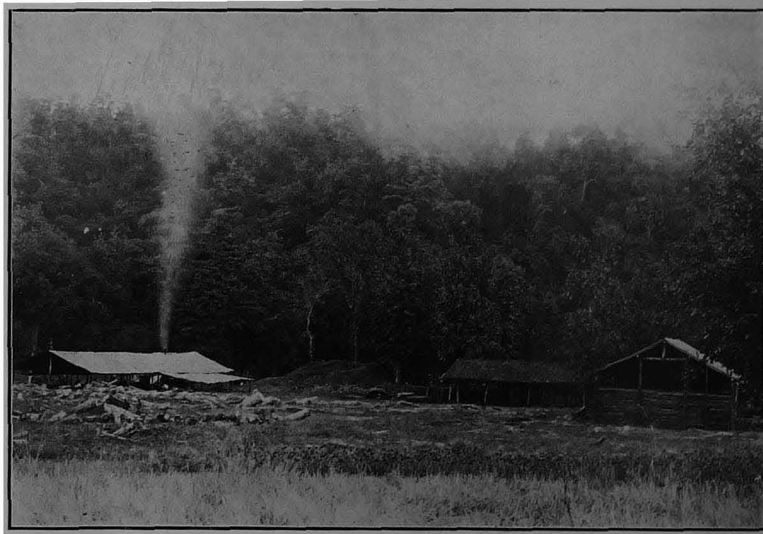


FIG. 19.—Karanjara sawmill in North Dangs cutting up waste material left by contractors in their coupes.

April when the rivers dry up and water becomes scarce ; Cholera then prevails. In all other seasons the climate is deadly to Europeans. The features of the country consist of a succession of hill and dale covered with forests The Dangs climate has so shattered Mr. Muller's constitution that he will not return to this country for active duty."

"The difficulties attending the survey cannot be denied. Besides the impenetrable nature of the country there was a total absence of labour so that the efforts of the Forest officers and the Dang Diwan failed to produce a single Bheel. Mr. Dalzell had, therefore, to engage men from the Surat Collectorate and as soon as they saw the country they threatened to return if not paid at the rate of annas 5 per diem. In addition to this the unhealthiness of the place was a serious obstacle to progress. Mr. Dalzell's men were breaking down rapidly and he had to beat a retreat, his field season having lasted only 2½ months."

It may be asked, what has happened to make the Dangs less inaccessible and the climate less deadly ? How is it that a considerable staff of officials manages to live there the whole year round in reasonable health, and how is it that these partially ruined forests produce a revenue of about four times what they did when they contained much bigger timber ?

The answer is that it is the Forest Department which has worked such changes and improvements as have come about.

The climate is probably as malarious as ever. But whereas in the time of Dalzell there were no buildings and the staff was exposed to all the rigours of alternating heat and cold, drought and damp, there are now well on for a hundred pucca buildings, including a Government dispensary.

The Forest Department has also constructed over two hundred miles of fair-weather roads and a number of bridges and causeways, all of which besides making it possible to extract timber of moderate quality at a profit, have helped to make the country less cut off from outside communication and supplies. The addition to pay of a small local allowance has also helped to reconcile the Forest and other officials to the want of the amenities of more civilised life, but for all these things the fact remains that service in the Dangs is notoriously unpopular and if Government wish to make the most of the great revenue possibilities of the tract they ought to increase these allowances so that they really will compensate for the undoubted hardships of the life.

