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SELECTIONS
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THE RECORDS
OF
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Published by Authority.

N^o. VI.
REPORT
ON THE
TIN AND OTHER MINERAL PRODUCTIONS
OF
THE TENASSERIM PROVINCES.

BY
CAPT. G. B. TREMENHEERE,
EXECUTIVE ENGINEER, TENASSERIM DIVISION.

AND
REMARKS ON THE REPORT, &c.

BY
T. OLDHAM, ESQ.
SUPERINTENDENT OF THE GEOLOGICAL SURVEY OF INDIA.

Calcutta :
F. CARBERY, MILITARY ORPHAN PRESS.
1852.

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R E P O R T
ON THE
TIN OF THE PROVINCE OF MERGUI.

BY
CAPTAIN G. B. TREMENHEERE,

ERRATA.

In page 10, line 10, for "63,176 grains," read 6 ounces and 176 grains.

In map facing page 30, for "*Hanzai*," read *Henzai*.

In page 36, line 4, for "*views*," read *veins*; and for "*not be*," read *be not*.

In page 36, line 21, for "*view*," read *vein*.

In page 41, line 25, for "*regarded to*," read *regards*.

GROUND, AND OF EXAMINING THE GRAVEL WITH WHICH THE TIN IS MIXED.

Their variable depth, and the amount of labor expended on them, is a tolerable indication of the success with which this has been pursued, and of the places in which ground might be again perhaps opened with advantage.

2nd. The streams themselves are rich in Tin, which may be collected from their beds in considerable quantities. The process by which it has been deposited for long periods, and for many miles along the line of valleys through which they flow, appears to be in active operation at the present day. Crystals of the peroxide of Tin washed down by the rivers and deposited with sand gravel in their beds, may, by changes of the river's course during the freshes, be quickly covered with a few

R E P O R T
ON THE
TIN OF THE PROVINCE OF MERGUI.

BY
CAPTAIN G. B. TREMENHEERE,

EXECUTIVE ENGINEER, TENASSERIM DIVISION.

THE Tin of this Province has not been sought for, since the Burmese took possession of the country from their Siamese neighbours; under the rule of the latter, or during the period at which Tenasserim was an Independent State, extensive works for Tin were carried on. It occurs chiefly in the beds and banks of streams issuing from the primitive mountains which form the principal feature of this Peninsula: portions of the banks of streams in which it is found are, in some instances, rivetted with rough stone-work to confine the water for washing operations, and the ground on either side, for many miles along their course, is penetrated by innumerable pits, from 8 to 10 and 12 feet deep. Traces of the work of many thousands of men are evident in several places. These pits are not connected with one another, but seem to have been sunk by separate small parties of men, to whom probably definite tasks were assigned, with a view of tracing the Tin ground, and of extracting the gravel with which the Tin is mixed.

Their variable depth, and the amount of labor expended on them, is a tolerable indication of the success with which this has been pursued, and of the places in which ground might be again perhaps opened with advantage.

2nd. The streams themselves are rich in Tin, which may be collected from their beds in considerable quantities. The process by which it has been deposited for long periods, and for many miles along the line of valleys through which they flow, appears to be in active operation at the present day. Crystals of the peroxide of Tin washed down by the rivers and deposited with sand gravel in their beds, may, by changes of the river's course during the freshes, be quickly covered with a few

feet of gravel and soil. The older deposits have, as far as my observation extends at present, the same alluvial character, and it would be well in future operations to have regard to the levels in which the streams may have formerly run. The first of these localities which attracted my attention was the Theugdau river, issuing from the primitive mountains in the immediate neighbourhood of the coal mine on the Great Tenasserim river. I visited this river in the course of my survey of the Coal Basin, and found pits in great number along its banks, of the existence of which I had been previously informed, though the object for which they had been dug, was not known to my informant. On washing some of the gravel from the bottom of one of the pits, a small quantity of Tin was found.

3rd. A Shan was subsequently sent there and collected 11,889 grains of Tin, of the Native peroxide, in the course of an hour and a half, specimen No. 1, which is equivalent to 19 ounces and 198 grains of pure Tin.

4th. After leaving the vicinity of the Coal mine, I proceeded down the river, and was accompanied by the Shan, who had been employed in Tin works in the Straits, and to whom several Tin streams in the Mergui Province were known. These are situated chiefly on the Little Tenasserim river, into which they empty themselves. The first and most accessible is the Thabawliek, which unites with the Thakiet, 3 miles above the junction of the latter with the Little Tenasserim. The mouth of the Thakiet is 11 miles from the town of Tenasserim.

5th. The access to this Tin ground is by land in the dry season. Landing at the village of Thakiet, I proceeded on foot 8 miles, and reached the Thabawliek.

6th. The intervening ground is for the most part flat. After passing a marsh of some extent, there is a low ridge of hills, which presents, however, no obstacle to land carriage of any description. The face of the country is as usual, except in marshy places, thickly covered with jungly trees, but the wild elephant's track is open and convenient. During the monsoon, boats carrying 100 bags of rice can ascend the Thabawliek to the place alluded to, in one day. The tide is felt about 6 miles from its mouth.

7th. Having arrived at the spot at a point known to my guide, and at which he had the previous year stationed himself for a few months for the purpose of collecting Tin, I found numerous pits and old cuttings from which Tin had been formerly obtained. It is found in layers of gravel immediately beneath the soil. The surface is undu-

lating, and during the wet season streams of water could have been conveniently conducted near the excavations for the purpose of washing the gravel.

8th. The guide stated that crystals of Tin could be in this manner separated by the hand without the usual aid of the washing trough. The rains not being at that time sufficiently advanced for that purpose, I did not succeed in obtaining any Tin from the pits. The line of deposit of the richest stanniferous gravel has been probably influenced by many causes, and the chances of finding it are much the same as those to which other undertakings of this nature are subject. A few trials, however, across the low ground through which the hill streams pass would enable the speculator to follow its course.

9th. The time of the Tin-washer was, I found, much better occupied in seeking for Tin in the bed of the river. He was assisted by one man, who disturbed the sand and gravel with his feet to as great a depth as he could thus accomplish, when a conical and shallow trough, about 2 feet in diameter and 10 inches deep, was filled with the same, and washed in the stream by a circular motion so as to get rid of the gravel and lighter particles, leaving the crystals of Tin to collect by their gravity on the apex of the hollow trough.

Each filling and washing occupied on an average 6 minutes :

One washing produced 1,041 <i>grs.</i> of native peroxide of Tin in 6 minutes,	} Specimen No. 2, equivalent to 1 oz., 335 <i>grs.</i> of pure Tin.
One ditto 1,265 <i>grs.</i> of ditto ditto,	
One ditto 1,785 <i>grs.</i> of ditto ditto,	} Ditto No. 3, ditto 2 oz., 31 <i>grs.</i> ditto.
One ditto 1,785 <i>grs.</i> of ditto ditto,	
One hour's work apart from the above produced of 8,166 <i>grs.</i> , ditto ditto, ...	} Ditto No. 4, ditto 2 oz., 430 <i>grs.</i> ditto.
One hour's work apart from the above produced of 8,166 <i>grs.</i> , ditto ditto, ...	
Total of half a day's work, including the above, pro- duced 25,406 <i>grs.</i> ,	} Equivalent to 2 lb. 9 oz., 232 <i>grs.</i> ditto. Specimen No. 6, contains of the latter 13.149 <i>grs.</i>

The price of labor in this province is 6 annas per day.

10th. The produce of a day's labor of two men would be, according to the above trial, equivalent to 5 lbs., 2 oz., 464 *grs.* of pure Tin at the cost of 12 annas, exclusive of the expenses of reduction to the metallic state. This process from the pure state of the mineral is extremely simple and inexpensive. The Tin collected in the trough would require one more washing, to remove particles of sand, &c., and charcoal is the only fuel required for its reduction. The pieces or ingots of Tin in the shape of the frustrum of a cone, Specimens Nos. 7 and 8, which are manufactured at the Rehgnon Mines on the Pakchan river, to the Southward,

and exchanged there for goods at 4 annas each, weigh 1 lb., 2 oz., 383 grains, and their value at Mergui, where the average price of Tin is 85 rupees per 100 Viss of 365 lbs. is 4 annas, 4 pie. The value, therefore, of 5 lbs., 2 oz., 464 grains, or the day's work of two men, would be 1 rupee, 8 annas, 4 pie; the cost of collecting being 12 annas, leaves 12 annas and 4 pie for the cost of the reducing process, and for profit on the labor of two men.

11th. On the morning after reaching the Thabawliek, I traced the Tin ground for a mile in a N. N. E. direction. The pits are in some parts more abundant than in others; and I was informed that they occurred and were thickly scattered throughout the entire course of the river between that point and the hills from which it issued, at the distance of an entire day's journey if the windings of the river are followed.

12th. The pits have not been worked since the Burmese took possession of the country. At the head of the stream there are said to be the remains of bunds constructed for distributing water for washing the Tin, and the posts of a house still standing, which is supposed to have been occupied by a Siamese Superintendent of the work there carried on.

The season was too far advanced to enable me to prosecute my inquiries towards the hills on this occasion, and my attention was therefore confined to the spot from which I obtained the results detailed above.

13th. Four other rivers, emptying themselves into the lesser Tenasserim, are said to produce Tin, but none are so accessible as the Thabawliek.

The following are the names of these streams with their distances from the Thakiet river :

The Thamoung-tang river. One day by the Little Tenasserim and 1 march inland.

Engdan river. No road through the jungle.

Kyeng ditto. Two days by the river and 2 days inland.

Thapyn ditto. Three days by the river and 1 march inland.

From the Thamoung-tang, Specimen No. 9, weighing 2,890 grains, was collected in 10 washings, but I did not visit the place myself.

The size of the Tin is larger than that collected in other places, though the produce is not equal in quantity.

14th. After returning to Tenasserim, I visited Loundoungia river, where Tin was said to exist; but it turned out to be Wolfram sand, which had been washed down from the adjoining Slate mountains, and was lying on the surface of the sandy bed of the stream.

15th. In proceeding down the Great Tenasserim river, towards Mergui, I halted at Moetong, for the purpose of visiting a Tin ground which was said to exist near the range of hills to the N. E. skirting the open plain in which this place is situated. On penetrating to the hill itself, I found it to consist exclusively of granite, with not a trace of another rock of any description. The dry beds of the water-courses consisted of granitic sand alone.

