Hutchins, D.E. Forestry in South Africa.

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From the Author

FORESTRY IN SOUTH AFRICA.

BY

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By D. E. HUTCHINS, F.R.MET.SOC., CONSERVATOR OF FORESTS,
CAPE TOWN.

THE INDIGENOUS TIMBER TREES.

"I am as certain as I stand here that Nature intended wide tracts of South Africa to be forest country."—(Lord Milner's farewell speech, Johannesburg, March 31st, 1905.)

Of the great variety of indigenous trees in South Africa only three have much importance for timber, and two for the peculiar value of their wood. The six chief trees are :—

{ *Podocarpus elongata*.—The large or Outeniqua Yellowwood.

{ *Podocarpus thunbergii*.—The small or Upright Yellowwood.

Ocotea bullata.—Stinkwood.

Olea laurifolia.—Black Ironwood.

Pteroxylon utile.—Sneezewood.

Callitris arborea.—The Clanwilliam Cedar.

Of these, the two Yellowwoods yielded nearly all the house-building timber used by the early settlers in the Colony for many years; and Yellowwood still represents about three-quarters of the commercial timber in the belt of dense indigenous forest which stretches in a much broken belt along the slopes of the coast mountains from Cape Town to the north-east of the Transvaal. From Yellowwood being the only large timber tree, the dense evergreen indigenous forest of South Africa is commonly known as the "Yellowwood forest." In recent years the Knysna forests have yielded 100,000 Yellowwood sleepers yearly for the Cape Government Railways. Yellowwood sleepers when creosoted are not surpassed by Jarrah, creosoted Baltic pine, or any sleeper known, but it is as a flooring board that Yellowwood timber finds its most valued use.

Ocotea bullata (Stinkwood).—The timber of this tree has a higher value than that of any other timber in the indigenous forest. Stinkwood, however, is rarely a large tree, and the timber is chiefly used for furniture and in wagon-making. Stinkwood furniture is most beautiful, but its cost confines it, at present, to the houses of the wealthy.

Olea laurifolia (Black Ironwood).—This tree reaches the stature of a medium-sized or large timber tree, but the wood is excessively hard and not durable in the ground. It is chiefly used for wagon-making and is occasionally exported as an ornamental hardwood.

Pteroxylon utile (Sneezewood).—This is usually a small tree with a very hard timber, but the timber is almost imperishable in the ground, so that it is highly valued for fencing poles.

Callitris arborea.—The Clanwilliam Cedar holds the first rank for general usefulness amongst the indigenous timbers. It is as easy to work as Baltic pine, it seasons well, and is very durable. It has a sweet lasting fragrance surpassed by no other Cedar. In growth this Cedar much resembles the Atlas Cedar of North Africa. The timber of *Callitris arborea* is more highly scented and more durable than that of *Cedrus atlantica*. Unfortunately Cape Cedar has been so destroyed in the past that its forest has at present no commercial value.

There are three other species of *Callitris* in South Africa. *C. cupressoides* is usually shrubby. *C. whytei* barely comes south of the Zambesi. *C. schwartzii* is a newly described species whose capabilities are not yet fully known. It may prove not to differ greatly from the tree form of *Callitris cupressoides*.

Apodytes dimidiata (White Pear) } Medium-sized trees prized
Curtisia faginea (Assegai) } for wagon-making.

Goniami kamassi.—Kamasi is a Boxwood substitute exported from Knysna.

Buxus macowani is a second-rate Boxwood formerly exported to some extent from East London.

Olea verucosa.—The common "Wild Olive" furnishes a good fencing post. The European Olive can easily be grafted on it.

Leucadendron argenteum.—The Silver Tree has practically no timber value. It is not known to occur naturally farther than fifty miles away from Cape Town.

There are in the Yellowwood forest altogether about 108 species of trees; but these, with the exception of those mentioned above, have little commercial value. They are occasionally brought into use for fencing poles, wagon-wood, etc., and all are employed on the eastern side of the Colony, in building Kafir huts.

With the exception of the Clanwilliam Cedar the indigenous timber trees are of weak natural reproduction and difficult artificial propagation. The indigenous timbers are also of slow growth and of delicate constitution. It is difficult to obtain seed of Sneezewood; it is impossible to procure any satisfactory supply of Stinkwood seed. Hence the improvement of the indigenous forest is no easy matter. The stock of commercial timber in the indigenous forest probably does not average above one-twentieth a full stock, and in the more accessible portions it is less. Instances have occurred where the *total stock of timber* in a good indigenous forest was only equal to *one year's growth* of timber in a Eucalypt plantation yielding a first-class hardwood, such as Ironbark. The value of the standing timber in the indigenous forest, taken at 3d. per cubic foot, may be averaged at:—

Forests of Cape Colony	..	..	..	£6 per acre.
„ „ Natal	..	..	..	£5 „ „
„ „ Transvaal	..	..	..	£4 „ „

It is certain that without the assistance of the picked timber trees of larger forest floras, Forestry in South Africa could never be the remunerative business it now is. Which of the introduced trees is best fitted to re-stock and restore the indigenous forest is still an unsolved problem.

I have mentioned that the Clanwilliam Cedar is an exception to the difficult propagation, the slow growth, and the delicate constitution of the indigenous trees generally. Unfortunately, that tree will not thrive away from its home in the rugged Cedarberg country—an area of 150 or 200 square miles on the western side of the sub-continent, situated 120 miles due north of Cape Town. The re-forestation of this area has been pushed forward as rapidly as the slender provision of funds has allowed of. Fires have been restrained, goat-grazing stopped, and only dead Cedar trees are now allowed to be felled, while 81,000 trees have been planted over 94 acres by the inexpensive process of plowing the ground and sowing the seed broadcast. Seed is obtainable as easily as Pine seed, and the growth of the young Cedars is as fast as that of the Cluster-pine on the Cape Flats. Such Cedar timber as is obtainable from dry trees sells easily in Cape Town for the same price as Stinkwood or Teak. No doubt in the future Clanwilliam Cedar will largely replace the costly imported Teak, but since the Cedar will not flourish away from the rigorous climate of its snowy mountains, it can play but a restricted part in the general re-forestation of the country. Hence the supreme importance of the introduced timber trees to the South African Forester.

THE INTRODUCED TIMBER TREES.

Some of the finest timber trees of the Northern Hemisphere have now been under cultivation in South Africa for 200 years, and may reasonably be considered to be completely naturalised. Most of them show an abundant natural reproduction from seed, and they flourish in localities where drought, frost and parching winds are a complete bar to the cultivation of the delicate indigenous trees. It is of course necessary to see that in their new home they are properly fitted to the climate—winter rainfall trees (such as those of the Mediterranean) to a winter rainfall climate; summer rainfall trees to a summer rainfall climate; all-the-year-round rainfall trees to an all-the-year-round rainfall climate; inland trees to an inland climate; and coast trees to a coastal climate. Hence, to the South African Forester, the prime importance of the study of climatology. The following trees are those which have shown themselves to be most hardy and useful in South Africa.

Pinus pinaster (Cluster-pine).—Grows like a weed along the southern coast of Cape Colony, wherever there is a good rainfall; particularly on the coast mountains and on the plains of the south-west, where there are winter rains and a Mediterranean climate. It is now being largely propagated for sleepers and firewood by the Forest Department. About 8 tons of seed are used yearly in these operations. For an account of the remarkable growth of this tree

The Tokai Oaks and Homestead.

on the Caledon Mountains see a pamphlet by the author, entitled "Cluster Pine at Genadendal," reprinted in 1904.

Pinus pinea (Stone-pine).—This tree seems to have been introduced by the early settlers before the Cluster-pine. About the old farms there are some noble specimens of this picturesque tree, with its flat umbrella top, so strongly recalling Southern Italy. Unfortunately, about thirty years ago it was attacked by a fungoid disease which has been pronounced to be a species of *Peronospora*. This disease has almost exterminated the Stone-pine, and has led to its being placed entirely outside the operations of the Forest Department.

Quercus pedunculata (English Oak).—This is a favourite tree around the homesteads of the early Dutch settlers in the south-west of Cape Colony, and it has been planted with success within the heavy rainfall area of the eastern mountains, particularly along the Amatolas, north of King William's Town. It does not flourish in the drier parts of the Colony, but in all the more fertile parts it is highly prized for its incomparable beauty in Spring and its heavy yield of acorns. To the farmers the acorns are a valuable crop; indeed, it has been truly said that the Oak in South Africa is more a fruit than a timber tree. The Oak in South Africa bears acorns abundantly every year, and these acorns average almost double the size of those commonly seen in England and northern Europe. The foliage of the Cape Oak is also denser than that of the same tree in Northern Europe.