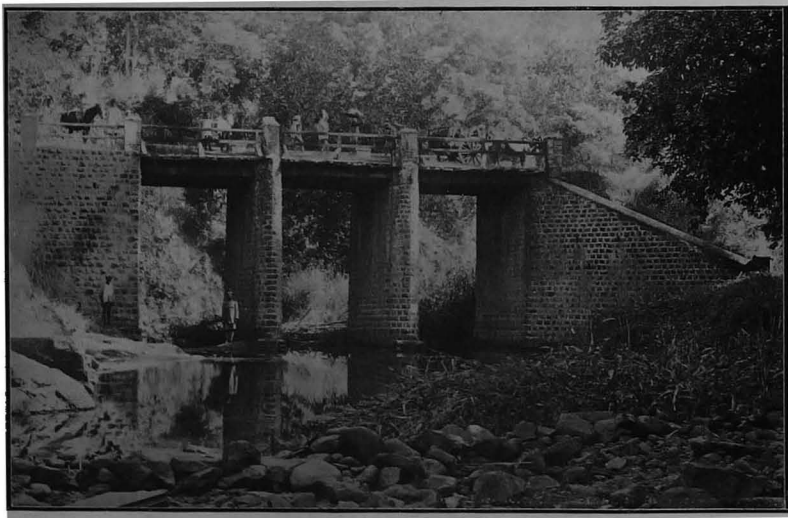


FIG. 20.—Devipara Bridge S. Dangs. The Local Forest Officer in 1916 enticed a Railway Engineer to the spot by inviting him to come and shoot a panther. The latter got his panther and the Forest Dept. obtained the Engineer's advice free of charge, so panthers are useful at times.



FIG. 21.—Government Sawmill at Chikhaldia, South Dangs, utilizing waste material from logging operations.

Chikhaldia is in the midst of very hilly country and all the machinery had to be transported under considerable difficulties along rough tracks through many miles of rocky hills and over nallas.

In spite of the condition to which unsystematic working and the destructive habits of the Bhils had reduced the forests, these are still of great commercial value and are rapidly taking their place among the richest teak forests of India. They still contain great quantities of old and middle-aged teak which though partially unsound yield good marketable timber much prized in the coast towns of Gujarat. Effective protection for over 30 years has also resulted in the natural growth of a magnificent crop of teak seedlings and poles which will in the course of the next 50 years produce a growing stock of immense value, if only funds are provided for its proper treatment now : that consists in removing the inferior species and damaged trees retarding its development. •

An enormous lot of work has still to be done before the forest resources of the Dangs can be worked to their full capacity. It is obvious that the sooner the present old and damaged stock of timber is removed and marketed the quicker the money returns will be realised by the State to the benefit of the tax-payer, and the sooner the promising young growth will develop into marketable timber in its place. But the only way to effect the above is to improve and extend the system of roads and buildings

and devise mechanical means for quick and economical transport of the timber ; moreover as so many of the trees are unsound they will not repay their haulage over long distances in their present form ; they must be cut up near the spot in sawmills so that only the net sound produce (in the form of standard sizes, boards, planks, sleepers, etc.) will have to bear the transport cost.

Considerable progress has been made already as the photographs here reproduced will shew. Nos. 16 to 18 are of various works erected during the construction of a road from Subir in North Dangs out to Navapur on the Tapti Valley Railway.

This road which is about 11 miles long passes through what was formerly considered absolutely impossible country but the difficulties were solved with the help of the Forest Engineer. Some idea of them may be gauged from the fact that it took a party of two Forest Officers and two Forest Engineers an hour to force their way on foot through the mass of rocks and débris and tangled jungles which now form one mile of the finished road illustrated in photographs Nos. 17 and 18. The road has cost about Rs. 60,000 without metalling. The result is that timber can now be conveyed over 20 miles of easy gradient to the railway which formerly had to find its way out through Baroda territory 32 miles. There is a sawmill of which the material is removed by it, shewn in Fig. No. 19. It is estimated that this road will eventually save Government Rs. 14,000 a year in reduced cart freight not to mention saving in