There were many excavations for Tin on the face of the hill ; several loads of gravel from the bottom of the pits and from the beds of the water-courses were carried to the river and washed, but the out-turn of Tin was very small. There is no water within convenient reach.

16th. The next spot visited was Kahan, a small hill near the Zeda-vaun Pagoda on the right bank of the Great Tenasserim river, 11 miles from Mergui. The Tin occurs here under conditions differing much from that of the localities above-mentioned.

Kahan itself is the highest portion of a low ridge of hills not more than 200 feet above the level of the river: it is composed of a soft, friable, white sand-stone rock, the upper portions of which are decomposed and irregular. The surface gravel does not contain Tin. It is found in the crystalized form, interspersed in decomposed granite, forming a vein about 3 feet wide, which is enclosed by the white sand-stone rock, and dips down at a high angle with the horizon. Specimen No. 10, if its form be preserved, illustrates well the Tin crystals imbedded in the decomposed granite, which are easily detached from the matrix. The Specimen 11, from the same vein, of a yellow color, is considered the surest indication of the presence of the mineral, and lies below the white No. 10 ; large scales of chlorite occur with it, which, as they are generally found where the Tin is most abundant, is called by the Natives the Mother of Tin. The face of the hill is in one spot scattered over with these, which appear to have been brought down from the vein with other matter from which the Tin has been separated by the usual mode of washing. It will be noticed that the granite is completely decomposed, and that the crystals would be easily separated by washing. No Tin has been raised here since the country came into our possession, but the locality has been known. It was worked during the Burmese rule, and valued as supplying the richest ore of Tin. A Burmese, residing near the spot, pointed out the place where his operations had ceased ; he had followed the direction of the vein alluded to, as well as he was able, and had driven a gallery under ground in an

inclined direction upwards till the bank above fell in, when the mine was abandoned. He stated that he had procured considerable quantities of Tin daily, and that he often found it in large masses mixed with the yellow ground above-mentioned. Arriving at the spot where his work had terminated, I set people to excavate and find, if possible, the vein which had been described. It was reached after about 2 hours' digging, at the depth of 5 feet from the surface of the cut in the hill in which we stood. In about a quarter of an hour a few baskets of the decomposed granite were removed down the hill, from which 3,900 grains of the crystallized peroxide of Tin, equal to 63,176 grains of pure Tin, Specimen No. 12, were collected, and the next day 23,400 grains, equal to 2 lbs. 6 ounces, and 100 grains of pure Tin were found in the same manner by one man's labor in excavating, one carrying down to the water, and a third washing.

17th. This locality appears to be of a very promising description, and I have little doubt that, if the work were aided by ordinary skill and means, a Tin mine here would be productive. A vein of Tin is, in fact, exposed to the day, and would only require for a considerable period of work the precaution of well-supported galleries and shafts to allow of its contents being easily extracted.

The Kahan hill is, I conceive, an indication of a valuable repository of Tin. It is but a quarter of a mile from the creek communicating with the river, which is accessible to any boats. Its proximity to Mergui offers also great facility for the procurement of labor and supplies.

18th. The localities, therefore, which appear to hold out the best prospect for Tin are, 1st, for Stream Tin, the Thabawliek river and the Thengdan river; and for Mine Tin, the Kahan hill. They all produce Tin of the same nature and quality, *viz.* crystals of the native peroxide, being a combination of oxygen and Tin only.

19th. No difficulty would be found in procuring labor from Mergui for carrying on Tin works at either of these places.

20th. The location of the Coal mine on the Great Tenasserim river has given rise to much additional cultivation along the banks of that river, where there are many Kareen villages, from which parties on the Thengdan could be supplied. Fruit trees not indigenous to the place, and other traces of a considerable population having once occupied its banks, are observable on this river. The banks of the Little Tenasserim are thinly occupied by Siamese villages. The country in this direction, except near the banks of the river, is utterly unpeopled and appears always to have been so.

Of the existence of Tin in considerable quantities, there cannot, from the facts above stated, be much question, and from the trial of the produce of one man's labor in a given time, there appears to be sufficient to justify every expectation of a profitable employment of labor on an extensive scale.

The results, however, which are given in detail can only be considered rough approximations to the probable out-turn of Tin with an establishment properly superintended. Much economy in labor might be effected in collecting the sand and gravel for the washers, but no better mode could, I think, be adopted in separating the Tin in the first instance than by people accustomed to work with the flat conical-shaped troughs before described. The quantity collected would fully repay the employment of men in this operation.

The Tin as produced by the washers should be placed on sloping boards, and water conducted over it from a trough pierced with holes for the purpose, in order to get rid of foreign particles; and it would then, after being finely pounded, be ready for smelting. Of all metals Tin is in this process the least troublesome after the ore is freed from the earthy and silicious particles with which, in other countries, it is often mixed. The crystallized form, in which the ore is here found, renders its separation extremely easy, and the whole processes of stamping and dressing, which in England are tedious and expensive operations, can thus be dispensed with. No arsenic or sulphur being mixed with the ore, it need not be roasted before it is placed in the furnace.

It will thus be seen that the Tin of the Mergui Province offers no ordinary inducement to the outlay of capital without much of the risk, uncertainty, and large previous outlay usually attending mining adventures.

21st. Communication by water from the Thakiet to the Thabawliek Tin ground is not open in the dry season, but the distance by land is short. The produce of two lines of country, that of the vicinity of the Great and Little Tenasserim rivers, passes the Town of Tenasserim at the junction of these rivers, only 11 miles from the Thakiet, and no difficulty in procuring subsistence for working parties on the Thabawliek need be apprehended.

G. B. TREMENHEERE, *Captain,*
Executive Engineer, Tenasserim Division.

MOULMEIN,
The 31st August, 1841. }

R E P O R T
ON THE
MANGANESE OF THE MERGUI PROVINCE.

BY
CAPTAIN G. B. TREMENHEERE,
EXECUTIVE ENGINEER, TENASSERIM DIVISION.

DURING my stay at the Tenasserim Coal Basin, a piece of Manganese ore, black wad, of good quality, was brought to me by a Kareen, who stated that it had been found accidentally in the bank of a stream called the Thuggoo, which enters the Great Tenasserim 17 miles below the coal site. Subsequently several other pieces of the same ore were brought by Mr. T. A. Corbin, Assistant to the Commissioner, from the Therabuen river, 5 miles above the Thuggoo, and from an intermediate spot, the locality of which had been previously known, and had been, I believe, originally pointed out by Lieutenant Glover of the Madras Army.

2nd. In proceeding down the river I visited these spots, and found at each that a valuable bed of Manganese ore existed close to the surface of the country. It had been apparently cut through by the action of the streams and river before-mentioned, leaving a section of the bed of ore in their banks covered only by the *debris* of the banks themselves. Large quantities might have been carried away, but a few hand specimens only were taken, which sufficiently show the nature of the deposit, and are fair samples of what might be easily collected.

3rd. The best Specimens, Nos. 1 and 2, are from the Thuggoo river and the bank of the Great Tenasserim. That of the Therabuen did not appear to be at the surface of so pure a quality, but the existence of the bed being known, it is perhaps premature to pronounce it an inferior ore from the examination of specimens taken from a hole extending not two feet into the bank. No. 5, is a portion of Manganese rock projecting into the Great Tenasserim river near the mouth of the Therabuen stream.

4th. Of the extent of these Manganese beds, it is difficult to pronounce. The face of the country in which they are situated is flat, thickly overspread with soil and with the densest jungle. It is not, as far I could perceive, intersected by many streams which would afford the means of tracing the mineral deposit. The Great Tenasserim river has passed through the Manganese bed in one spot, $2\frac{1}{2}$ miles removed from two other points at which it occurs to the North and South, at both of which it is likewise discovered near the surface by the action of the streams Thuggoo and Therabuen. The probability, therefore, is that it is a horizontal deposit covering many square miles. But without indulging in conjecture, there is sufficient at the localities referred to, to indicate large quantities of Manganese ore, which could be collected by penetrating through the soil lying above it and immediately near the spots, in which it is now exposed to the day.

It occurs in the form of the black oxide, and is the Manganese of commerce. It is largely consumed in Europe in the preparation of bleaching compounds, and, when pure, is valuable to the manufacturer of glass.

5th. The soft black ore No. 1, is a hydrate of the peroxide of Manganese, known under the name of Wad. It contains of water two equivalents, or 29 per cent.

Iron 1.96 grains by analysis. Its specific gravity, is 1.47

The specific gravity of the grey peroxide No. 4, is 2.46

G. B. TREMENHEERE, *Captain,*
Executive Engineer, Tenasserim Division.

MOULMEIN, }
11th September, 1841. }

To. G. A. BUSHBY, Esquire,

Secretary to the Government of India,
General Department.

&c. &c. &c.

SIR,

In reply to your letter of 24th ultimo, No. 1684, I have the honor, under instructions of the Coal and Mineral Committee, to say that the specimens of peroxide of Tin received from the Tenasserim Provinces, are the usual ore of Tin, which is worked with much advantage in the Dutch Possessions in the Straits, and in the lower parts of the Malay Peninsula, South of the British boundary; but it has not hitherto

been supposed to be sufficiently abundant on the Coast, to be profitably worked beyond the tenth degree of North latitude.

2nd. The importance of this ore depends entirely upon the quantity in which it occurs; the most profitable repositories are those in which it is found in the form of crystals in soft gneiss. It is often, however, profitably obtained from the sands of rivers, when it is called Stream Tin ore.

3rd. The Tin occurs as stream ore in all the localities described by Captain Tremenheere, except Kahun, a hill on the right bank of the Great Tenasserim, about 11 miles from Mergui, vide Paragraphs 16 and 17 of Captain Tremenheere's Report. Here Captain Tremenheere found the ore in its native repository, a friable gneiss rock, similar to that in which it occurs at Banka.

4th. The Committee are of opinion that the circumstances brought forward by Captain Tremenheere in the 16th and 17th paragraphs of his Report, are such as to render it desirable that the miner recently employed in Kemoon under Captain Drummond should, if now available, be placed under the orders of Captain Tremenheere, for the purpose of ascertaining the value of the ore at Kahun.

5th. I have the honor to return the specimens as directed, for the purpose of being presented to the Asiatic Society, having, however, retained a portion of each for the Committee's collection of minerals.

I have the honor to be, &c.,

J. McCLELLAND,
Secretary to the Coal Committee.

CALCUTTA,
The 15th December, 1841. }

Extract from a letter from the Hon'ble the Court of Directors to the Government of Bengal, in the Public Department, No. 20 of 1843, dated 25th October, 1843.