Populus alba (White Poplar).—This tree was probably one of the first to be introduced to South Africa, and is now completely naturalised, in vleys and damp places from Cape Town to the Northern Transvaal. The Poplar bush is a standing institution in many up-country farms, and the Poplar in South Africa furnishes a light useful timber for farm purposes and second-rate house building.

Populus nigra (Black Poplar).—This tree has also been long introduced to South Africa, but it is less hardy and less wide-spread than the White Poplar. It is usually seen in the form of the Lombardy Poplar, and as such is used as a break-wind in the vineyards and fruit orchards of the South-west of Cape Colony.

Populus monilifera has been introduced more recently, but it seems quite at home, and is very fast growing.

Eucalyptus globulus (Blue-gum).—This was not introduced to South Africa till 1828, but is now the most wide-spread and generally hardy tree on the sub-continent. From Cape Town to the Northern Transvaal, wherever trees are planted, the Blue-gum will be seen generally occupying the largest space. It commends itself to farmers on account of its hardness and rapid growth. But the efforts of the Forest Department are now directed to replacing it by other Eucalypts which may be equally quick-growing and produce a timber of superior value.

Eucalypts Generally.—Of the 150 odd species of Eucalypts nearly all have now been planted in South Africa. There are nearly

100 species in the Government arboreta at Tokai. Of these among the most valuable for sleepers and general use as hard woods may be mentioned *Eucalyptus pilularis*, the fastest grower known in the Cape Peninsula, *E. microcorys* or Tallowwood, *E. resinifera*, yielding a Jarrah-like timber, *E. paniculata*, an Ironbark, and *E. saligna*. The above are being planted on a large scale for the production of sleepers, for which item alone Cape Colony has now to spend yearly £100,000, most of this money going to Australia. After the Blue-gum the tree that has been most widely planted is *E. tereticornis*, commonly known in South Africa as the Red Gum. Up-country it flourishes at all elevations, from Johannesburg at 6,000 feet to Delagoa Bay, where it may be seen growing with Cocoa-nut Palms and other tropical trees. *E. maculata* flourishes on poor soils within the summer-rainfall areas of the sub-continent, and the closely-allied *E. citriodora*, with its scented foliage, in the warmer parts of the same region. Of Iron-barks, the pearl of Eucalypt timbers, *E. paniculata* has given the best results near the coast, and *E. sideroxylon* inland. *E. paniculata* is one of the fastest-growing Eucalypts in South Africa, and a hardwood of unsurpassed excellence. Other valuable Eucalypts being largely propagated are *Eucalyptus diversicolor* or Kari, a hardy free-grower, and one of the giant trees of the world in its home in West Australia. *E. marginata*, the West Australian Jarrah, has not proved to be one of the most profitable of the Eucalypts to plant for timber, though it grows well enough in its own climate in the south-west of Cape Colony. *Eucalyptus corynocalyx*, or Sugar-gum, is a tree recently introduced to the drier districts, and growing with great success at Robertson and elsewhere. It also produces a first-class timber. Other Eucalypts suited to the drier parts of the country are *Eucalyptus tereticornis*, *E. leucoxydon*, *E. hemiphloia*, and the two Coolgardie gums from West Australia; *E. salmonophloia* and *E. salubris*. *E. polyanthemus* is the Eucalypt that has proved hardest against frost and drought in the severe climates of the high South African plateaux. All the above Eucalypts are being planted on a large scale in the Government timber plantations.

Pines.—Most of the extra-tropical pines are now being grown by the Forest Department. Of the Pines recently introduced the most promising appears to be *Pinus canariensis*. The timber of this tree is justly esteemed at a high value in the Canary Islands. On the southern mountains of Cape Colony it appears to rival the Cluster-pine in hardness and quickness of growth. It is also being successfully planted in Natal and the Transvaal.

Pinus insignis.—This handsome Pine has been largely planted in recent years in South Africa. It is only climatically suited, however, to the winter rainfall districts, and the wholesale planting of this tree in Natal and the Transvaal has produced disappointment. This is a large, rapidly-growing tree, particularly at first.

Other Pines being planted more or less extensively are *Pinus halepensis* or Jerusalem Pine, *P. muricata* and other Californian Pines, the two Japanese Pines *P. thunbergii* and *P. densiflora*,

together with the four Pitch Pines of the Gulf States of the United States of America, *P. australis*, *P. mitis*, *P. cubensis* and *P. taeda*.

The Mexican and Chinese Pines remain for trial in the summer-rainfall, high-plateau country—Transvaal, Orangia, Basutoland, Transkei and Natal.

Cypresses : Junipers and Cedars generally.—Trees of the genus *Cupressus*, with their valuable Cedar-like durable timbers, have naturally not escaped the notice of the Forest Department, but their planting is somewhat restricted by considerations of expense. They grow slowly, more especially at first, and are frequently costly to establish. There are, however, extensive areas under Cypress at Tokai, Ceres Road, Fort Cunynghame, and elsewhere in the Government timber plantations. The Cypress that has been most largely planted (and often out of its climatic habitat) is *Cupressus macrocarpa*. This rapidly becomes a tree of much beauty. *Cupressus guadalupensis* may almost be looked upon as the hardy, drought-resistant form of *C. macrocarpa*. The planting of this tree is rapidly extending. Quite equal to *C. macrocarpa*, however, is *C. lusitanica*, which, under various names, has been extensively planted throughout South Africa, and, judging from its natural reproduction, it seems to have become naturalised in the Transvaal, Natal and Cape Colony. *C. goveniana*, *C. lindleyana*, and *C. torulosa* have also been planted to a less extent.

Junipers.—These trees yielding the Cedar of commerce have naturally claimed the first attention in an extra-tropical country. *Juniperus virginiana* has proved extremely hardy, but it seems too slow-growing to produce timber economically, and the same is true with regard to *J. bermudiana*, *J. chinensis*, *J. mexicana*.

J. foetidissima and *J. procera* remain for trial on the plateau country. I have lately received from Dr. Perez seed of the almost extinct *Juniperus cedrus* of the Canaries. Altogether there are some fifteen or twenty Junipers under trial in the Government plantations of the Cape and the Transvaal.

Cedrus.—*Cedrus deodara* is being planted on a large scale in the Transvaal, where it shows an excellent growth.

Taxodium.—*T. dystichum* has given but poor results, even on swampy ground, in Cape Colony. It promises better in the Transvaal. The Mexican *T. mucronatum* awaits seed for trial planting in the Transvaal.

Callitris.—Eight or ten Australia species are under trial. *C. robusta* and *C. calcarata* seem the most promising.

Cedrela.—Several species are under cultivation in the warmer summer-rainfall climates, but the proper testing of this most valuable genus of all the Cedars has as yet scarcely begun.

Wattles.—The so-called Wattles of Australia belonging to various species of *Acacia* form an extremely valuable forest resource. Their exact utility lies in the production of tan bark and in their rapid and early yield of small wood for fuel. Of the Wattles planted, the best known are the Black Wattle in Natal (described under "Natal") and the plantations of *Acacia saligna* and *A.*

pycnantha in the south-west of Cape Colony. *A. saligna* (sometimes called Port Jackson Wattle) grows like a weed on the Cape Flats and elsewhere in the south-west of Cape Colony, and it furnishes a bark which has been largely used by the Cape Town tanners, and which bark contains up to 23 per cent. of tannin. The Wattle, however, which yields the largest percentage of bark, surpassing even the Black Wattle, is *A. pycnantha*, or the Golden Wattle of South Australia. This is now being grown on the Cape Flats and elsewhere in the Government plantations. It flourishes throughout the whole region of winter rains from Cape Town to Knysna, and should be more largely planted than it is by farmers. Wattles yielding a return in from five to seven years can be produced by private enterprise and have thus not been so largely planted in the Government State Forests.

These are the most important of the introduced trees now being planted for timber in South Africa. Many more are being grown; the range of choice in the extra-tropics is wide. It would be impossible here to even mention by name all that are being and have been tested by the Forest Department. Of trees not falling within the four chief classes—Eucalypts, Pines, Cedars and Wattles—there are such valuable timbers as Blackwood (*Acacia melanoxylon*), Californian Redwood (*Sequoia sempervirens*), Camphor (*Cinnanomum camphora*), several species of Podocarpus and Araucaria, and others which cannot even be mentioned here.