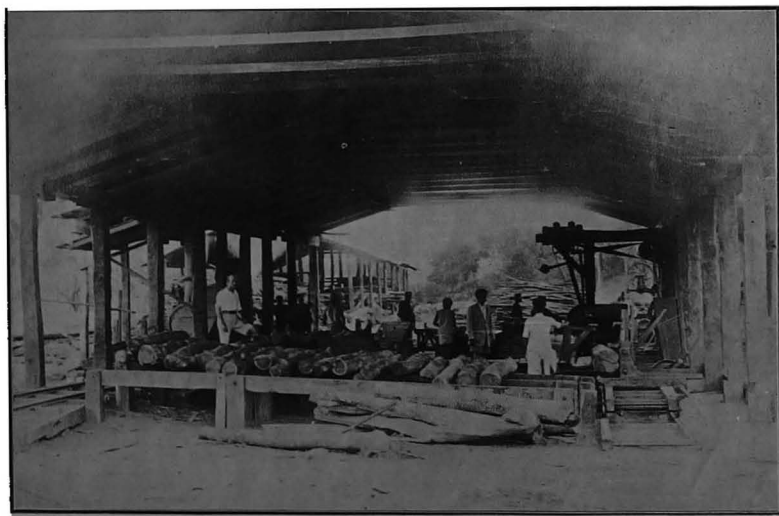


FIG. 22.—Interior of Chikhaldia Mill.



FIG. 23.—Departmental fellings in North Dangs—Bhils preparing logs.

time and a greater output of timber. The bridge shewn in Fig. No. 20 was constructed in 1915-16 before the rates for labour and all kinds of material had increased. It has helped to render possible motor traffic far into the heart of the South Dangs where ten years ago it was impossible to take a loaded cart. This road is 30 miles in length and when completed will establish communication right from the Nasik boundary through the Dangs to Jharya where an extension of the Baroda Light Railway will connect it with the main line at Billimora. Already material from two sawmills is worked out along this road which will eventually transport several thousand tons of timber annually.

Nos. 21 and 22 shew a sawmill lately erected 14 miles from Jharya along the above road, at Chikhalda. Two years ago this busy site was a lonely maidan. It now hums to the tune of four saw benches to which a fifth will shortly be added. The whole plant cost about Rs. 50,000. It is now cutting teak pillars for railway waggons, metre-gauge sleepers, and scantlings, boards and battens for the Gujarat market.

Photograph 20 gives a good idea of the interior of a Dang forest. A "clear felling" is in process. These fellings are a new and economical method whereby everything on the ground is cut over excepting promising saplings and groups of young teak poles which will form a portion of the next crop. The people engaged on these fellings are now principally Dangis—Bhils and Kokanis. Twenty years

ago not a single Dangi took part in such work. They have been gradually trained to it by the patient efforts of the forest officials helped to a great extent by the industry and enterprise of a forest contractor Mr. Ardeshir Kolabhai of Bulsar. Needless to say their condition has improved beyond knowing by participation in forest work, for they are also employed on roads and buildings, fire lines and other things. Roughly two lakhs rupees of wages are earned by the Dangis in a year.

The Bhil.

Is he the most miserable or the happiest man in India?

He may be depicted as ill-clad, underfed, ignorant, hopelessly addicted to excessive drinking, living in wretched little huts not fit to kennel a dog, eking out a precarious existence by laboriously scratching up little patches of rocky land dotted about in the midst of wild rugged hills where every human being suffers much from malaria, his water supply is a contaminated pool in the bed of a nalla and often he has to scratch up the gravel to get a pittance of water in the hot weather, in years of scarcity he wanders through the forests living on wild fruits, tubers, rats, squirrels and so on. In fact his life may be regarded as the limit of human misery.



FIG. 24.—Dangi families on road construction.



FIG. 23.—Departmental fellings in North Dangs—Bhils preparing logs.

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FIG. 24.—Dangi families on road construction.