PARA. 10. The specimens of Tin ore received from Mergui have been examined by several competent persons in this country, who consider them to be of the best kind. As a profitable speculation every thing must depend upon the expense at which this ore can be prepared for the market. According to Captain Tremenheere's Report it can be procured in abundance and at a cheap rate.

15-16. Forwarding Reports by Captain Tremenheere on the Tin Grounds and Manganese Beds of the Mergui Province.

No. 30.

FROM MAJOR A. BOGLE,
Commissioner, Tenasserim Provinces,

TO J. P. GRANT, ESQUIRE,
*Secretary to the Government of Bengal,
Fort William.*

DATED MOULMEIN, 21ST JUNE, 1850.

SIR,

It is generally understood that there are in the Provinces of Tavoy and Mergui rich deposits of valuable ores, and that in Mergui in particular there are extensive Coal fields, one of which, but not the best, was a few years ago the scene of some limited operations, but at no time has any minute or scientific examination been made into the extent or value of these resources, by persons possessing full leisure and in all respects qualified to undertake the task, and it is now generally asserted that the Coal-mining operations were discontinued just at the time when very superior Coal had been discovered, and they promised most favorably. The importance of ascertaining something more of the mineral resources of the Southern portion of these Provinces, and of the numerous islands in the Mergui Archipelago, appears to me not to admit of any question, and I would particularly solicit attention to the great saving which might annually be effected to Government, and the great advantage which would accrue to these Provinces should it be found practicable to discontinue the importation of Coal, and to supply the Government Steamers, and, probably before very long, private Steamers also plying between Calcutta, Ceylon, and the Straits, with safe and economical fuel. I am aware that objection was formerly taken to the Coal of Mergui on account of its tendency to spontaneous combustion, but I am given to understand that the Coal to which this suspicion attached was not extracted from the best mine; it certainly does not at all follow that because some specimens have been found to contain dangerous properties, the entire Coal of a Province should be equally unfit for use, and that because some parcels have ignited under suspicious circumstances, that combustion proceeds entirely from the quality of the Coal.

2nd. As a proof of the fallacy of such an argument, I may mention that some hundreds of tons of Coal imported from England and Scotland have been consumed in the depôt at this place, within the last few

years, yet no one has ever thought of attributing the fires solely to the peculiar properties of the Coal.

3rd. The expense of importing the quantity annually required for the service of this port, does not fall short of rupees 30,000, a sum which if expended within the Province might be productive of much good.

4th. But it is not merely to the Coal deposits, valuable as they are believed to be, that I would direct attention; it is well known that there is excellent Iron and Tin in the Southern Districts: it is believed that Copper is also to be found, and probably Lead and Silver may likewise be discovered.

5th. It is also well known that one of the first elements of success in the development of mineral riches exists in the highest perfection, *viz.*, water carriage; the numerous streams are navigable for a considerable distance, and the Islands may be closely approached on all sides by vessels of large burthen; indeed few countries are more favorably situated in this respect than the Tenasserim Provinces, yet the whole coast is neglected, and the very extent of our territory is still a matter of doubt.

6th. I have no intention of recommending at present that mining operations should be renewed on the part of Government, but as it is well known that an extensive steam communication is about to be established in the Eastern Seas, and such communication must inevitably increase with the progress of time, I consider it my duty to draw the attention of Government to the importance and expediency of causing the resources of the Southern Districts of these Provinces, which are believed to be the most rich, to be carefully examined and reported on, in the expectation that should the results be favorable, the great Steam Navigation Companies or other Capitalists may be attracted to localities which seem to be most conveniently situated, and although I have no Assistant who is capable of conducting an inquiry of this nature, I am happy to say that should the Government approve of the suggestion, the services of Mr. E. O'Riley, who has long resided in these Provinces, and possesses much information respecting them, and probably sufficient knowledge of Geology and Mineralogy to admit of his furnishing a valuable report at a charge of perhaps not more than Rupees 500 per mensem, including travelling expenses, are available. Mr. O'Riley is the same gentleman whom I lately recommended for employment on a mission to the Shan States, but doubts may well be entertained whether the state of affairs in that direction may at the beginning of the cold

season admit of his proceeding to Zimmay with any prospect of benefit to commerce.

7th. Feeling convinced of the importance of ascertaining more of the resources which are believed to exist within these Provinces than is at present known, and of the incalculable advantages which might result to this jurisdiction from the facts being made known to the world at large, I beg to recommend that the opportunity which presents itself of obtaining much useful information at small cost, by employing Mr. O'Riley, may not be permitted to escape. I should think that Rupees 500 per mensem, including travelling charges, would be a fair rate of remuneration, and the period of his deputation would not exceed 3 or 4 months.

I have the honor to be, &c.,

A. BOGLE,

Commissioner, Tenasserim Provinces.

No. 83.

FROM MAJOR A. BOGLE,

Commissioner, Tenasserim Provinces,

TO J. P. GRANT, ESQUIRE,

Secretary to the Government of Bengal,

Fort William.

MOULMEIN, 21ST AUGUST, 1850.

SIR,

With reference to my letter to your address, No. 30, of the 21st June 1850, I beg to state that when Captain Berdmore was lately here he brought to my notice the circumstance of some rich specimens of Tin ore having lately been discovered at an entirely new place not far from Mergui, and of some peculiarly favorable indications of the existence of a highly bituminous and valuable description of Coal at a place which has never yet been explored.

2nd. I therefore think it proper to bring the same to the notice of the Hon'ble the Deputy Governor, in further illustration of the advantages which I anticipate from the employment of Mr. O'Riley on special survey of the Southern parts of these Provinces.

3rd. Our great want is population; the people who are most likely to emigrate from the countries South of Mergui are the Chinese, who are now stated to be almost too numerous in the Straits, and nothing is more likely to bring them than authentic information of the existence

of good Tin, Coal, and Iron deposits: with an increase of population the developement of all our resources may be hoped for. I therefore trust the Deputy Governor of Bengal will afford me his support in the moderate and inexpensive scale of experimental operations, which I have been induced to recommend.

I have the honor to be, &c.,

A. BOGLE,
Commissioner, Tenasserim Provinces.

No. 235.

FROM MAJOR A. BOGLE,
Commissioner, Tenasserim Provinces,

To J. P. GRANT, ESQUIRE,
Secretary to the Government of Bengal,
Fort William.

MOULMEIN, 14TH FEBRUARY, 1851.

SIR,

I have the honor to transmit herewith copy of the communications noted in the margin* being a Report from Mr. O'Riley, of Moulmein, on an excursion which he lately made from Tavoy to this place, in search of Copper and other mineral resources, with a memorandum on the specimens submitted by him and which are forwarded in a box addressed to you; likewise his Report on the Bay of Henzai, which is situated between this place and Tavoy, but, although so close to Moulmein, does not appear to have hitherto attracted any attention.

2nd. When I was at Tavoy in November last, I had the pleasure of meeting Mr. O'Riley there, when he communicated to me the result of a journey which he had lately made through the jungles, from Tavoy to Mergui, and also of an effort he had just returned from, to reach Henzai Bay overland, but in which he had failed, when on the very point of accomplishing it, from want of supplies, his means of carriage having been entirely deficient.

3rd. As it appeared to me that there were strong reasons for believing that an examination of the country in the vicinity of Yé and between it and Moulmein would result in the discovery of Copper, if

not of the more precious metals, and that the numerous streams which fall into Henzai Bay merited attention, from their reported richness in Tin, I felt an earnest wish to avail myself of Mr. O'Riley's energy and intelligence before the cold season had passed away, I therefore took it on myself to make him an advance of Rupees 500, merely to enable him to hire an elephant and coolies and lay, in common necessaries for the journey, his own funds having been exhausted; and the Reports and specimens I have now the honor to submit are the result. I would of course have much preferred awaiting His Honor's sanction to the above outlay before making it, but had I done so I feared that the season might expire and the opportunity be lost; I trust the Deputy Governor will approve of my having supplied Mr. O'Riley with the requisite means of carrying out, in some degree, the examinations I wished to have made.

4th. On his report it is difficult to arrive at any very satisfactory conclusion, and the subject is one on which, without a personal visit to the places inspected by him, I am reluctant to express any opinion, but I feel confident that Mr. O'Riley has followed up his inquiries, as far as his means would admit, with much zeal, and perseverance, and it is very certain that he has encountered much fatigue and privation, travelling chiefly on foot and without camp equipage, and subsisting for the most part on the simple diet procurable in the villages. He has indeed proved himself possessed of all the activity and hardiness calculated to ensure success in overcoming the numerous serious difficulties incident to attempts to explore regions covered with the densest jungle, and his Reports contain useful information, and display much ability and intelligence.

5th. Of the ultimate discovery of auriferous deposits of any extent or value, or of even Copper, I am far from being sanguine, although it would appear that both exist in a limited degree, and also Lead and Silver, but the existence of valuable Tin in some quantity in the streams which fall into Henzai Bay, may, I think, be viewed as an established fact, in proof of which I submit a sample smelted at this place, which appears to me to be very superior indeed. Some new deposits of Coal, very favorably situated, have also been lately discovered in the Mergui district, of which I hope to be able to furnish some fine specimens hereafter, and these added to the fields already well known on the banks of the Tenasserim river, and the rich Tin mines, long since discovered on the Pakchan, the Southern boundary of the Province of

Mergui, may, I think, be regarded as satisfactory evidence that we possess mineral resources of considerable value, and that further search and inquiry may reasonably be entered on, in the expectation that discoveries of much greater importance will be the result.

6th. It is also most satisfactory to know that Mr. O'Riley found Teak trees in the line which he traversed, as in the event of the Government at some future period undertaking to plant Teak here, as is now being done in the Madras Presidency, it is very desirable that the most favorable country should be known.

7th. With respect to the Copper scoria found by Mr. O'Riley, not far from Moulmein, I lost no time in instituting further inquiries, but I have not yet been able to ascertain either the object of the smeltings which appear to have been carried on at some remote period, or whence the ore was obtained; the matter, however, still has my best attention, and I trust I may yet hear some good accounts of it.

8th. To Mr. O'Riley's Memorandum on his specimens, I beg leave to solicit very particular attention, especially to the concluding part, which has reference to the Coal deposits, and I would earnestly recommend that all the specimens be submitted to the examination of the best Geologists at hand, and that I may be favored with His Honor's instructions respecting the further prosecution of mineralogical inquiries in these Provinces. I am not sufficiently acquainted with the subject to hazard any definite remarks upon it, but I may observe that Mr. O'Riley's Reports have in no way dissipated the expectations I entertained when, under date the 21st August 1850, I recommended his employment in this very interesting field.