FORESTRY IN CAPE COLONY.

The forests of extra-tropical South Africa occupy but a small portion of its area, and are still less fitted to supply the wants of the country in timber. This had long been recognised. As early as 1819 there was a Superintendent of Lands and Woods at Cape Town. In 1876 Forests and Plantations were constituted a separate department of the Ministerial Division, its principal officers corresponding directly with the Ministerial office. The chief forest officer was then at Knysna. At last in 1881 a separate Forest Department was organised, and the Cape Government obtained the services of an eminent French forester, the Count de Vasselot, as head of the Cape Forest Department. This gentleman had obtained his professional training in the French National Forest School at Nancy (than which there is no better), and had since obtained distinction by particularly good work in connection with the great re-forestation operations in Gascony. The work there was with Cluster-pine (*Pinus pinaster*), which is at the same time the pine that has been most largely employed in the pine plantations of South Africa. Count de Vasselot made a forest tour through the country, and his recommendations after this tour will be found in the valuable report which was translated and presented to Parliament in 1882. This report should be referred to by those who may wish for further information on the position of Cape Forestry at that time. In 1883 the writer, who had also been trained at Nancy, arrived from India, and was

subsequently transferred from the Indian to the Cape Forest Service. By 1884 the newly-formed Forest Department had got to work, the oldest of the western plantations being founded by Mr. J. S. Lister, now Conservator of Forests in charge of the Eastern Conservancy. The Cape Forest Department may thus be said by now (1905) to have had twenty clear years working existence. During that time the timber plantations near Cape Town, the chief Colonial market, have been largely extended, more especially recently with the object of supplying sleepers to the railways. At the same time the "high-timber" indigenous forest of the country has been demarcated, and the wasteful system under which it was formerly worked replaced by systematic fellings under the supervision of competent Forest Officers.

For administrative purposes Cape Colony is divided into four Conservancies, each in charge of a Conservator of Forests, the Conservator stationed at Cape Town having at the same time consultive functions on technical matters.

As soon as the forests had been demarcated, it was seen that a Forest Act was necessary to give effect to the demarcations, and to regulate and enforce the working of the forests. In 1885 I submitted a draft founded on the Madras Forest Act of 1882, and in 1888 was passed the Cape Forest Act, No. 28 of 1888, which has since been in force, and which has served as a model for other Colonial forest legislation, not in South Africa only. In 1902 this Act was strengthened and amended in certain particulars, the chief of these being a provision which requires that the National Forests cannot be alienated, nor any forest rights granted, without the previous sanction of both Houses of the Legislature. Further measures may be necessary in order to entirely safeguard the forests from the loss to which they are liable as long as they remain under political control.

The total cost of forest work during the last twenty-two years in Cape Colony has been over three quarters of a million pounds sterling, of which sum more than a quarter of a million pounds sterling has been spent on the timber plantations in the neighbourhood of Cape Town and the south-west. There is a total Forest Staff of twenty-six (Conservators and their assistants) in the upper grades, and eighty-four European Foresters, besides a few native guards in the Native Territories.

It was early recognised that an efficient Forest Staff required that the superior officers should have a technical training beyond what was obtainable in South Africa. In 1892, Mr. C. B. McNaughton, the present Conservator at Knysna, was sent for a special course of training to the Cooper's Hill Forest School in England, and he has since been followed by four others, all of these, except Mr. K. Carlson (at present Conservator in the Orange River Colony), obtaining a grant from Government which averaged somewhat less than half their total expenses. Partly on account of the high cost of this training, the last Forest Officer sent from the Cape for his professional training has proceeded to the American Forest

School at Yale; and he has been joined by a forest apprentice from Orangia. But for the obstacle presented by a foreign language, the training at Nancy is that which would best satisfy the requirements of Cape students; since, in the South of France most of the trees now cultivated in the timber plantations of Cape Colony are to be met with, and the climatic and fire-conserving conditions resemble those in Cape Colony. In view of the fact, however, that there is no English speaking forest school devoted entirely to extra-tropical forestry, the expense of sending forest students abroad, and the increasing demand for forest education in South Africa, the project of a South African Forest School has been recently revived, and has obtained the serious consideration of Lord Milner and the South African Governments.

The policy of the Cape Forest Department may be said to have two chief objects:—

(1) Production at home of the timber now imported from abroad. This is to be accomplished by conserving and improving the indigenous forest, and by forming plantations of the most valuable trees of other countries, near the railways and chief centres of Colonial consumption.

(2) The furtherance of general tree-planting in a nearly treeless country, by advice and assistance to landowners and the public. The principal trees planted have been sketched above. It remains only to mention that the cause of tree-planting generally is assisted; by professional advice in the form of pamphlets, lectures, and visits to the forest centres; and by practical aid in the issue of young trees and seeds to the public at cost price. In round numbers, 550,000 young trees are issued yearly to the public at an average price of about $\frac{3}{4}$ d. each, each of these trees being securely rooted in a planting tray. These planting trays are formed of old paraffin tins cut lengthways. During the last ten years the average value of the plants and seeds sold to the public has amounted to £1,844. These figures are rapidly increasing, thus during the last year in the Western Conservancy the sales amounted to £3,859.

Under Act 4 of 1876, one half the cost of all the tree-planting done by Municipalities and Divisional (County) Councils (up to a limit of £250 in one year) is re-imbursed by Government. The administration of the tree-planting grants made under this Act, rests with the Forest Department, as also the adjudication of the special grants sometimes made to private tree-planters.

THE GOVERNMENT TIMBER PLANTATIONS.

The total expenditure on forest work since the Forest Department was organised on its present basis in 1883 amounts to £778,000; of which £293,000 has been spent on the large plantations near Cape Town and on Forestry in the south-west of Cape Colony; and £485,000 on plantations and Forestry elsewhere in Cape Colony. The large timber plantations are situated near the chief Colonial markets, and either on or close to, lines of railway. The trees planted are Eucalypts, Pines, and a lesser quantity of Cedar and other

trees. The best known of these western plantations is that at Tokai, which runs along the Table Mountain range from the boundaries of the Muizenberg Municipality to Constantia. The total area there planted to date is 2,371 acres, at a nett cost of £28,791, so that the average cost of planting has been £12 3s. per acre. The revenue from this plantation up to December, 1904, was £16,766. The total area of the estate is 6,475 acres. Planting began twenty-one years ago, in 1884. A preliminary valuation of the timber made in 1900 worked it out to a total of £51,825. The revenue realised from this plantation varies from half to two-thirds of the expenditure, and this revenue is obtained from the sale of plants, seeds and thinnings, none of the main crop being yet fit to cut, so that the financial results of this plantation cannot be considered otherwise than satisfactory. In the best portions of the estate the growth of timber is scarcely exceeded in any portion of the world. Thus, from a thirteen-year-old plot of Kari, *Eucalyptus diversicolor* (Prinz Kasteel block) there has been a mean yearly yield of timber amounting to 625 cubic feet. From a six-year-old plot of Kari on Cedar Ridge there has been a mean yearly production of timber amounting to 533 cubic feet. And similarly, another block of Kari on Manor House Ridge has yielded a figure of 377 cubic feet. The largest trees on the plantation are some particularly fine specimens, now over 100 feet high, of *Eucalyptus saligna*. These, at eighteen years old, showed a mean yearly production of timber (acrim) amounting to 527 cubic feet. When one considers that the best yielding forests in Europe—the Spruce and Silver-fir of Saxony do not average more than 150 cubic feet per acre per year, it will be seen how satisfactory is the growth of timber at Tokai.

At Ceres Road, 84 miles from Cape Town on the main line of railway, is another large Government timber plantation, which, with the addition of the adjoining sleeper plantation, has nearly the same area as Tokai, viz., 6,000 acres. The trees planted here and the results obtained are similar to those at Tokai.

There is a further large Government plantation on the Cape Flats, also amounting to about the same area, viz., 6,000 acres. Here, the soil being poor and sandy, the trees planted are almost entirely tan Wattles and Cluster-pine. The tan Wattle used is mainly *Acacia saligna*, though a little of the more valuable *A. pycnantha* has been planted of late years. For the last thirteen years, however, the planting on this plantation has been confined to Cluster-pine, designed to produce sleepers, firewood, and coarse Pine timber. These Pine plantations are formed by the inexpensive process of plowing the ground and sowing broadcast; the total expenditure, plus interest at $3\frac{1}{2}$ per cent., amounts to £64,104, the revenue with interest to £26,047. The timber is now being valued.