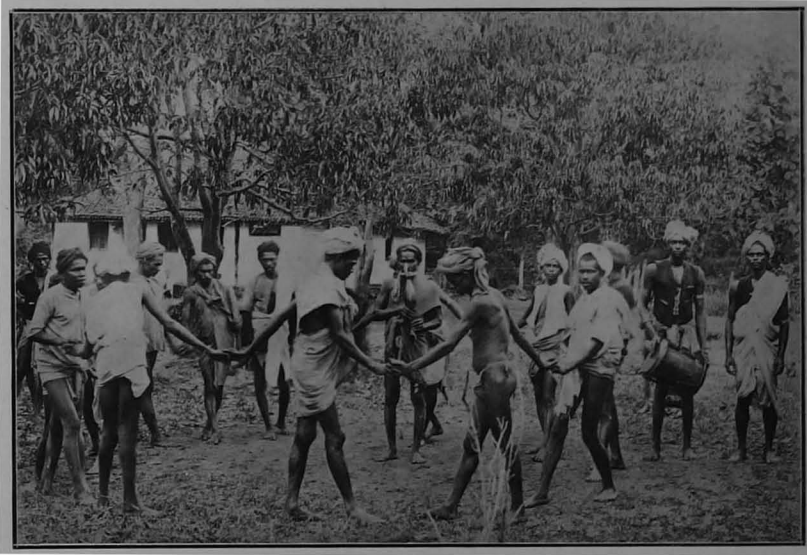


FIG. 25.—The Rajah of Pimpri (on the right) with his Bhils dancing during Divali festival.

As a matter of fact he is a happier man than the average cultivator in this country or in any other country. He never allows himself to become a slave to his work and he enjoys a good proportion of his days in contented indolence. He is cheery and laughs lustily at any little incident that tickles his fancy. He enjoys his hunting and fishing, will dance with great gusto for many hours on end and thoroughly enjoys his drink. Even when exerting himself in removing large boulders for making a timber track along the hill side the Bhil shouts with laughter as he sends a big boulder bounding down the hill side crashing through the undergrowth.

In spite of his low standard of living he can and does enjoy life. Figs. 24 and 25 show the Bhils at work and at play.

Duties of the Forest Officer.

'What do you do in the forests? Go about shooting tigers?' The work of the Forest Officer is away in unfrequented hills and few people outside the service have any idea of forest work. What does the Forester do? Wood in some form or other is required by most people in the country and many like to help themselves free of charge. Forests are soon destroyed by theft of wood, fires and too heavy grazing.

Checking destruction of forests gives every Forest Officer constant employment. Teak and sandalwood are valuable and in every district there are plenty of people ready to carry off what they can at any time of the year.

Detection of theft and punishment of the offender when caught entails considerable work.

Fire-tracing and watching for fires from hill tops and extinguishing fires in many districts keeps the forest staff on the run for weeks together in the hot weather.

Forest fires have a way of breaking out on the hottest days in the afternoon. To extinguish a forest fire is generally an exhausting and unpleasant job. Where coarse dry grass is abundant counterfiring may be necessary, relays of men often are required. They must be collected during the night and the work continues in the early morning.

A few thunderstorms are longed for and what a relief to the Forester when they do come sufficiently often in the hot weather to check fires!

The regulation of grazing is another matter that requires close attention. Fellings are arranged as far as possible for the convenience of grazing. When the forests on one side of a village are closed the adjoining forests on the other side are left open to grazing.

Rough thorn fences are laid down where stray cattle are likely to enter a closed area. To protect the young growth on a felled area closure must be continued until the plants are sufficiently developed to be safe from being trampled and broken down by cattle. With teak coppice the closure period is usually 10 to 12 years.

Besides protection various technical works must be carried out. Coupes must be surveyed and demarcated, trees marked for felling or reservation.

There is the tending of nurseries, preparation of soil in recently felled areas for seed and seedlings.

The planting and tending of young crops is carried out during the monsoon. This is followed by weeding or the young plants may be completely killed off by coarse grasses.

Thinnings and improvement fellings must be marked and carefully carried out. There is constant war to be waged against creepers and weeds that damage young growth especially.

Arrangement and control of contracts, feeding sawmills, supplies to railways, etc., measurement and registering of timber in depôts, auction sales, issuing and checking passes for removal of forest material along roads leading from the forests, collection of fees and other forest revenue, surveying, construction and repairs of roads, timber slides, construction of buildings and wells for the Forest staff, collection and sale of minor produce such as myrobolans used for tanning, arranging for local supply, permits, etc., these and many other matters help to keep the Forest staff busy. Correspondence and accounts require daily attention.