9th. On paper No. 3, descriptive of Henzai Bay, I have but little to say, except that I am informed by others that the entrance is by no means so bad as Mr. O'Riley represents, there being a very sufficient channel for vessels of considerable draught, and within the last few weeks I have received three applications for waste lands on the margin of the Basin from Europeans who purpose to establish settlements there. These applications are in course of being complied with under the provisions of existing rules, and it really appears to me that if such Tin as that which accompanies this letter is procurable there, in any abundance, the grantees may be very successful.

I have the honor to be, &c.,

A. BOGLE,

Commissioner, Tenasserim Provinces.

P. S. Since the above was written, I have received from Tavoy some specimens of magnetic Iron ore and Tin ore collected by Mr. O'Riley, and I now do myself the pleasure to forward them.

I beg to state also, that by this mail I have received an application for a grant of land from three gentlemen in Calcutta, who are anxious to work for Tin near Mergui, which I hope is only the precursor of other applications of a similar nature.

If it could be made convenient to make Mr. O'Riley's papers public, and to place his specimens within the reach of capitalists, I think it probable that the interests of these Provinces might be advanced thereby.

A. BOGLE,
Commissioner, Tenasserim Provinces.

No. 1.

To MAJOR A. BOGLE,
Commissioner, Tenasserim Provinces,

DATED MOULMEIN, 17TH JANUARY, 1851.

SIR,

Agreeably with the wish you expressed when at Tavoy, that I should extend my examination of the provinces in continuation from Mergui to the streams of the Henzai Basin, I have the honor to submit the following particulars of my route to this place, overland from Tavoy, for your information, together with the accompanying Reports on mineral specimens, and the Henzai Basin.

2nd. From Tavoy I proceeded to make a second examination of the gold washings in the streams which feed the Tavoy river in the vicinity of "Kalein Owng," my previous visit to this locality having been during the South-west Monsoon when the water had attained its highest point, and greatest strength of current; I regret to state that the same causes operated on this second occasion, to prevent a thorough examination being made: the streams being still too deep to admit of the water-courses being properly examined; I ascertained, however, from the Karens located in the vicinity, that the Shans never visit the locality before the end of the present month, when the water-courses have sufficiently drained to admit of being worked profitably.

3rd. The only streams worked periodically (from January to June) are

1. The Dzin Bah Choung above, and
2. The Eem Bah Choung below the point of Kalein Oung, from which the produce per man for the month's washing was stated to be from three mats to two ticals of gold dust. This would give a fair average of $1\frac{1}{4}$ ticals per man for the month's labor, at a valuation of 28 to 30 Rupees per tical, according to the quality of the gold; the correctness of this statement may, however, be questioned, as it is not probable that the Shans would cross the frontier from the Siam border provinces for so small a rate of remuneration, nor is it to be expected that they would communicate to the Karens the actual amount obtained. The examination of the upraised formations, afforded no data by which to judge of the existence of any of the gold-bearing strata, and from the smallness of the party employed in its collection, and only at the localities stated, I think the inference is warranted that it is partially and scantily distributed, at a distant part of the streams; and not of sufficient importance to induce the employment of capital in its more extended development.

4th. From the sources of the Tavoy river, I proceeded across the range of mountains to the examination of the streams which descend from their Western sides into the Bay or Basin of Henzai; passing through the country formed by the base of those mountain ranges; and, after the examination of the whole of the minor streams on the Western water-shed, I descended the main stream, which enters from the South into the beautiful Basin of Henzai. The result of this investigation I have the honor to submit in the separate form No. 3, in addition to which I have merely to state, that its natural advantages are such as to secure for it, at no distant period, a place in the scale of importance second to none in the provinces, provided efficient measures be adopted to bring forward the vast mineral resources to which it is the key.

5th. As stated in my remarks on the specimens of Tin, Gold and Copper, it was in one of the small streams which fall into the Henzai Basin that I discovered the existence of these metals, and in explanation of the steps I took to carry out to the full its exploration, I may here state, that my party consisted of but one elephant and six men, and that having been prevented from ascending the stream by its bed, owing to the numerous rapids and deep pools, which are not fordable before the end of the present month (January,) I there attempted the passage by land, keeping the course of the stream; but after two days

of excessive labor I had not progressed more than five miles from the point of starting. The fallen bamboo jungle, which covers the whole face of the country, proving a complete barrier to our progress, and until opened by the annual fires which spread through the jungles during this and the next month, without more ample means than I possessed, it were perfectly impracticable, but, from February to May inclusive, the country will have become more open, and the streams much reduced, when, if considered desirable, a more effectual exploration can be instituted.

6th. Leaving Henzai, by its Northern stream, I ascended to the hilly region to the eastward of Yé, where my Karen guide informed me that a deposit of Copper ore had been discovered some 10 years ago. After an unavailing search for six days, and owing to the provisions being exhausted, I was compelled to abandon the search, and descended the Yé river from its source on a bamboo raft, to the old Town of Yé. That nothing should be wanting to induce a further search, I distributed specimens of Copper ores to the Karens, and engaged a party to proceed again to the hills, after obtaining a supply of rice and other necessaries, and I have every reason to hope that a more successful result may be shortly attained.

7th. In my route across the country from Henzai to Yé, I met with a considerable number of teak patches, the serviceable trees of which appear to have been exhausted a considerable time since; the full grown trees remaining are few in number and worthless, but in their vicinity are many young trees of good growth; in greater abundance are the Henzai Khowngs which, with trifling attention in keeping them clear of the surrounding jungle, will afford at maturity a very desirable supply of good timber.

8th. From Yé I proceeded by the old road from Moulmein to Tavoy, which skirts the hills, and known as the "Daing Koon" road: the various localities examined, afforded no evidence of metallic or other valuable mineral deposits, but, at a day's march from Moulmein, near the Talain village of Kyiek Myraw, I discovered several heaps of "scoria" buried in the alluvium, upon which a high jungle had grown; its examination showed it to have been the refuse from smelting furnaces in which Copper ore had been reduced (see Specimens and Remarks).

9th. I made every inquiry on the spot as to the locality of the ore; but it would appear that subsequent to these metallic deposits having

The third deposit of the kind I discovered.

been worked (during the Birman supremacy) the whole of the population of these provinces was removed, and many thousands absconded into Siam, so that it is a very rare occurrence to find a man who has resided in the particular locality, possessing any local knowledge anterior to our taking possession of the country; added to which, is the almost insuperable objection which exists with both Talains and Karens to disclose the existence of any metallic deposits known to them, thus rendering the exploration of the interior more arduous than is generally supposed.

10*th*. The existence of "Copper scoria" at three distinct localities between Moulmein and Mergui, is a substantial proof of the existence of that metal in the provinces to a valuable extent, and as it is not probable that the veins originally known to the Burmese were exhausted or worked to any considerable depth below the surface, it may be expected that, with the aid of a proper establishment, and guided by scientific data, its locality could be ascertained without much difficulty, and unattended with any expense commensurate with the vast importance such a discovery would prove; but this should be undertaken during the present dry season, ere the rains of the South-west Monsoon clothe the surface with its annual jungle, and change the streams into mountain torrents.

11*th*. I regret that the mineral specimens forwarded during my route to Tavoy should not have arrived, to have enabled me to report more fully on that subject, but this can be done on their arrival, should it be deemed desirable: I also possess information from native sources, which, if correct, would prove exceedingly valuable, but in its present crude state, or until I have tested its correctness by personal investigation, I hesitate to lay it before Government.

12*th*. In conclusion I have to make my acknowledgments for the timely assistance you afforded me, to enable me to carry out my observations as herein stated; and with the regret that I feel at not being more successful, I have to express the hope, that, under the circumstances, you have tenable grounds for satisfaction in the result.

I have, &c.

E. O'RILEY.

No. 2.

MEMORANDUM

ON

MINERAL SPECIMENS.

STREAM TIN ORE.—These specimens form the quantity collected on the various streams which empty themselves into the Henzai Basin from the South through the main stream of the “Oung Beng Quin.” In regard to quality, it occupies the same position in its classification as the peroxide of Tin (ore) the produce of the Banka mines, the pure metal of which bears the highest value in the home markets.

Nos. 1 AND 2 STREAM TIN.* It may be necessary to state that the quantity forming the present specimens, was obtained by washing the sand taken out of the streams which I crossed in my route through the country to the South-east of Henzai, and having no time to spare in freeing it entirely from the sand which accompanies it, the mass may contain from 30 to 40 per cent. of foreign matter, and as it is not likely that the Natives will bestow more care upon the collection of the ore than that bestowed upon this, it may be considered a fair sample of the Stream Tin of those localities, which, with a proper process of reduction, will produce of pure Tin from 55 to 60 parts in 100.

Having, from want of more efficient means, been compelled to confine my examinations of the different localities to the beds of the streams and the sections in their banks, it may not be expected that I can speak decidedly as to the depth or extent of these Tin beds; to obtain such data would require a process of sinking shafts in the “alluvium,” on to the Tin deposits which occupy the whole surface of the country on a level with the base of the hills, and which must, at a remote period, have formed the water-courses into the sea; by such a method of explora-

* The larger specimens sent to Tavoy to be forwarded per “*Proserpine*.”

tion, the extent and richness of the Tin beds, would be ascertained, but from the comparatively short time occupied in obtaining the quantity now forwarded, as well as from the information of the Natives who occasionally wash these streams for both Tin and Gold, it would appear that from 6 to 8 lbs. of clean ore can be obtained by a woman during a broken day's work, and for a regulated system of labor by competent men, double that quantity, or from 18 to 20 lbs. of ore, may reasonably be expected as the produce; in excess of which, I am prepared to state, that neither the richest deposits in the Malay Peninsula nor those on the Island of Banka have ever produced.

“**PEROXIDE OF TIN.**”—This small specimen of Tin ore demands more particular notice, from the circumstance of the larger portion of it being formed by a mass of crystals of Tin-stone, giving evidence of the existence of a Tin lode in the formation washed by the mountain stream in which I procured it, and more especially so as, on examination of the mass at the end of the day's journey, I found it to contain the accompanying specimens of Copper and Gold.

NO. 3, LARGE WATER-WORN
CRYSTALS OF TIN-STONE.

NO. 4, “COPPER.” NO. 5,
“GOLD.”