The fourth large Cape timber plantation is situated at Fort Cunynghame on the Eastern line of railway north of King William's Town. Here the area planted amounts to 3,000 acres, the total expenditure to £35,408, while the revenue and estimated value of

the timber amount to £160,000. The chief trees planted are Black Wattle (*Acacia decurrens*), Cluster-pine (*Pinus pinaster*), various Eucalypts, and on the lower better ground Oak (*Quercus pedunculata*). There are various smaller timber plantations which, together with the larger plantations mentioned, amount altogether to about 23,000 acres.

DRIFT SAND PLANTATIONS.

Among the most successful plantations undertaken by the Cape Forest Department must be reckoned those performed with the object of fixing the sands. Of such plantations there are large areas on the Cape Flats, undertaken some years ago to protect the Railway from drifting sands. At the head of False Bay an artificial

Morram Grass-planting at Agulhas, 1904.

coast dune like the "dune littorale" of Gascony, has been run along the shore, stopping the further ingress of sand. Even at Port Nolloth, where the rainfall is only four inches per annum, it has been found possible to stop a serious sand drift threatening the harbour by the planting of *Eragrostis* and other grasses. The grass that has been most largely employed for sand fixing is Morram, (known as Bent grass in Scotland), *Psamma arenaria*. Drift sands threatened to overwhelm the Agulhas Lighthouse: nowhere has the planting of Morram grass succeeded so remarkably as here. Its growth can be seen from ships passing some distance out at sea, and it opens up wide possibilities for turning to account the dreary

areas of sand which mark the extreme southern point of the African Continent. Morram grass has been planted successfully further east at "Still" Bay, but this, so far, is the limit of its successful growth. At Port Elizabeth, where are the largest sand-drift fixing operations, Morram grass has been found not to succeed: and it is necessary there to proceed by the more expensive process of covering the sands with town refuse, conveyed on to the sands by a special line of railway. After the sand has been temporarily fixed with town refuse, it is sown with seeds of various sand-fixing vegetation, and the Wattles *Acacia cyclopis* and *A. saligna*.

The Cape Budget for the Financial Year 1903-1904 showed a total expenditure of £31,500 on the Forest Staff and £60,000 on Forest work. Owing to the present financial crisis the total forest expenditure has been cut down to £50,000, viz., £30,000 Staff and £20,000 work.

FORESTRY IN NATAL.

Natal has been called the "Garden Colony" of South Africa. The part of the Colony from which it derives this name is the central, well-watered portion traversed by the belt of Yellowwood forest. In the southern portion of this belt is situated some of the finest of the indigenous Yellowwood forest. About many of the homesteads in or near this belt have been planted introduced trees which are growing with a vigour unsurpassed elsewhere in South Africa.

Natal has a large native population (about seventeen blacks to one white) and as the natives were settled in Natal they were unfortunately given destructive forest rights. These forest rights and the settlement of the country produced a deplorable destruction of its rich forests. In 1886 the services of a Cape Forest Officer, Mr. H. G. Fourcade, were obtained, who, after a tour through the country, submitted an able report (Maritzburg, 1887), which may be read to-day with the utmost interest. Unfortunately, Natal was at that time a Crown Colony, and practically nothing was done to give effect to Mr. Fourcade's recommendations, or to those of his successor, an eminent young German Forest Officer, Herr Schöppflin. At last, in 1901, when the Colony was managing its own affairs, Forestry was again taken up. Mr. J. S. Lister, Conservator of Forests in the Eastern Districts of Cape Colony, was deputed to visit and report on the forests, and at his recommendation the present Conservator, Mr. T. R. Sim, was appointed in 1902; and Forestry in Natal is now organised on much the same footing as in Cape Colony and other South African States. Mr. Sim's preliminary report for 1902 and his last report dated June, 1904, are interesting documents, and show what is being done in Natal to make up for the long years of forestal neglect. It is a sad tale of waste and ruin!

The Conservator of Forests has his headquarters at Maritzburg, and is assisted by a European staff of thirty permanent Forest officials and five apprentices. The Natal Forest Staff now

ranks second after that of Cape Colony. A list of reserved forest trees has been published, and a modification of the Cape Forest Act embodied in the Forest Regulations. Game reserves under the charge of the Conservator of Forests have been established in Natal. There is an area of about 20,000 acres in the wild country near Giant's Castle, at the headwaters of the Bushman's and Tugela Rivers in the Drakensberg. There are also game reserves in Zululand.

At Cedara, lying at an altitude of between 3,500 and 5,000 feet, in the strip of well-watered country immediately north of Maritzburg, are being formed a large distributing nursery, forest arboreta and forest plantations. An area of 407 acres here has been planted, 100,000 trees have been issued from the nursery, and 170,000 remain in stock (1904).

On the semi-tropical coast lands of Zululand a plantation has been formed at Empangeni, with a nursery for the supply of plants to the public. Cocoanuts and Dates are amongst the trees being planted in this warm country. Attention is also being given to the cultivation (here and elsewhere in Zululand) of the Rubber Vine (*Landolphia kirkii*), and interesting figures regarding the good natural reproduction and growth of this rubber producing tree in Zululand are given in Mr. Sim's report referred to above.

Private Plantations in Natal.

There is more forest planting on private plantations in Natal than anywhere else in South Africa. Round many of the substantial homesteads forest arboreta have been formed which I found of greater interest and variety than anything I have yet seen in South Africa outside the Government timber plantations in Cape Colony. The area of private timber plantations in Natal is estimated to amount to not less than 5,000 acres; these plantations, though embracing a great variety of trees, are in the main composed of Eucalypts. Besides this, in Natal is to be seen the most remarkable and successful instance of private timber planting in the modern world. The plantations of Black Wattle in Natal now embrace an area of 25,000 acres, and give a return of £100,000 yearly. They are being extended steadily. The Black Wattle used almost exclusively in Natal is *Acacia decurrens* var. *mollis*. I have seen the open-leaved variety (*Acacia decurrens* var. *normalis*) on some of the plantations, but it is stated that this does not give as good a result as the *mollis* variety. The Black Wattle plantations occupy the middle districts of Natal on a belt extending north and south above Maritzburg. In 1886 thirty-nine packages of Black Wattle bark were exported to the value of £11 ! During the three years, 1901-1903, an average of 13,814 tons of bark, valued at £71,662 has been exported, the average value being thus about £5 per ton. The great rise in value of the Wattle plantations that has taken place in recent years is due to the good prices obtained for the poles concurrently with the bark. From the Railway returns it appears that about 20,000 tons of

mining props pass over the Railway yearly, and of these the greater portion is exported for use in the Transvaal mines. The bark is exported from Natal in the form of roughly-ground chips. Other outlets have been sought for the Wattle timber, particularly paper pulp. The reports of the trials made in 1899, however, are not favourable. The wood is too hard for mechanical pulp, and has been found unsuitable for chemical pulp by the sulphide process. The soda process yields a coarse pulp of inferior quality.

The total present yield from the Black Wattle plantations, including bark, pit-props and firewood, is put down at not less than £100,000 yearly. The £10 shares of the Town Hill Wattle Company at Maritzburg, whose fine plantations I visited in 1903, were then quoted at £100! The average cost of these Wattle plantations is set down at £6 per acre. And it is considered that for land well suited for Wattles from £1 to £6 an acre may be paid. It is now twenty years since the Black Wattle was first planted in Natal. The Wattle is fit to cut from five years upwards, the average cutting time being ten years. The yield naturally varies much with the different plantations, especially as many of the early plantations in Natal have been planted in unsuitable localities, but the average may be taken at 5 tons of dry bark and 30 tons of dry timber. The price paid for this bark at Dalton, the centre of the Noodsberg district, now averages from £6 to £6 10s. for bark in bundles, ground and bagged £1 more. Black Wattle firewood fetches up to £1 per ton, put on the railway; good pit-props double this price, or £2 per ton.

The forest expenditure provided on the current year's budget amounts to £9,028, and the Conservator of Forests also administers the two allied items of expenditure, viz.:—Fruit trees, £2,752; game reserves, £1,176.

FORESTRY IN ORANGIA.