A Divisional Officer usually has charge of 300,000 acres of forest and a Ranger has 50,000 or more. In extensive forest areas labour is difficult to obtain and there are no artisans locally available. For construction of buildings, bridges and culverts stone cutters, masons and carpenters have to be brought from long distances and even for felling and logging works local labour is rarely sufficient. Cartmen before leaving

their homes to come and work in the forests require advances to provide for their families in their absence. Considerable sums must be advanced and even after receiving advances workmen frequently delay in coming on to the works, putting forward excuses and when they do come they frequently leave before work is completed. To get a small work carried out in the hills far from centres of labour supply entails much trouble and worry. The men rarely stay more than two or three months and half completed works, buildings, bridges, are liable to damage in the monsoon floods.

Batches of labourers obtained with difficulty often leave without any warning, logging works are left half finished and fires may get in and destroy much valuable material.

The conditions under which the Forest Officer has to work are difficult and discouraging and a man to show any progress must have energy, grit and determination besides being blessed with a strong constitution.

Protection of Agricultural Crops against Damage by Wild Animals.

It may not be generally known that up to the year 1903 no wild elephants had been seen in North Kanara by the oldest inhabitants, excepting one stray animal, which soon felt lonely and returned to Mysore. In 1903 a small herd came into Siddapur and Sirsi forests from Mysore. This incursion proved a misfortune to the country. The Kanara ryot's lot has always been an unending struggle against malaria and wild pig. Night after night when his crops are ripening in October he would be perched up in his little machan down in the damp cold paddy fields scaring away the pig, this too at a season when the malarial mosquito abounds. With elephants about he felt unsafe on his flimsy platform supported by four sticks and in most cases he took refuge in a big tree somewhere along the boundary of his field where he was unable to guard his crops efficiently from the pig. Consequently several of the small isolated fields had to be abandoned. The destruction of wild pig in these extensive forests, some 3,000 square miles, seems impossible. The pig are seldom seen in the daytime, they will travel long distances at night, they are not easily trapped and are extraordinarily immune from poison and diseases. Even in the Poona District in localities where there is no forest, crops are frequently damaged and the wily pig escapes destruction. The following notes are taken from an official account of an attempt to hunt them down in the neighbourhood of Malegaon, Poona District :—

“The rate of payment then settled was Re. 0-12-0 for the man and Re. 0-6-0 per dog for the working day only.

“In our present gang, we had only seven good dogs, three small and four big. Out of these seven only three were the best ones. There are two types of shikari dogs—(1) small dogs, (2) big dogs. The small dogs trace out the animals. If there be no animal in the crop, these dogs will simply move inside the crop, but will not bark at all. If they find any animal, then and then only they bark and thus we know approximately the position of the animal. We had only one remarkably best dog of this type. The big dogs catch hold of the young ones, females and even the males one or two years old. We had two very best dogs of this type and these

belonged to Mr. Bajirao Shelke a sugarcane-grower of Malegaon. He is very fond of hunting and had kept eight dogs and has newly purchased two small barking dogs. He himself used to accompany our party very often. All the pigs killed by dogs as shown in the accompanying statement are killed by these two big dogs and spears and the success of the campaign is partly due to these dogs.

"The total number of animals killed during 66 shikar days from 23rd March to 22nd August 1919, is 193, the average per working day being nearly three.

"Some of the pregnant female pigs were killed and each female bears 6 to 12 young ones at a time and thus it will be seen that a great check is also put to the future progeny. Amongst the females killed, pregnant ones were found only from July onwards. The cost of killing one animal has been worked out to be Rs. 6-12-9 and the damage done by one animal will not at any rate amount to less than Rs. 100 per annum. The Superintendent of the Victoria Gardens, Bombay, has given me to understand that 2 lbs. of wheat bran is the daily ration of one wild pig, but we have considered that the wild pigs in the canal area feed on sugarcane and other grain crops, and the more important thing to be remembered is that they spoil and damage much more (perhaps twice or thrice the quantity) than what they require for their consumption.