In my letter accompanying, I have detailed the circumstances connected with the discovery of this very interesting specimen, and its accompanying more valuable metals; it is only necessary, therefore, to remark here, that the position at which I found these specimens, being considerably above the level of the streams from which the other stream ore was obtained, in a tract of country, in fact, showing a decidedly metalliferous character in the upraised rocks of the older formations, from which the greater portion of the mineral wealth of Cornwall, Tin and Copper, is derived, leads to the hope, that by prosecuting a minute search in the upper portion of the stream, when the waters have sufficiently subsided to admit of doing so effectually, the Tin lode *in situ* may be discovered, and with the same object that of exploring the locality for the “*Gold and Copper*” deposits would be associated.

The unusually large size of the grain of Gold, induces the opinion that some section of the water-course, above the position at which it was found, contains a line or vein of “auriferous quartz,” from which it has been separated by decomposition of the matrix, and that rich deposits exist in its immediate vicinity. The same remarks apply to the two small specimens of Copper, and the question as to their form of native metal may, for the present, rest either with the supposition that they

formed portion of a vein of native metal, which in filamentary ramifications is found in the transition schists and slates accompanying the granite, or in the shape of a rich carbonate ore of the metal, has been reduced by the action of the fire which sweeps across the surface of the jungles annually.

The discovery of either of the foregoing deposits, it is almost unnecessary to state, would be of the most vital importance as affecting the prosperity of these provinces, and that the three combined in the same locality would form the basis of mining operations, which would command the immediate attention of the capitalists at home, to the speedy improvement of our at present limited and declining resources.

These specimens of Copper Slag were obtained by me from three different localities occurring between the mouth of the Tavoy river and Moulmein.

NOB. 6, 7 AND 8, COPPER
SCORIA.

No. 6.—On a small range of hills, forming the Southern bank of the Tavoy River, and near the entrance of the Toung Byouk river, I found the evidences of old smeltings both of Iron and Copper; the surface soil being mixed up with the "scoria" of both those metals, the latter, however, predominating. From an old Talain I heard, that the ore was procured in the vicinity of the slag deposits, but as the period of working occurred during the occupancy of the Birman, upwards of 30 years ago, the exact position of the former excavations could not be ascertained, the surface having been burnt and used for "Toung Ya" plantings on several occasions since that time, so that the surface has become uniformly level, and encumbered with decayed and decaying vegetable matter; I was enabled, however, to trace the original position of a large vein in the main formation, which, cleared out, would, I have no doubt, reveal the Copper deposit at no considerable depth, as small fragments of the rock, which I found on the site, gave sufficient evidence of having been originally in contact with an ore of Copper.

No. 7.—This specimen was procured from the alluvial deposits on the banks of the "Oung Beng Quin" stream, the main stream, which, as before stated, enters the Henzai Basin. Its character was perfectly unknown to the natives in that quarter, nor could they afford me the slightest information regarding it. It originally formed the surface out-crop of some ore of Copper in the vicinity, but without instruments or people to enter into a more particular search than that afforded by the stream and its banks, I could not enter upon a more minute search for the precise locality of the deposits.

No. 8.—To the locality from which this specimen was obtained, I would respectfully urge the immediate attention of Government in a further exploration for the site of the Copper deposit. Near the village of Kyiek Myraw, barely a day's journey from Moulmein, I came upon three separate mounds of "scoria," from which the specimen was taken, but neither as to the period of its collection at that spot, by whom worked, or the locality from which the ore was obtained, could I obtain the slightest information; and from circumstances connected with my late tour which rendered me quite incapable of following up the inquiry and examination of the vicinity, I can at present afford but this slight notice regarding it. The metalliferous lime-stone presents itself at a short distance from the site of these "scoria" heaps, and I have no doubt but that a continuous search in that direction would bring the site of these former workings to light if conducted upon known scientific data.

SLATE COAL.—This specimen, with the one following, was obtained through the Agency of Captain Berdmore, during my stay at Mergui. The general report upon this deposit appeared some years ago in the papers of the Coal Committee, where its good qualities are noticed. The present specimen is much inferior to others obtained from the same locality; the reason being, that the natives who brought it in, took the broken pieces from the surface, to avoid the labor of digging for others in a portion of the seam less exposed to the atmospheric influences; in its present state, however, more especially in its freedom from any "pyritous" matter, it gives ample evidence of possessing a large proportion of "bitumen," rendering it well adapted for steam purposes; and as it presents four or five out-crops, at considerable distances from each other, it may be concluded that the deposit in question forms a portion of the true Coal Basins, from which an inexhaustible supply of good Coal may be obtained. The facilities for its extraction, however, have still to be ascertained, and until this be effected, a more complete report is impracticable.

CANNEL COAL.—This specimen, it will be seen, shows small veins of a highly bituminized Coal, dispersed through a clay matrix, the latter, from the excess of pure bitumen it contains, being rendered combustible.

No. 10, COAL FROM LENTYA. From the information obtained from the native who brought it in, it would appear that the locality is near the head of the "Lenya" river,

considerably nearer the sea coast and in closer proximity to water carriage than the deposit on the upper waters of the Little Tenasserim ; the specimens were taken from a large mass out-cropping on the surface, which appears to lie in immediate contact with the richer seam below ; the natives, however, being totally unacquainted with the nature of such deposits, and satisfying themselves merely upon its inflammable property, did not go below the surface for purer specimens. Its exploration, however, is desirable, as, in the event of the subordinate strata containing seams of such a magnitude as to render their being worked advisable, a supply of the finest blazing coal in India will be secured, and from its vicinity to water carriage and the coast where a depot could be formed, it may be expected that its cost will be less than that at which the supplies from the Burdwan and other mines are received.

Having despatched the bulk of my specimens by way of Tavoy to be forwarded from thence by the "*Proserpine*," which vessel has not proceeded to Tavoy in the interim, they are at present unavailable for report upon. In addition to the larger specimens of Stream Tin, the collection comprizes several specimens of "Lead ore," (Galena,) from localities to the Southward of Tavoy, one of which may be classed as an "argentiferous Galena," containing a considerable per centage of Silver, which with an analysis by the proper authority, would, in the present plethora of unemployed capital in England, claim immediate attention in its development.

There are also bulky specimens of a "Native Iron," highly magnetic, which I found in the vicinity of the Tavoy river, but from the difficulty of access to the site, and excessive hardness of the matrix, its extraction by Native means would afford no encouragement as a profitable operation.

EDWARD O'RILEY.

MOULMEIN,
15th January, 1851. }

No. 3.

R E P O R T

ON

T H E H E N Z A I B A S I N ;

ITS STREAMS,

AND THE COUNTRY IN ITS IMMEDIATE VICINITY.

THE entrance into "Henzai" from seaward, according to Captain Lloyd's survey, lies in latitude $14^{\circ} 43' N.$ or about mid-distance between Yé and Tavoy. It has been for many years past a place of resort by the Natives during the dry season, for the purpose of catching the fish (which abound in its wide Basin) which, with the deer and other wild game of its forests, is cured on the spot and brought to Moulmein for sale.

2nd. A reference to the annexed rough sketch, which, having been made without the aid of instruments, has no pretension to a survey, and is only intended to show the general conformation of the locality, will show, that the Basin is fed by streams from the interior, which drain the system of hill ranges stretching in a North and South direction along the coast: these streams to the South, which fall into the larger one of Oung Beng Quin, are occasionally washed for their Tin ore by the few villagers located on the main stream, but only it would appear by the females, when otherwise unemployed, the small amount of Tin ore so collected being disposed of to the Chinese at Tavoy, who smelt it for the Tin.

In traversing the country South of the hill systems before stated, or those which shed their waters into Henzai, I found the streams more or less containing Tin with an admixture of Wolfram or "Tungstate" of Iron, a continuation, in fact, of the same deposits which occur almost uninterruptedly from the Pakchan to the point above stated; here, however, the geological features of the country become changed and show a disposition more "metalliferous" than that further South: hence the stream ore and larger crystals of Tin-stone noticed in paper No. 2 are purer than any procured from localities to the Southward.



Land

AI.

3rd. With the present scanty population distributed between the towns of Yé and Tavoy, it is not probable that much ore will be collected within that space for some time to come, even were a small depôt formed on the spot for the encouragement of its collection, but in the event of a settlement being formed within Henzai Basin, and the attention of the Chinese emigrants from the Straits directed thereto, I am convinced that, through their agency, the rich deposits of Tin which now lie unnoticed will be developed, the system adopted by the Chinese miners being not merely that of washing the "debris" found in the water-courses, but, by sinking shafts in various localities which indicate the ancient water-courses at the base of the stanniferous formations, the Tin beds are found varying from 6 to 12 feet, and as I discovered the presence of both *Gold* and *Copper* in one of these localities, it is more than probable that, through the medium of such a progress of investigation, rich deposits of both those metals will be eventually found.

4th. With regard to the adaptation of Henzai as a locality for the formation of a new settlement, I beg to offer the following remarks in elucidation of its value in this respect :

A.—The site upon which a native town would be commenced is the Island in the centre, or rather at the Northern extremity of the Basin ; upon which, at varying distances from the shore, the higher ground occurs: the intervening space is formed by rich alluvial lands more adapted for grain cultivation, and through this lower portion of the Island convenient nullahs occur at moderate distances in its whole circumference, offering the best possible means of carriage to the cultivator from his village to his grain lands.

B.—The same description of lands exists in great area on the Eastern shore of the Basin, the lower parts of which being admirably adapted for the formation of salt levels, the salt water from the open sea coming in direct at a short distance, clear and unmixed with any diluvial matter from the fresh-water streams.

C.—Both on the Island and in the adjacent forest the wood-oil tree abounds to an extent that employs the natives of several of the villages to the South in its collection, and manufacture into torches for the Moulmein and Rangoon markets.

D.—In the same forests, and on the higher portions of the streams, the finest specimens of "Thengan" are to be found, of which every canoe and trading boat on the coast is formed, and as being superior to teak for the particular purpose of house-building, &c., an abundant

supply of material of the best description, and occupation of a profitable nature, are here present within the reach of all.

E.—The great abundance of fish which the Basin contains offers every facility for the establishment of extensive “fish curings,” from which not only Moulmein and Rangoon could receive supplies, but the capacity of supply which the locality possesses, would render its shipment to Bengal a profitable undertaking.