The Orange River Colony consists of elevated treeless plains so subject to drought, frost, and drying winds that tree-growing is a matter of great difficulty. Nevertheless, the beauty and comfort of trees in such a country, and the necessity of doing something to replace the large importations of timber, have been fully recognised at Bloemfontein. In 1903, Mr. J. S. Lister made a forest tour in the country, and his report was followed by the founding of a Forest Department, which will doubtless soon develop beyond its present American modelling. Orangia Forestry is in charge of Mr. K. Carlson, an able and experienced officer, formerly in the Cape Service. He is assisted by a staff of three or four foresters and seven probationers, one of whom has been sent to the Yale Forest School to obtain a professional forest training. Plantations are being formed near Bloemfontein, and in the only part of the country where trees can be grown without great difficulty, that is to say, the Eastern frontier bordering Basutoland. Here, two or three large Government nurseries are in process

of formation, and at Prynnsberg, near Clocolan, are the oldest timber plantations in South Africa, formed by Mr. Newbury.

There is no natural forest in Orangia, and there has been much disappointment in the tree-planting efforts that have been made. This disappointment is almost entirely due to the haphazard selection made. As an instance, Bloemfontein may be mentioned. Here, for years there have been persistent efforts at tree-planting, but the tree mainly planted has been the Blue-gum, a tree making the largest demand on water supplies, while Bloemfontein has an uncertain and small rainfall, and but a poor supply of irrigation water !

The Forest expenditure provided for the Orange River Colony during the current year, 1904-1905, is £10,600.

FORESTRY IN THE TRANSVAAL.

The indigenous high timber forest of the Transvaal, with Yellowwood as the chief species, is limited to the better watered districts on the Eastern frontier. From Belvidere (near Pilgrim's Rest) one looks down on to a forest scene recalling that of the Western Ghauts of India. Here, on the top of what would be called the Ghauts in India, is the dense Yellowwood forest, stretching in a nearly unbroken line along the eastern slopes of the mountains, and spreading in patches over the plateau, occupying the southern and eastern sides of the mountains and deep dark valleys. Below the heavy Ghaut forest stretches the open forest of the hot, low country, gradually tailing away to the thorn bush and scrubs of the coastlands. The area occupied by the Yellowwood forest in the Transvaal, to enjoy the same amount of effective moisture as at the Cape, must, on account of the lower latitude and greater altitude, have a considerably heavier rainfall. This rainfall may be estimated at from 40 to 80 inches. The largest area of dense evergreen forest (Yellowwood) in the Transvaal is the Woodbush, which, with the adjoining Helsbush (so-called on account of the difficult nature of the ground) amounts to about 10,000 acres. While the Yellowwood forest does not extend beyond the heavy rainfall area of the eastern mountains, all the eastern side of the plateau, and the better watered areas on the plateau are either treeless or carry only low thorn-wood and scrub forest ; there thus remains a very large area, in fact the best portion of the Transvaal, which, though nearly treeless now, is suited to produce first-rate timber forest, using the hardier trees of larger and stronger forest floras.

The first Boer settlers planted Poplars and Willows in the vlees. Afterwards the more enlightened settlers planted Blue-gum and *Tereticornis* gum ; and, in certain localities under irrigation, such as Lydenburg (the capital of the old Lydenburg Republic), most of the winter rainfall Cape trees were planted. As long as they were irrigated such trees succeeded fairly enough. It is interesting to see the results of these early tree-planting efforts under irrigation in the townlands of Potchefstroom, Pretoria and Lydenburg.

Indigenous Yellowwood Forest, M'Dich, George, nr. Pilgrim's Rest, Transvaal.

But such planting was naturally limited, and practically did not extend beyond the planting of trees for ornament and shade. With the discovery of the Johannesburg goldfields there came a change. It was recognised at once that pit timber was one of the most expensive items in working the mines, and the mine-owners laid down considerable areas of timber plantations, mostly in the neighbourhood of Johannesburg. Unfortunately, altogether fallacious estimates were based on the profits to be realised from these plantations. The rapid growth of isolated and avenue trees was taken as a basis for the growth of trees in masses. Sufficient allowance was not made for the reduced growth consequent on the increased drain on subsoil moisture when trees were planted in dense forest. It was often assumed that so many trees planted per acre would leave a nearly equal number of trees to fell at the final cutting; and, worst of all, there was little climatic selection. Fifteen years ago we were positively assured that all the trees that grow at the Cape would succeed at Johannesburg! This was an astonishing assumption!

It was assumed that trees growing naturally near the sea with winter rains would succeed on an inland plateau, between 4,000 and 6,000 feet above sea level, and where the rains fall entirely in summer. The countries to which one would naturally look to furnish trees for the Transvaal are not winter rainfall areas such as the Mediterranean and California, but summer rainfall areas such as Mexico, the drier western Himalayas, and part of the Argentine; while for test purposes, trees should be tried from the more southerly latitudes of inland eastern Australia. The slopes of the Andes will also supply certain trees. The failure of much of the early planting done around Johannesburg must not be considered any criterion of the prospects of future Forestry in the Transvaal. The largest of these mining timber plantations are at Bramfontein, near Johannesburg; the Willows (H. Struben) near Pretoria; and just across the border at Vereeniging (S. Mark's). In the latter an open, low-lying, damp, soil makes up, to a large extent, for the deficient rainfall.

In 1903 I visited the Transvaal and framed a forest scheme, which was published in a report to the Transvaal Government (Pretoria, 1903). This scheme contemplated an expenditure of £100,000 yearly for six years. The report gave a list of over 450 species of timber trees *suitable* for cultivation in the Transvaal. Of these only a small proportion are already growing there. The following year I again visited the Transvaal, and this was followed by the appointment of Mr. Charles Legat as Conservator of Forests, with a moderate staff of assistants. Mr. Legat himself is a former member of the Cape Forest Department.

During the short time that the Transvaal Forest Department has been in existence a central nursery and seed store has been established at Irene, in charge of a Forest Officer who was also for some time in the Cape Forest Department. This nursery during its first season (summer 1904-1905) had a revenue of £2,000 from

Dry Open Forest, Inchlomu Tree on Bank of River, Nelspruit, Transvaal.

the sale of young trees, which is the largest revenue of any forest nursery in South Africa.

Government plantations have been established in the following five localities :—

Lichtenberg.
Ermelo.
Pan.
Potchefstroom.
Belfast.

In these plantations excellent work has already been done. It is anticipated that 2,000 acres will be planted next season. Hardly any Mexican trees have yet been planted owing to the great difficulty in obtaining seeds of forest trees from that country. Difficulty has been experienced also in obtaining Deodar and other Himalayan seeds from India. A small plantation (350 acres), successful but costly, near Pretoria, was taken over from the late Government; and a fine estate near Johannesburg has been made over to the Transvaal Government by Messrs. Wehrner, Beit and Co. A considerable portion of this princely gift has already been planted with forest trees. Test planting is being also undertaken in and around the indigenous forest at Woodbush, at Sàbi and at Pilgrim's Rest. Here the climatic conditions are of the best and there is every prospect that some of the finest timbers of the extra-tropics will succeed, notably many of the noble Conifers of Japan.

During its first complete working year the Transvaal Forest Department raised $1\frac{3}{4}$ million young trees, and $1\frac{1}{4}$ million were distributed to the public and various Government institutions. There were also nearly 1,000 lbs. of tree seed sold. In the various plantations there was a total area of 682 acres planted, the greater part of this planting being at Pan, a favourably-situated locality on the Delagoa Bay line, not far from Belfast.

Good progress has been made with the demarcation of the indigenous forest in the north-east of the Transvaal, an area of about 14,000 acres having already been brought into the Forest Reserves. This forest possesses peculiar interest. It lies at an elevation of from 4,000 to 6,000 feet, and marks the northern end of the dense evergreen indigenous Yellowwood forest of South Africa. North of this, across the great valley of the Limpopo, occurs forest of quite another character, the dry, open, leaf-shedding scrub-like forest of semi-tropical Rhodesia.

TIMBER IMPORTED INTO THE TRANSVAAL.