"If the life of pig is then taken into account, one can easily imagine what amount of loss is done by a single animal. The cultivators who take agriculture in the light of business realize this amount of loss and therefore strongly desire that the campaign should be continued till the trouble of pig is nullified.

"I beg to propose that two parties for killing in the Nira Valley may be maintained for a few years. Each party should consist of 20 men and 12 dogs . . . For the maintenance of one party about Rs. 5,000 will be required per year as detailed below :—

	Rs.
Wages of 20 men and 12 dogs	3,750
Ammunition	400
Medicines	50
Halting allowance of 20 men	600
Compensation if required to pay for damage	200
Total	<u>5,000</u>

"I make here some remarks for future guidance regarding qualifications of the individuals engaged. Out of the men employed, only 10 were really useful, while the rest were required to make the total of the beaters to make sufficient noise inside the crop. The names of the useful members of the party are :—

- (1) Shripati Bayaji Ramoshi. He shoots better than other shikaris in the present party, but he is a slow man, being lame by one leg. He possesses the power of tracing out the animal by footprints. He has one small barking dog.
- (2) Motya Aba shoots the animal on the spot, inside the crop if it is spied.

- (3) Soma Gena is very bold and his sight is well trained for spying the animal stealthily while sitting inside the crop and he shows the animal to Motya who shoots on the spot.
- (4) Badu Subhanya is bold to enter the crop for beating out the animal.
- (5) Jayappa Tuka is very bold to enter the crop for beating out the animal.
- (6) Laxuman Babu Dasari is a shikari, most active and bold. He is a fast runner and traces out the animals by footprints. He is the most useful man for pig hunting.
- (7) Ambu Dasari is bold to enter the crop and possesses the best small barking dog named Motya. This dog was exceedingly useful and was the only one best dog of this type for tracing out the animal inside the crop.
- (8) Chandu Dasari is a very fast runner to pursue the animal and to keep an eye on it.
- (9) Margya Shetiba Dasari boldly enters the crop.
- (10) Musalya Dasari is also a beater.

"The rest of the men used to follow the beaters mentioned above and to encourage them by making noise. There is one Gangaram Ramoshi at Baramati who is said to be a good shot and is likely to be available. He possesses a single barrel muzzle-loading gun."

This campaign against pig was in open country with no forests in the neighbourhood within 30 miles and it shows the difficulty of driving out this pest. Proposals have from time to time been made to exterminate pig in Kanara and along the adjacent Dharwar country, a Herculean or rather an impossible task.



FIG. 26.—Typical of the ruined condition of many of the Teak Forests.

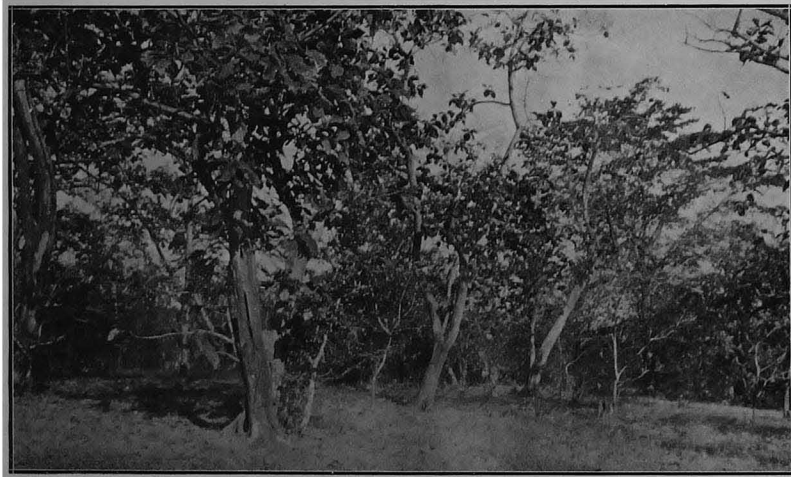


FIG. 27.—The two Teak trees on the left of the picture are hollowed out from top to bottom by jungle fires.



FIG. 28.—The damaged forest shown in Fig. 27 replaced by sound young straight Teak.