F.—At a part of the coast to the South of the entrance, an extensive patch of Attap Palm occurs, from which the covers to the houses are made, and if to this be added the existence of fresh water of the purest kind in natural springs at several points, and the fact of “game” of the deer kind being numerous in the surrounding jungles, the locality may be said to possess more advantages than any of the other ports on the coast. After traversing the Provinces for nearly their whole length, and on several occasions through their breadth, to the Siamese frontier, I can safely aver that the locality at “Henzai” possesses those elements of progressive prosperity in its valuable mineral deposits and natural advantages, otherwise not equalled by any other part in them.

The most material objection, and that an insuperable one, to “Henzai” Bay becoming the resort of square-rigged vessels of any considerable burden is the Bar at some miles distance from the entrance seaward, which appears to extend almost across the whole space, and leaving only a small passage in shore to the northward, through which the native craft enter; the Bar passed, however, the channel is clear throughout, and both in the passage and inside the Basin 9 to 10 fathoms of water form the soundings, affording space for a large fleet of vessels to lie in still water. The natives state that a passage exists near the centre of the Bar, with $3\frac{1}{2}$ to 4 fathoms in it at high water, which I attempted to examine in a small fishing canoe, but was prevented approaching it by the heavy rollers: this point, however, could be ascertained by the “*Proserpine*” without any risk and with little delay to the periodical trip to the Southern ports.

E. O'RILEY.

MOULMEIN, }
15th January, 1851. }

(True Copies,)

A. BOGLE,
Commissioner, Tenasserim Provinces.

REMARKS
ON
PAPERS AND REPORTS
RELATIVE TO THE
DISCOVERY OF TIN AND OTHER ORES
IN
THE TENASSERIM PROVINCES.
BY

T. OLDHAM, ESQ.
SUPERINTENDENT OF THE GEOLOGICAL SURVEY OF INDIA.

The daily increasing importance and value of the mineral wealth of the earth, and the many new and hitherto unknown applications of these products, render it of essential importance that new sources of those now largely in use, should be made known; and thus a continued supply kept up to meet the demands of extending manufactures and commerce.

In this point of view, the reports of Mr. E. O'Riley are very interesting, as making known, or rather as confirming the knowledge, of the existence in the Tenasserim Provinces of extensive and rich deposits of Tin ore, and of the occurrence of other valuable ores also: and I can fully agree with Major Bogle in thinking, that the importance of ascertaining something more of the mineral resources of the Southern portion of these provinces, and of the numerous islands in the Mergui Archipelago, cannot be questioned.

If such an examination, however, be undertaken with a view to any practical result, it must be by persons fully competent to the task, and who are capable as well as of estimating the probable commercial value and importance of such deposits, as of ascertaining their existence. There is probably nothing which has more materially, or more universally tended to repress justifiable exertions and speculation in mining

operations, than the failure of schemes founded on the too highly coloured statements of persons, who have formed opinions of the mineral wealth of a country or district from the discovery of some rich mineralogical specimens; valuable perhaps for a cabinet or museum, and interesting mineralogically, but affording no just index to the resources of the district, and giving no evidence whatever of the probability, or even possibility, of a profitable return being derived from any expenditure of capital in such district.

Further, the failure of any scheme, however well founded, so inevitably, and for so long a period, discourages from similar attempts, that such a result is carefully to be avoided in the first opening out of a new field; and the slow and gradual development of the resources of a district is very much more likely to be productive of permanently beneficial result, than the forced growth of any local operation.

I have been induced to make these observations, not as wishing to depreciate the value of Mr. O'Riley's Reports, for I can fully agree, that these Reports give evidence of considerable ability and intelligence, and of zealous perseverance in the examination of the country under considerable difficulties. These Reports are further valuable, even as regards those points on which they are only confirmatory of previous knowledge, as indicating the exact locality of some of those rich metalliferous deposits known to extend over a very large area in the Malayan Peninsula, and extending Northwards into the Tenasserim Provinces.

But to enable a fair opinion to be formed of the *value* of such deposits a much greater amount of detail, as regards the extent of area covered by them, the relative amount capable of being obtained from any given quantity of the ores, the facility of access, the presence or absence of water power, or the abundance of fuel, would all be necessary.

GOLD.—Taking the matters of Mr. O'Riley's Reports in the order in which he has placed them, I perfectly agree with him in thinking that the amount and distribution of the auriferous deposits, which he visited, along the banks of the Dzin Bah Choung and the Eem Bah streams in the vicinity of Kalein Oung, are not such as to justify any more systematic or extended research.

It is, I think, obvious, that although the amount stated to be obtainable by a man (*viz.* on the average, $1\frac{1}{2}$ tical per month, at the value of 28 to 30 Rupees per tical, or about 35 Rupees per month, per man,) would be more than sufficient to tempt some persons from a much greater distance than the Siamese frontiers to such employment, still

the smallness of the area, and local character of the deposits, would never yield a sufficiently steady and continuous source of profit to sanction the outlay of capital. Taken in conjunction with any system of workings which may be adopted for the procuring of the Stream Tin, with which the Gold is associated, it may possibly be a source of additional profit to direct attention also to the seeking for Gold (a result easily effected by a slight modification of the ordinary mode of treating Tin ores), but singly, even in much larger quantities than it is stated to occur, the Gold would yield too precarious and uncertain a return to be profitably sought after. And, wherever this is the case with the deposits containing Stream Gold, any search after the original vein containing the metal, and from which it had been washed, would be more than useless.

Nor can I agree with Mr. O'Riley in supposing that the unusually large size of the grain of Gold would lead to the opinion that there must be a "line or vein of auriferous quartz" and rich deposits in its vicinity, inasmuch as the *size* of the grains or materials in any water-carried deposit depends, not on the distance from which they may have been transported, but on the force and transporting power of the water or stream which moved them. The angular and slightly-worn condition of the crystals of Tin-stone in one of the specimens forwarded by Mr. O'Riley, does justify him in supposing that a Tin lode must exist in the vicinity, but the same kind of evidence does not apply to the specimen of Gold, which, in all probability, never was in a true crystalline form, and the rounded condition of which gives therefore no evidence as to the distance from which it has been transported.

COPPER.—Among the specimens of Copper forwarded by Mr. O'Riley, there are two small fragments of metallic Copper. One of these appears to me to have been undoubtedly manufactured, and to be a small fragment of some copper vessel, the other is too small to form any opinion regarding it. There are also specimens from some heaps of scoria which Mr. O'Riley traced in three places during his journey, (one of them only a day's march from Moulmein at the Talain village of Kyiek Myraw, and in two other localities between Tavoy and Mergui,) which are peculiarly interesting, as affording valuable evidence of the former workings of the inhabitants of these provinces. As Mr. O'Riley does not notice the occurrence of any remains of villages, or of the habitations of the people who wrought these deposits, it is more than probable that the occurrence of such scoria heaps, at certain localities, points to

the occurrence also in their immediate vicinity of the sources from whence the ores operated on were derived, and these heaps, therefore, may form an excellent guide in any future search for such metalliferous deposits.

I would, however, remark that the extent of such views must be not estimated as *in proportion* to the extent or quantity of the scoria. In the earlier stages of civilization, the processes adopted for smelting and working metallic ores are so rude and so rudely carried on, that the refuse remaining after the completion of the process is generally much more than the useful material obtained, and at the same time while such heaps undoubtedly prove the existence of Copper ores in the neighbourhood, it must be borne in mind, that the demands which such manufactures, as they indicate, were intended to supply were only the very limited ones of a very limited and scattered population, whose wants were few. It must not, therefore, be too sanguinely or too hastily concluded, that the same metalliferous sources would be sufficient to repay any such outlay as would lead to their more extended working.

There appears to me, however, no question that Mr. O'Riley's statements are more than sufficient to justify a careful examination of the localities indicated, with a view to trace, if possible, the sources from which such ores have been derived, although the view which Mr. O'Riley did see, near the entrance of the Toung Byouk river, did not look very promising, nor is the occurrence of "lime-stone" in the vicinity of Moulmein, a very favourable circumstance either.

TIN.—But of all the metallic minerals noticed by Mr. O'Riley, by far the most important, and also apparently the most abundant, is the *Tin-stone*, of which he has forwarded excellent specimens.

The valuable reports of Captain Tremenheere, on the Tin-stones of the Mergui Province, in 1841, and the still earlier reports of Dr. Helfer, in 1837 and 1839, had abundantly proved the existence, over a very large portion of the Tenasserim Provinces, of deposits of Stream Tin, which had been worked extensively under the Burman rule, and from which much ore had been obtained; and to these Mr. O'Riley, has now added the knowledge of some other localities (in which no doubt the existence of Tin might have been inferred from the position, and circumstances of the locality) but where it was not positively known to exist. It is to be regretted that Mr. O'Riley has not forwarded with the specimens he sent, some of the sand and clay in which the Tin-stone occurs in its natural state, unwashed at all, from which an estimate

could be formed of the relative abundance of the Tin-stone and the probable expense of the various operations of washing, &c., to which it would have to be subjected, nor has he stated whether he made any investigation of this point on the ground. To form, however, any estimate of the probability of profitable working of such deposits, it is absolutely essential that we should know not only the per centage of the whole, which the Tin-stone constitutes, but also the average composition of the gravel or sand itself, with special reference to the presence or absence of any materials of equal or greater densities than the Tin-stone, as this most materially affects the facility with which the operation of cleaning the ore for the furnace can be performed. For instance, in one of the specimens forwarded, there is a small quantity of Wolframe sand, which in any appreciable amount would render the working of the Tin unprofitable, from the difficulty of separating it during the washings. Mr. O'Riley has certainly stated as the result of his inquiries, that 6 to 8 lbs. of clean ore can be obtained by a woman during a broken day's work ; and estimates that under a regulated system of work by competent men, from 18 to 20 lbs. of ore might reasonably be expected. Should this estimate be correct, there is no question, that such workings would yield large profits in return for the outlay required. But on referring to Captain Tremeneere's reports, I find that his results would not warrant us in supposing more than an average return of 8 to 10 lbs. of clean ore from two men, or only 4 to 5 lbs. from each man during a day's work ; a result very different indeed from Mr. O'Riley's.

I have analyzed several portions of the ores forwarded by Mr. O'Riley, and find that, properly cleaned, they will yield from 55 to 65 per cent of pure metal, a fair return.