In his last annual report, the Conservator of Forests gives the following return of timber imported into the Transvaal :—

			Unmanufactured.		Manufactured.
1896	..	..	£271,868	..	£328,947
1897	..	..	178,145	..	258,741
1898	..	..	130,013	..	217,447
1899	..	..	74,258	..	118,368 (6 months)

			Unmanufactured.	Manufactured.
1900	..	..	.. ..	..
1901	..	..	£15,283 ..	£8,542
1902	..	..	275,332 ..	67,328
1903	..	..	781,409 ..	241,445

The forest estimates for the current year provide for an expenditure of £16,770; for the ensuing year (1905-1906) the estimates amount to £25,000.

FORESTRY IN RHODESIA.

Here we have a country in which forestry should play an important part. The natural timbers of the country are almost all excessively hard, while the majority of them are not durable and season badly. The larger portion of the high veldt of Southern Rhodesia is covered with forest of an open character, which, though better than scrub, is far from being good timber forest. Doubtless, it can be improved by demarcating out the areas that are best wooded and best supplied with moisture, and then husbanding the subsoil moisture by thinning into groups. But very much must remain to be done by planting more valuable exotic timbers, particularly Cedars and other timber of that class which fall under the description of durable softwoods. We may particularly mention several species of the genus *Cedrela*, *Taxodium mucronatum* of Mexico, *Cedrus deodara* of the Himalayas, *Callitris calcarata* and *C. robusta* of Australia, and lastly the slow-growing true Cedars belonging to the genus *Juniperus*. A list of trees suitable to Rhodesia will be found in a report prepared by the author for the Rhodes' Trustees in 1903. In this report are enumerated 440 valuable timber trees, which are more or less climatically suited, to Southern Rhodesia. This list is divided into two portions, the first embracing the more suitable trees, and the second comprising trees which, although not entirely suited climatically to the country, are worthy of test planting. Planting in Rhodesia is at present almost entirely confined to the Botanic Gardens at Bulawayo and Salisbury, and the fine work initiated by the Rhodes' Trustees in the Matopa Park. In his will, leaving the Matopa Park and its road and railway as a gift to the country, Mr. Rhodes enjoined the planting of every suitable forest tree in the Matopos. This injunction is now being carried out by the Rhodes' Trustees, and the planting of the Matopa Park will, it is hoped, soon afford an object lesson of the greatest value to the residents and others interested in the country. The Matopa Forestry scheme embraces the formation of a National Arboretum, which, for this semi-tropical country, will supplement the extra-tropical arboreta in Cape Colony and the Transvaal.

The first step to be taken as regards Forestry in Rhodesia is to determine what areas should be definitely reserved as forest, to demarcate these out, and to protect them from fire.

AREA OF FORESTS—SOUTH AFRICA.

The following statement shows the area of forests in South Africa brought up to May, 1905. This area includes the whole of South Africa south of the Zambesi, with the exception of Rhodesia and the Portuguese Territory, for which data are wanting. Though there is much open forest in the Portuguese low country, and the whole of the Rhodesian plateau is more or less covered with open forest, it is believed that in neither country is there any appreciable area of dense forest comparable to the Yellowwood forest of Cape Colony, Natal and the Transvaal. This does not mean that there is no valuable forest in Rhodesia. The Wanki Forest, yielding Rhodesian Teak, may be cited as one of probably great economic value, but the areas that it is intended to reserve as forests in Rhodesia have not yet been demarcated, and I have no data, even approximately, of their size.

CAPE COLONY.				Forests.	Plan- tations.
				Acres.	Acres.
Transkei: Demarcated, indigenous	..	..	..	102,000	
Plantations (1,500 wattles, 562 timber)	..	..	..	..	2,062
Actual Forest area, Eastern (Cons. Rep.) ..	..	..	..	168,000	
Plantations (including sand drifts 4,000 wattles)	..	..	..	..	8,877
Actual Forest area, Knysna (Fourcade) ..	..	..	..	90,818	
Plantations	..	..	..	..	905
Forest Area, Western:					
Plantations (excluding sand drifts) ..	..	..	..	..	11,691
Cedarberg Forest	..	..	..	116,494	
Indigenous Yellowwood	..	..	..	1,555	
				478,867	23,535

If we allow another 27,500 acres for forests in the Transkei not yet brought on to the Reserves, that would make a total of 529,902 acres of Government timber forest in Cape Colony: there are 413,408 acres of Yellowwood forest and 18,035 acres of timber plantations exclusive of wattles.

The following may thus be stated as the approximate areas under timber forest in South Africa:—

<i>Cape</i>	Acres.
<i>Natal</i> (excluding scrub forests):	529,902
Old Natal	40,000
Zululand	50,000
	90,000

Three-quarters of the Natal forests have been alienated, and of the 40,000 remaining one-third is on Native locations. For the forests of Zululand 50,000 acres is merely a very rough estimate.

<i>Swaziland :</i>	Acres.
Numerous small detached areas, say	1,000
<i>Transvaal :</i>	
Demarcated (1905) 14,000	
The total area of Government forest is probably about	20,000
Total Forest area of South Africa	640,902
Excluding the very poorly-stocked Cedar Forests there remains of Indigenous Yellowwood Forest	524,408

With the exception of Cape Colony, Forestry in the various South African States dates only from the reconstruction following the war: and it is only in the Transvaal that there is, as yet, any notable forest expenditure.

In Cape Colony systematic Forestry has been practised for nearly a quarter of a century, during which time over a million (£1,000,000) has been spent in the formation and conservation of the forest estates, reckoning interest at $3\frac{1}{2}$ per cent. The value of the Cape Forests is estimated now at about two millions (£2,000,000).

The average value of the timber imported to Cape Colony is estimated at £450,000 yearly, and the total South African timber bill at $1\frac{1}{2}$ millions (£1,500,000) yearly.

*From the 'REPORT OF THE SOUTH AFRICAN ASSOCIATION FOR THE
ADVANCEMENT OF SCIENCE,' Vol. I.—APRIL, 1903.*

See 23-11
Forsberg

SOME ASPECTS OF SOUTH AFRICAN
FORESTRY.

BY

D. E. HUTCHINS, F.R.MET. SOC.

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SOME ASPECTS OF SOUTH AFRICAN FORESTRY.

BY D. E. HUTCHINS, F.R.MET.SOC.

This paper was to have been on Forest Education in South Africa. We are at present absolutely devoid of any forest teaching in South Africa. A proportion of Forest Officers in the Government Forest Department now receive their training at the India Forest School at Cowper's Hill, England; but most men, whether in the Forest Department or out of it, acquire their knowledge haphazard. At the Government Agricultural Farm, Elsenberg, where there were formerly lectures on Forestry there are now none, though curiously there are lectures on carpentry and wood-working. This is something like cooking your hare before you have caught it! On reconsideration, however, I thought it better to alter the title of the paper to that which it now bears "Some Aspects of South African Forestry," thus making it of more general application and, I hope, utility. One is apt to forget that in a British community there is too often a complete ignorance of Forestry and to talk about it one has to start from the beginning.

Owing to historical reasons, England and South Africa are to-day practically without forests. In South Africa the reasons belong to geological history. They have not yet been fully traced. We know from the coal-fields and fossil remains of trees that forest formerly existed in South Africa, both where it is now too dry for it to flourish and in well-watered parts. If we compare South Africa with West Australia, we see that each has a highly specialized Forest Flora peculiar to itself; and a Flora within so restricted an area that it is comparable to many of the weak Island floras of the globe. Owing however to differences in the geological history of the two countries, whereas West Australia has still preserved its giant tertiary trees, the ancient forest of South Africa is gone, and the indigenous forest of to-day consists of generally stunted ever-green trees confined to sheltered kloofs and the most favourable localities on the mountains facing the coast. The trees are, as a whole, semi-tropical species, with a better development towards the tropics, while here in the extra-tropics, they are slow of growth, delicate in constitution and with a weak natural reproduction. It is probable that they will gradually be replaced, as they have in the Cape Peninsula, by the hardier members of larger forest Floras. In this respect, in appearance, and in characteristics generally, they much resemble the "Shola" forest on the Nilgiri plateau of Southern India. There also we have a small isolated extra-tropical country with weak semi-tropical trees that are easily ousted by the stronger species of the Australian extra-tropical forest flora.