Three or four expert guns with 50 to 100 beaters out all day would often fail to get even one pig in these extensive forests.

Government treasuries would be exhausted long before the pig become extinct if hunting parties were entertained at the expense above suggested. The rearing of shikar dogs too would be a profitable business hiring them out at 6 annas a day.

In Ratnagiri District, a non-forest district, an agricultural committee report wild pig have effectively stopped the cultivation of groundnuts, a very paying crop, and stray cattle cause much damage and prevent people from attempting to grow second crops though water is available. The committee suggest that punishment to the owner of stray cattle must be made more deterrent.

The wild pig is not only one of the most intelligent animals in the forests but he is undoubtedly the most courageous. The pig would develop intelligence as he is in constant opposition to the ryot, the brainiest creature on earth. His courage is needed to protect him against his enemy, the panther, and he is quite capable of fighting a panther to a standstill. A boar may be chased by men, horses and dogs until he can hardly get along but no matter how many people are after him he will suddenly turn with a grunt or two charging into and scattering the lot. He will even charge elephants, drive off panthers. Their intelligence, boldness, freedom from deadly epidemic diseases render extermination extremely difficult. Their numbers are kept down by tiger and panther. A panther will not tackle a boar but will kill sows and the young.

An increase in the number of pig and damage to crops is often due to tigers and panthers being killed out and as man-eating tigers in this Presidency are practically unknown, though there are occasionally man-eating panthers, the tiger, by keeping down the number of pig and nilghai probably does the ryot more good than harm on the whole. There is irrefutable evidence in India that the extinction of tigers in certain localities has led to an increase of damage to crops by pig and nilghai.

In heavy forest areas protection of crops from wild animals is a matter of vital importance and it is remarkable that ditches and walls which were formerly kept up are now allowed to go out of repair throughout the Kanara District. The following remarks in the Forest Administration Report of Bengal are worth attention :

"the fencing of plantations with combined barbed wire and wove-wire Hercules fencing is completely justified, more especially as the cost of the material has been greatly reduced in the last two years."

These plantations are mainly *sal* plantations and the pig uproot the seedlings unless the areas are fenced.

The Forests are improving and becoming more valuable.

After centuries of neglect and constant damage by forest fires raging through every acre each hot weather the Forest Department took over the forests in a wretched condition. The stock of timber was sparse and much damaged by hacking and hollowed out by fire.

Figures 26 and 27 show the teak hollow and crooked and practically worthless.

Figure 28 shows straight young teak twelve years old. This photograph was taken on the same spot as photograph No. 27 and it clearly demonstrates the conversion

of almost valueless forest into very promising forest. Improvement of the forests in this manner is going on all over the Presidency. Very little money need be spent on planting but successful protection from fire, loot and overgrazing is essential. By replacing crooked burnt unsound trees by straight sound material the capital value of the forest is greatly enhanced and future generations will benefit thereby. Much depends upon the behaviour of the public regarding protection of the forests from fire. Forestry is a sound swadeshi business and the Forest Department appeals to the public for reasonable support. Why spend lakhs and lakhs of rupees on large quantities of imported foreign timber which could be produced in the country if the people did not burn the forests? Why waste in forest fires a large proportion of the wood produced by nature? The more timber grown in the forests the more money circulated among the poor hill cultivators. When the latter have no work in their fields they can earn good wages in the forests, felling can be carried on any month of the year and the fifty lakhs now spent on timber extraction and forest works must be of considerable economical value to the country.

It is the poorer class of cultivators who depend to a large extent on the forests and every forest fire by reducing the quantity of timber in the forests takes away the means of livelihood from these people. In Europe a considerable proportion of the population is dependent throughout the winter on the forests and industries fed by timber obtained from the forests.

If the people took an interest in the protection of the forests the quantity of timber produced would soon be double what it is at present and with this increased yield the sum spent annually in the forest would rise to a crore of rupees a year and imports of foreign timber would decrease. All people who have the good of their country at heart should encourage the protection of the forests, one of nature's greatest gifts to the country.