It would be very desirable, that should Mr. O'Riley undertake any further investigation of these stanniferous deposits, he should direct attention to determining, by actual experiment, the per centage of Tin-stone in the sand, say, the average quantity in a cubic yard : and that in forwarding any further specimen, he should be requested to send some of the sand and gravel or clay, containing the Tin-stone in its unwashed state and just as taken from the ground. The careful examination of the sands containing Tin and Gold has been of great scientific interest during late years, and it would be desirable to be furnished with the means of extending these inquiries to the stanniferous and auriferous sand of the Malayan Peninsula. The constant presence of some mine-

erals in these sands, from whatever country they may have been procured, is a point of interest, tending to elucidate the history of their formation, and though not directly bearing on any practical results, is of sufficient value to justify their examination. In the specimens forwarded by Mr. O'Riley, (which, however, having been previously washed, I did not consider worthy of any very detailed examination,) I have detected the presence of Spinelle, not hitherto noticed in auriferous sands; and also of an extremely minute portion of the rare and valuable metal Platinum, which possibly may occur in larger quantities in other portions of Tenasserim.

Viewing the question of the possibility of developing the mineral resources of these Provinces on a large scale, and the desirableness of the present times for such an attempt, I would venture to direct the attention of His Honor to the recent legislative enactments of the Government of Holland, by which the workings of Tin, hitherto a Government monopoly, have been thrown open to individual enterprise.

These enactments, calculated to instil new energy into such mining operations, have already led to the opening out of the mineral deposits of the valuable Island of Billetin, near Banka, with every prospect of profitable return; and many are now to my certain knowledge looking forward to speculation in this region, as likely to be very productive and remunerating. How far it may be possible to divert some of the already trained experience and skill of English miners, to similar operations within the British territory in the same seas, is a question not now to be decided; but I would impress the fact, that however undaunted the energy, and undoubted the skill of British miners, there is no class of men less likely to undertake such works in districts deprived of regular and constant communication with the towns around and with their own country; and I would suggest that for the fair development of the resources of the Tenasserim Provinces, nothing is so perfectly essential as the opening of roads, and means of communication between the several towns. A district such as Mr. O'Riley has with such energy and perseverance traversed, accessible only through jungle, or up the beds of mountain torrents, is not the country in which any amount of mining energy is likely to develop itself, and although it may be unquestionably true that such means of communication would result from any extension of the trade, or increase of the population of the districts, it is, I think, equally true, that, to a considerable extent, facilities must pre-exist before any progress can be made.

Nay, further, the opening out of such highways of intercourse would in itself form an admirable means of examining the country. The want of population is referred to both by Major Bogle and by Mr. O'Riley, and undoubtedly the opening of a country stated by all who have visited it to be both fertile and healthy, would tend to increase the number of its inhabitants.

There would, however, be no want of population did the means of profitable occupation exist; settlers would be found abundantly to flock to any locality where they would be able to acquire a livelihood on more favorable conditions than at present; and judging from the facility with which Chinese and others are obtained for the workings at Banka, I cannot anticipate any difficulty on this score.

COAL.—The specimens of Coal forwarded with Mr. O'Riley's Reports and alluded to in his "Memorandum on Mineral Specimens" consist of some from the Little Tenasserim, supplied to him by Captain Berdmore, and others from the Lenya river.

Those from the Little Tenasserim river did not prove on analysis equal in quality to the Coal from the same vicinity referred to in the Reports of the Coal Committee (1846, pages 144-145,) a difference accounted for by Mr. O'Riley from the fact of his specimens having been taken from the surface after having been exposed to atmospheric influence.

His Reports do not afford any information regarding the facility of access to this Coal, or the possibility of its economical extraction.

The specimen forwarded can scarcely be called a Coal at all, consisting almost entirely of Argillaceous shale, charged with a considerable amount of bituminous matter, and consequently inflammable; some few thin flakes of pure Coal occur traversing the mass.

With regard to the specimens from the Lenya river, called by Mr. O'Riley Cannel Coal, they are peculiarly interesting, geologically, from the abundance of amber or resinous matter which they contain, in thin flakes, and small nodular masses. Although from all analogy the presence of this amber would lead me to suppose that this "Coal" is geologically of much more recent date than the true carboniferous system, I should be unwilling to arrive at any definite conclusion from such small hand specimens.

It is the presence of this amber, which renders the mass so highly flaming, and which might possibly render it a useful material for the manufacture of gas, but it entirely unfits it for sea-going steamers, or any purposes, where it would not be stationary.

In several of the reports submitted to me, and also in the published reports of persons employed by Government to examine various districts, I find such variety of statements with reference to Coal, and such uncertainty as to the relative values of the different kinds submitted to trial (most of these reporters appearing to suppose that the power of *raising steam rapidly* is all that is necessary), that I would beg to submit for the information of His Honor the Deputy Governor of Bengal a brief summary of the qualities which every Coal should possess for the purposes of sea-going steamers. That the fuel used should be capable of raising steam in a short time, or, in other words, that it should be *quick in its action*, is desirable, but it must also possess high evaporative power, or be *capable of converting a large quantity of water into steam*, relatively to the consumption of fuel; it must besides have such a *cohesion among its particles*, as that the constant motion of the vessel should not break it into small fragments, and further it must unite with a considerable density, such a *mechanical structure as will enable it to be stowed in small space*: a difference of great importance, inasmuch as in Coals possessing the same evaporative power, or capable of converting the same quantity of water into steam, there is frequently a difference in respect of stowage of fully 20 per cent; that is, 120 tons of one Coal can be stowed in the same space as only 100 tons of the other. There are points not peculiarly applicable to Coals used for steamers, but to be attended to in all Coals, such as the absence of any considerable quantity of sulphur, which would render it liable to spontaneous combustion; and the absence also of any undue amount of bituminous matter, which would produce a disagreeably large amount of smoke.

Undoubtedly all these qualities do not exist together in any one Coal, but the value of a fuel, specially for the purposes of steam ships, essentially depends on the comparative presence or absence of a combination of these qualities.

Viewed, therefore, with reference to these qualities, neither of the Coals submitted by Mr. O'Riley, (even supposing they could be obtained in any quantity and economically) are calculated to prove a good fuel for sea-going steamers; they both possess too little cohesion of particles, or are too brittle. The evaporative power of one is very low, that of the other rather high, but too rapid; while neither promise to *stow* well. These opinions must, however, be understood as formed solely from an examination of the specimens sent forward by Mr. O'Riley, and which may not afford a fair average of the Coals procurable in the District.

The papers subsequently received also are to my mind quite conclusive as to the improbability of any profitable workings being carried out to any extent in the localities Mr. O'Riley has described; as well from the difficulties of access, and want of facility of carriage, as from the unpromising nature of the beds which he has described.

Major Bogle has very justly directed attention to the fact of an extension of Steam Communication in the Eastern seas, as a strong inducement to ascertain precisely the probability of useful deposits of Coal being formed in such localities within the Tenasserim Provinces, as might be readily accessible. There can be no question that the discovery of any extensive and easily wrought coal field in these Districts, would be one of extreme importance. The rapidly increasing spread of Steam Communication to India, to the Cape of Good Hope, and onwards to China, and the contemplated establishment of lines of Steam Communication between the Australian Colonies and other places, both by Panama and the Cape, together with the shorter lines, which must inevitably be dependent on these great undertakings; all these indicate the value of any good Coal field conveniently placed for the supply of fuel to the many depôts, which must be established; and in many respects the Tenasserim Provinces possess great advantages, as regards the locality, and the question of the existence of good and extensive deposits of mineral fuel in these Provinces, becomes, therefore, one of very much larger scope and importance, than if viewed simply as regarded to Coal supplies.

I am not inclined to rely much on the statements made to Major Bogle that the Coal Mining operations in Mergui were discontinued just at the time "when very superior Coal had been discovered, and they "promised very favourably." Such assertions are almost invariably made on the abandonment of any mine, and generally proceed from persons who allow their private interests to overcome their accuracy of statement; and Major Bogle is also perfectly justified in repudiating the objection (of its spontaneous combustion) urged against some of the Mergui Coal, as being applicable to all; the cases in which this occurred may have originated in carelessness in shipping the Coal, or in many other ways, on which, without a knowledge of all the circumstances, I could not speak; but even did the combustion arise from the peculiar chemical composition of the Coal, the serious objection arising from it, would only apply to Coal of the same quality and from the same bed;

and by no means to other Coal, which might perhaps be obtained within a few feet of the bad fuel, and yet possess all the qualities of a good useful coal. Major Bogle's letter alludes to mining operations carried on by Government in the Mergui District. Of the extent and character of these operations, I have no knowledge whatever, but I am disposed to think that no mining operations whatever should be undertaken or carried on immediately by the Government of this country. To conduct satisfactorily any mining operations, demands, on the part of those superintending them, such an amount of constant and unremitting attention, as can scarcely be expected where the personal interests of the parties are not concerned, and where the responsibility is to a great extent divided, and the experience of all past attempts fully confirms the opinion, that it is much more expedient that private parties should be induced (even by allowing them at first great benefits and large profits) to undertake such schemes, than that Government should through their agents do so.

I respectfully conceive that all that a Government is fairly called on to do is to obtain such information as may be depended on for its accuracy, and shall be entirely above the suspicion of being given by interested parties. And this information, when considered desirable, being made public, there can, I should think, be little question, that if a fair prospect of good remuneration exist, there will be no want of persons to undertake the practical and actual working of the scheme, and one advantage resulting from this is that the persons whose attention is likely to be attracted by the publishing of such information, are exactly those who, from former experience or previously acquired skill in similar undertakings, are the most likely to be successful in carrying them on. Restrictions as to the mode of working will undoubtedly be desirable to guard against a waste of the valuable material, and the chances of loss of human life; and should mining operations become considerably extended in India, certain legislative enactments regulating the operations, may be necessary; but at the first opening of a District such will not be required.

From these considerations, I would most fully coincide with Major Bogle in recommending that mining operations should not be renewed on the part of the Government, either at present, or at any future period, while I equally agree in thinking it both important and expedient, that the Provinces to which he refers, should be carefully examined and reported on.

LEAD.—Among the specimens forwarded by Mr. O'Riley, are some small ores of Galena (sulphuret of lead) of good average quality, one specimen I subjected to a trial, and found it to contain about 175 ounces of Silver to the ton. But the amount forwarded was not sufficient for a fair analysis, and in the absence of any information as to the circumstances of the locality, and the quantity of ore obtainable, I do not anticipate any very favorable results from such ore.

IRON.—I would fully confirm Mr. O'Riley's report that the extraction of such ores of Iron as those forwarded, under the circumstances of difficulty he enumerates, would afford no encouragement as a profitable operation.