In England and Northern Europe the ancient tertiary forest of giant Eucalypts is gone; but England and Northern Europe in the

succession of glacial and semi-tropical periods have never been cut off from the great forest region of the North. Up to comparatively recent times England was rich in forests. Cæsar found Oak and Beech in the South, Scotch-pine in the North and nearly the whole country a vast forest. There was still good forest when William the Conqueror came, but he had to resort to, perhaps necessarily, severe measures, to obtain the compact area in the South—the “New Forest.” What finally destroyed the forest wealth of England was the confiscation of the rich Church forests in the time of Henry VIII. At that time the nobles were powerful, the people and the national sentiment of modern times were weak. Nearly all the confiscated Church forests went to the nobles, and shared the eventual fate of all private forests; that is to say, gradual destruction. On the Continent of Europe the rich Church forests were not confiscated until the troublous times of the French Revolution at the beginning of 1800. When taken from the Church which had preserved them intact for centuries, they were given, not to the nobles as in England, but to the people of the country. Hence we see the curious contrast of to-day, no National Forests and no Scientific Forestry in England; on the Continent of Europe great and increasing forest wealth. The forests of Germany occupy one quarter of its total surface and their capitalized value is reckoned at 900 million pounds sterling. Great Britain and Ireland in Forestry occupy the lowest position among the States of Europe, being one per cent. worse off than Portugal:—

Percentage of Woodlands.

Russia in Europe	...	...	...	36	Scientifically conserved and permanent.
Austria	...	...	...	30	
Germany	...	...	...	26	
Switzerland	...	...	...	19	
France	...	...	...	17	
Portugal	...	...	...	5	Parks, small Plantations, etc.
Great Britain and Ireland	...	...	...	4	

The average proportion of Forest on the Continent of Europe is calculated at $29\frac{1}{2}$ per cent.

FORESTRY IN THE BRITISH ISLES.

In no particular is the insular isolation of England seen more than in the matter of forests. To-day England is paying in round numbers twenty million pounds sterling yearly for timber that could be produced twice or perhaps thrice over within the limits of the British Isles if the ancient forests were restored. When we consider that, in the more settled time before the late Boer war, the total cost of the Army was £24,000 and of the National debt £25,000 it will be seen that this forest question in England is the great question of the future. It must come prominently forward in the near future in

connection with the great social question of the rural population. If the loss of this goes forward at the present rate, the Empire must fall to pieces for want of recruits for the Army. In Germany it is estimated that the yearly wages of the people employed on forest industries amount to something like £30,000,000 sterling, and that roughly 12 per cent. of the total population of Germany is employed in the forest and out of the forest. About 1,000,000 people in the forest, i.e., directly employed in working the forest estates, and about 3,000,000 out of the forest, i.e., in working the forest produce, chiefly timber, into the various articles manufactured from wood. These forest workers in Germany are the pick of its manhood, the backbone of the nation. In England they have been replaced by the weakly, hysterical, knock-kneed factory operative, and his sickly tea-drinking wife, whose mistaken ambition is to avoid the health and strength following manual labour out-of-doors! These are sad facts which struck me very forcibly when travelling through the forests of the Continent and the rural districts of England. It was not till I got to Scotland that I saw a woman working out-of-doors. In the first part of the Boer war, out of 11,000 men offering themselves as recruits in the Manchester district 8,000 were found to be physically unfit to carry a rifle "and of the 3,000 who were accepted, only about 1,200 attained the moderate standard of muscular power and chest measurement required by the military authorities." (R. E. Dudgeon, M.D.) England can better afford to pay the cost of its wasted forests, viz., £20,000,000 a year, than allow the present waste of its manhood to proceed!

Not only is there a loss of non-production within the British Isles, but the cost of importation by sea of so bulky a material as timber is naturally very heavy. To produce within the British Isles the timber now imported would require an area of about nine million acres of forest, that is to say, one acre of forest to $8\frac{1}{2}$ acres of open country. This would amount to on an average about $1\frac{1}{2}$ "New Forests" to every county. Germany as we have seen has one acre of forest to every 4 acres of open country. Cape Colony spends £60,000 per year on its Forestry, or about one per cent of its average revenue. If England were to reforest at the same rate £1,000,000 yearly would represent the forest expenditure, and about two-thirds of a county the area of restored country. France spends over half a million yearly on Forestry.

According to the report of the recent Commission on British Forestry there are 21,000,000 acres of heather and rough pasturage in England and Scotland available for reforesting; 8,000,000 acres of forest would produce the timber now imported. It is calculated that if all the waste lands of Great Britain and Ireland were reforested the production of timber (excluding a small proportion of hardwoods) would be 3 or 4 times the timber now imported. (National Forestry" in Jour. Soc. of Arts, Nov., 1899.)

There is one redeeming feature in the present sad position of Forestry in England. Since the doom of English Forestry was sealed in Henry VIII's time it has not been possible to restore artificially

the National Forests, at a remunerative rate. When I was a boy it was necessary to pay 5% for money on good security. Forests in Europe have not returned hitherto more than $2\frac{1}{2}$ or 3%. It is only within the last fifteen or twenty years that money could be borrowed at a sufficiently low rate of interest to make the restoration of the forests remuneratively possible.

FORESTS OF CAPE COLONY.

The total area of indigenous forests in Cape Colony, from Cape Town to Natal, is estimated at 500,000 acres, or 810 square miles. Of this all but an estimated area of about 30,000 acres is Government forest worked systematically by the Forest Department. This is but a small percentage of the total area of the Colony, rather less in fact than $\frac{1}{2}$ per cent. Small though this area is, if it were well stocked it would be enough to supply the country's present wants and leave a good margin for export; but unfortunately the forest area is but poorly stocked with commercial timber. The yield of the Indigenous forest in its present poorly stocked state is estimated at only from 6 to 10 cubic feet per acre per year. This may be compared with the yield of European forests from 50 to 150 cubic feet, or with the yield in Eucalypt plantations which ranges up to 700 cubic feet per acre per year. The following is a selection of actual forest yields from Eucalypt and Pine plantations in Cape Colony.

YIELD IN CUBIC FEET PER ACRE PER YEAR OF TIMBER PLANTATIONS IN CAPE COLONY.

	Cubic feet.
Tokai: Kari (Prince Kasteel)	025.
„ „ (Cedar ridge)	533.
„ Eucalyptus saligna (Sphinx rock) $\frac{1}{4}$ Acre: 18 years old in 1900	527.
Worcester: Euc. globulus (Copse first 5 years)	457.
Tokai: Kari (Manor House Ridge)	377.
Plumstead: Cluster pine (14 years old)	341.
Worcester: Euc. globulus (1st crop over the whole 60 acres)	332.
Ceres Road (sample area Euc. globulus)	322.
Newlands: Cluster pine (G. 93. 52. Heywood)	178.
„ „ „ (Heywood & Brown)	170.

An inspection of these figures brings out the curious fact that as much timber can be got in one year from a good Eucalypt plantation, as during 100 years in the indigenous forest—the “rotation,” or life-time of the forest (so to speak) from seed-time to harvest.

EXHAUSTION OF COAL-FIELDS MET BY FUEL PLANTATIONS.

This high rate of production has a general interest outside the production of timber. As I showed recently (“Nature,” March 20th,

1902) it furnishes one of the most convenient and practical means of fixing and utilizing the sun's energy. The fixation of carbon, in a quick growing Eucalypt or Wattle plantation in South Africa, is about fifteen times that of a similar plantation in Europe. To-day, near Cape Town, it is less costly to plow the ground and produce wood fuel in a plantation of Wattles or Gums than to import coal fuel oversea, or by a long journey overland. If, on the World's surface, we take latitudes below 40° and rainfalls above 40 inches, and imagine this covered with forest, either with tropical forest or the quick-growing Eucalypt and Acacia forest of the extra-tropics, I calculated that there could be produced yearly, at the lowest computation, thirty times the world's present consumption of coal! Details of this calculation are given in one of the forest pamphlets which are on the table for distribution.

CAPE COLONY'S TIMBER BILL AND THE MEANS TAKEN TO MEET IT.

During 1902 the imports of timber to Cape Colony amounted in round numbers to half a million pounds sterling. Previous to the war the average for some years was a quarter of a million. South Africa is a poor dry country. It cannot afford to go on sending these enormous sums out of the country to pay for foreign wood, hence the existence of Forestry at the Cape. In its Forestry Cape Colony now stands at the head of every British community. Speaking recently Dr. Schlich (who occupies at this moment the position of the highest authority on forest matters amongst Englishmen) stated that amongst the British Colonies and dependencies, only India and Cape Colony had seriously considered the forest question. India is a tropical country with vast areas of poorly stocked pestiferous forests and a comparatively small area of well-stocked, healthy extra-tropical forest on the Himalayas. For some years past Cape Colony has spent, on an average, £60,000 yearly on Forestry. Of this amount between £40,000 and £50,000 is spent on timber plantations, composed mainly of Eucalypts and Pines. The bulk of the Eucalypt planting is to produce sleepers for the Railways. The Cape Government Railways require annually about one million cubic feet of timber and literally train loads of imported sleepers, mostly Jarrah, can be seen now by any traveller on the Cape Railways. These Jarrah sleepers come from West Australia and cost at the rate of 5/- per sleeper delivered here. The Cape Government Railways have now to spend nearly £100,000 yearly for imported sleepers. It is thus a matter of great importance to produce this timber at home, especially when it is considered that we have an exact duplication here of the climate of Australia, where these Eucalypt sleepers are produced. *Eucalyptus marginata*, or Jarrah, is the sleeper now most in favour. Some time back metal sleepers were used, but these have turned out as unsatisfactory here as in most other places where they have been tried; and the creosoted pine sleepers require the extra expense of a plate to prevent them being cut into by the heavy rails and rolling

stock they now have to carry. There are immense areas of Jarrah and Kari timber in Western Australia, in nearly pure forest, near the coast, so that access is easy and supplies assured. Kari timber is more suitable for use above ground than in the ground, but Jarrah has a well-established reputation for lasting in the ground; and there is, I think, no doubt that few better sleepers can be obtained than the Jarrah sleepers of Western Australia. East Australia is naturally fitted to produce equal or rather better sleepers. The Iron-bark timbers of Eastern Australia are harder and even more durable than Jarrah, and there are some half dozen other Eucalypt timbers equal to Jarrah in durability. But East Australia is comparatively an old settled country. It is 100 years since the British Colonists set to work destroying the forests; and to-day, East Australia cannot supply Iron-bark sleepers under 6s. or 6s. 6d. landed here. The unique Cedar-wood of East Australia, *Cedrela toona*, is also mostly destroyed; and so great and so utterly reckless has been the destruction of forest in East Australia that even the luxuriant Black-wattle has now become scarce. Not many months ago an enquiry actually came from Australia, to the Natal Black-wattle plantations, asking at what price bark could be shipped to Australia! The Black-wattle tree came not very long ago from Australia to South Africa, and the Natal plantations are entirely the work of the last few years. However, to return to our sleepers. The Cape Government Railways lately decided to lay down special sleeper plantations, for which purpose sites have been chosen near existing lines of railway, so as to avoid the heavy cost of transport to the railway. The financial position of these railway plantations is very striking. It is estimated that they will cost £60,000 or £70,000, and in 20 or 25 years will bring in a *perpetual revenue of £100,000 per annum*. This is calculated on the basis of the present mileage of Cape Railways and the prices paid for sleepers. The species of Eucalypts that I have selected for sleeper plantations are the following:—

EUCALYPTS FOR SLEEPER PLANTATIONS.

- (1) *E. paniculata*; an Ironbark.
- (2) *E. pilularis*; Flintwood.
- (3) *E. microcorys*; Tallow-wood.
- (4) *E. resinifera*; a Jarrah-like timber.
- (5) *E. saligna*; Quick-growing good timber.
(*E. marginata*; Jarrah, low yield.)

These timbers are equal or superior to Jarrah, and they are more fast growing.

SOFT-WOOD FOR SLEEPERS AND HOUSE BUILDING.

In spite of the fact that Soft-wood sleepers require the extra cost of a bearing plate and of creosoting, they are now being produced largely, especially in plantations where the poor nature of the soil is unadapted to the rapid growth of Eucalypts. The species which

is almost exclusively used for these plantations is Cluster-pine (*Pinus pinaster*). This is a tree which has become completely naturalized in the South-west of Cape Colony, and which, by means of plantations, is spreading elsewhere in South Africa. Cluster-pine is largely used for sleepers in the South of France and the North of Spain. It is so hardy and grows so vigorously along the Southern Coast of South Africa that Mr. J. S. Gamble (author of the classical work on Indian timbers) is of opinion that it should be given the preference to Gums in sleeper plantations. It is spreading self-sown up the crags of Table Mountain, and out over the sands of the Cape Flats. The Cape Forest Department uses about twelve tons of Cluster-pine seed yearly in its re-forestation operations. So far, it is free from any serious pests, insect or fungoid. From its great enemy, fire, it is protected by cutting up the pine plantations, like a chess-board, with protective strips of Eucalypts. These Eucalypt fire-lines are productive instead of being a source of expense, and are more effective in arresting sparks than the usual cleared or plowed fire-lines.

The other pines that have grown largely enough to be now considered naturalized are:—

Pinus insignis, or Insignis pine.

Pinus halepensis, or Jerusalem pine.

Pinus canariensis, or Canary Island pine.

Pinus pinea.—The Stone-pine, or Umbrella-pine, of Italy, has been grown at the Cape for 150 years or more; apparently it was introduced before the Cluster-pine. But about 25 years ago it was attacked by a fungoid disease—*Peronospera* sp.—and has now ceased to have any importance as a forest tree. *Pinus insignis* suffers from a variety of diseases; it can no longer with safety be planted in large masses, for which purpose its place may be taken by its home associate *Pinus muricata*. The beauty and rapid growth of the Insignis pine will, however, ensure its continued planting as an ornamental tree.

The four Pitch-pines of the Gulf States of the United States of America are being planted with caution. They are climatically suited only to the wettest parts of the Southern coast. They are:—

Pinus australis.

„ *mitis*.

„ *cubensis*.

„ *taeda*.

OTHER TREES.

Besides the Eucalypts and Pines a great variety of other trees are being planted in Cape Colony. It would take too long even to enumerate these. The Cedars alone would require a paper to themselves to describe. About twenty-five species yielding Cedar or Cedar-like wood are under cultivation. These are absolutely the most valuable timbers grown in South Africa, but they have not the economic importance of the Eucalypts and Pines on account of their slow growth. These trees

belong to the genera *Juniperus*, *Cupressus*, *Callitris*, *Cedrella*, and *Cedrus*. Cape Cedar, the most useful of the indigenous timbers, is *Callitris arborea*. It grows on the rugged Cedarberg Range 100 miles North of Cape Town, to the size and stature of the Cedar of the Atlas Mountains; but, alas, the former extensive Cedar Forests of Cape Colony were ravaged, by axe and fire, for 150 years before the Forest Department came into existence, and only vestiges of these valuable trees now remain. Unlike the delicate trees of the ever-green Indigenous forest, Cape Cedar is perfectly hardy against wind, drought, frost, and snow; it seeds abundantly, and is easily propagated.

Other interesting timber trees now being planted are the Black-wood, *Acacia melanoxylon*, and the Camphor. Black-wood has a timber like walnut; and Camphor the scented wood yielding the Camphor of commerce.

Of ornamental trees we may mention the Pepper-tree, *Schinus molle*, which flourishes in the dry inland districts; the brilliant scarlet flowering Gum, *Eucalyptus ficifolia*, on the coast districts; the noble English Oak, which is here more a fruit tree than a timber; and the Plane, with its dense foliage flourishing, like the Weeping-willow, near water.

The Government timber plantations, which are mostly near Cape Town, or in the mountains North of King William's Town, now embrace about 20,000 acres of timber, and they are now manufacturing timber for the country at the rate of about three million cubic feet yearly. This is above one-third our present timber importation, $7\frac{1}{2}$ million cubic feet, or more than half of what we were importing before the war, 5 million cubic feet. None but it has been used for pit props, and the thinnings supply already a great deal of firewood. Indeed, one of the oldest of the plantations near Cape Town keeps a sawmill constantly at work sawing up firewood, and the revenue from the sale of firewood and young plants in these plantations now equals the expenditure, before cutting a stick of the main timber crop! This is a most satisfactory result.

There are, as mentioned, up to date, about 20,000 acres of fully stocked timber plantations in Cape Colony. One of the oldest and best known of these plantations is at Tokai, $1\frac{1}{2}$ hours from Cape Town. I was absent from Cape Town when the official programme of the Association's visits was drawn up; but an unofficial visit to Tokai has been since arranged for Friday afternoon, and I shall be very happy to see there, on that day, all those who take an interest in Forestry. If they will kindly give me their names now, I will make the necessary arrangements for free conveyance by rail and cart to Tokai.

The short time remaining now at our disposal will be fully occupied with the examination of the South African wood specimens on the table.

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