HENZAI BAY.—The desirability of ascertaining the existence of a good and easily accessible harbour, so favourably placed on a coast, which in many respects is unfavourable to navigation, must be obvious; and the statements of Mr. O'Riley referring to Henzai Bay, will, I doubt not, receive the attention they merit from the Marine Authorities, but its advantage can only be ascertained by careful examination by some competent person. The existence of a Bar under the circumstances of the locality would seem unavoidable, but it may be possible, if considered desirable, to improve the entrance to the Bay very considerably, by a trifling expenditure. Mr. O'Riley's statements appear to me sufficient to call for an examination and report on the Bay by some competent Naval Officer.

In briefly reviewing the whole of the papers submitted to my examination, I would beg to offer my testimony to the zeal and energy which Mr. O'Riley appears to have shown in the prosecution of the task entrusted to him.

The great extent of the stanniferous deposits, and their reputed richness, amply justify a more accurate and detailed examination, with a special view to determine, as far as may be practicable, their commercial value, and their probable extent, disregarding as of minor importance, the ascertaining of any new localities, where Tin-stone may occur.

The present indications of Copper do not appear to me to be, in themselves, sufficient to warrant any detailed examination of the district for Copper; but of course, this would form one point of inquiry, should any Geological investigation of the country be undertaken.

To establish the existence of an extensive and accessible field of good Coal, is essentially important, and the numerous and favorable,

although in many respects conflicting statements, regarding the Coal of the Tenasserim Provinces, call for further and more competent investigation, before any decided practical result can be anticipated.

THOMAS OLDHAM,
Superintendent of the Geological Survey of India.

SELECTIONS
FROM
THE RECORDS
OF
THE BENGAL GOVERNMENT.

Published by Authority.

N^o. VII.

REPORT
ON
THE ELECTRIC TELEGRAPH
BETWEEN CALCUTTA AND KEDGEREE.

By
W. B. O'SHAUGHNESSY, ESQ., M. D.
SUPERINTENDENT OF THE ELECTRIC TELEGRAPH.

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F. CARBERY, MILITARY ORPHAN PRESS.
1852.

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Prof. A. C. Coolidge

R E P O R T
OF THE
EXAMINATION OF IRON DISTRICTS, &c.
1852.

No. 114.

FROM THE SUPERINTENDENT OF THE GEOLOGICAL SURVEY,
TO THE SECRETARY TO THE GOVERNMENT OF BENGAL,

DATED MAY 18TH 1852.

SIR,

I have the honor to forward herewith, for submission to the Most Noble the Governor of Bengal, a Report of my proceedings in connection with the Geological Survey, during the last cold weather.

My attention having been specially directed to the question of the possibility of manufacturing Iron in this country, I devoted the time to visiting those localities, where there appeared to be any geological conditions favorable to the development of this branch of industry. I did not, therefore, visit new localities so much as carefully re-examine those regarding which something was already known.

We were, further, much impeded, and indeed, entirely prevented from penetrating some parts of the country, which were covered with jungle, by not having elephants. It will be in your recollection that no elephants were available at the time of our proceeding to the field, and although they were sent after us, as soon as they could be spared, they did not reach us until the beginning of the month of March, after we had left the most difficult part of the country.

B

Mr. St. George also, my second Assistant, could only be spared from the Railway Department in which he had been previously engaged, about the same time: so that the Survey was in reality only working with its present force for little more than one month. My own slight acquaintance with the country was also a source of some delay, but I trust that the experience gained during the present year will enable me to take the field with greater success next season.

There are still some detailed results of our observations, determination of elevations of different localities, &c., for the complete reduction of which I have not thought it desirable to delay forwarding this Report: but which shall, as soon as completed, be forwarded.

I have, &c.,

THOMAS OLDHAM,

Superintendent of Geological Survey.

REPORT OF PROCEEDINGS FOR 1851-52.

My early and serious attention having been directed to the important question of the manufacture of Iron, more especially as connected with the introduction of Railways into India, by desire of the Honorable the Court of Directors, as conveyed in their Despatch, No. 27, of 1850, I took advantage, by desire of his Honor the Deputy Governor of Bengal, of the season in 1851, during which field-work in the plains of Bengal was impracticable, in directing my inquiries to this question among the Kasia Hills. The Honorable the Court had indicated as the localities represented to them as the most eligible for carrying on Iron-works, "Sikree Gully, near Rajmahal, the banks of the Damoodah River, parts of Sylhet and Beerbhoom."

Upon inquiry, it became obvious, that the "parts of Sylhet" alluded to, were the Kasia (or Cossia) Hills, where the manufacture of Iron was already carried on to some extent, and from which much Iron was brought down, and found a ready sale in the plains below. On my return from that district, towards the close of the year, I had the honor to submit to the Deputy Governor my reasons for supposing that so far at least as that portion of the country was concerned, there were no

prospects of the manufacture of Iron being there carried on efficiently, or to any extent.

I was then anxious to visit and examine the coal field of the Damoodah valley, which had already been reported on in considerable detail by the late Mr. Williams, and in which extensive beds of that valuable ore, the Clay Iron-stone, were stated to occur. And with this object in view, his Honor the Deputy Governor was pleased, on the 9th December 1851(a), to desire me to proceed to the Damoodah valley, and from thence to pass into the country between that and the Gangetic valley; my object being to pass from the Damoodah valley through the Iron-yielding districts of Beerbhoom to Sikree Gully, at the Northern extremity of the Rajmahal hills.

Owing to the delays in preparation for the field, arising in some degree from my want of experience in the country, and from my being unacquainted with the necessary requisites for a march of some months' duration, I was not able to get away from Calcutta, until the 1st of January 1852, some weeks later than I should have desired. I then pressed forward to the coal fields of the Damoodah, and reaching Munglepore, devoted some days to the examination of the collieries of Messrs. Erskine, immediately adjoining that village; those of the Dhoba Company at Chowkeedangah; some smaller ones in the neighbourhood, now in the hands of Mr. MacSorley and some natives; and also the extensive workings of the Bengal Coal Company, at Raneegunge.

The workings at Raneegunge, at the fine colliery of Seersole (Baboo Gobin Pundit's,) and at Mr. Erskine's at Munglepore, are all carried on in the same seam of coal, a splendid bed of not less than 9 feet in thickness with a slight dip or inclination, and therefore workable at no great depth from the surface. Indeed a bed of coal so favorably placed with a view to its profitable extraction is seldom met with.(b)

In this portion of the coal-bearing series of rocks, however, no Iron-stones occur of any thickness or importance.

Passing westwards from Munglepore, I visited the collieries of Cheenacoory, (Bengal Coal Company), and subsequently those at Taldan-

(a) Mr. Under Secretary Seton-karr's letter, No. 783, dated the 9th December 1851.

(b) I would take this opportunity of expressing how much I was indebted to the civility and liberality of the resident Agents of all these Companies, for the free access they afforded to all parts of their workings, and the facility with which they communicated every information.

gah, Chaunch and Doomerkoondah. The latter three collieries are not at present being worked. They are on the western side of the Barakur and between the Great Trunk Road and the river Damoodah, and all belong to the Bengal Coal Company. There are also a few openings for coal, north of the Great Trunk Road, where small quantities are raised by natives; but these workings are of extremely limited extent, extremely rude in their machinery, and careless in their operations. Mr. Williams has already described in detail the associated rocks and the mode of occurrence of these beds.

Associated with these beds, and belonging to the middle section of the coal-bearing rocks, occur the beds of Clay Iron-stone, from which Mr. Williams proposed to procure the supply of ores requisite for the furnaces he purposed to establish.

These Iron-stones occur in considerable abundance, and are of an average quality, occasionally very good. They are not, however, in thick beds, few of the beds being more than 14 inches thick; and there would therefore be a very great difficulty in getting the natives to work such beds, unless by allowing them to remove such an amount of the associated rocks as would make good head-room for themselves. But this would at the same time very considerably increase the expense of working.

Having visited and carefully examined all the collieries in the Damoodah field, we proceeded westwards to Parisnath Hill, desirous of tracing the connection of the coal measures with the older rocks upon which they rest, and of becoming acquainted with the character of the latter. Doubling round the base of Parisnath Hill on the west side, we ascended to the summit from Muddubund, and were intensely delighted with the glorious scenery of the mountain itself and the striking contrast which it afforded, after having been for weeks among the almost unbroken plains of Bengal. The wonderful beauty and richness of its thickly wooded sides, broken up by the cool grey of the projecting rocks, whose precipitous cliffs cast their deep shadows around, with the almost boundless view from its summit, stretching away over the billowy ridges to the west and north-west, and the unbroken plains to the east; the clearness of the atmosphere above, while all below is shrouded in a hazy mist called up by the overheated air of the plains, all combined to render it a scene of amazing beauty, and to impress one forcibly with the idea of the desirability of such a resort being made

accessible to Europeans, as a relief from the destructive glare and broiling heats of Calcutta. (a)

From Parisnath we passed northwards through a country composed entirely of gneissose rocks, with intercalated beds of hornblende slates, and hornblende rock, with occasional granite, and thick quartzose veins, and trap dykes, to Curhurbaree coal field, described by Dr. McClelland in 1849. I was anxious here also to see the circumstances under which the Iron-stone, said to occur there, was found; its extent, quality, and the feasibility of working it. On arriving here, I found that since Dr. McClelland's report was published, Mr. Inman had opened this field, and had wrought one of the beds to some extent. The bed on which he is at present working is that at Rhamnadee, of Dr. McClelland's report, near the centre of this little field. Instead, however, of being a five-foot bed, as described by Dr. McClelland, it is in reality a bed of *eleven feet*; very rarely less than ten, but often eleven. Mr. Inman has not as yet extended his workings far: only one shallow shaft has been sunk, and all the coal has hitherto been carried out on the heads of women and coolies.

This coal is of *excellent* quality, it comes out in larger and more symmetrical masses, and is freer from admixture, though still possessing the same laminar texture as the Damoodah coals. The whole of the produce is sent from the pit-mouth on carts, to Soorajgurrah, on the Ganges, and at present is entirely absorbed by supplying the Ganges Steam Navigation Company's Steamers at Monghyr. The great drawback to the full development of this little field is the immense expense necessary for the removal of the produce. The cartage alone, of the coal to Soorajgurrah (nearly 80 miles), costs upwards of five annas per maund; therefore, although at Monghyr and Patna, where coal is dear, such an arrangement may be profitable, it will be obvious that under

(a) I may state, though not immediately connected with Geological inquiries, that a good road from the plains beneath to the summit of Parisnath, could readily be made, and at a small cost. Materials are abundant and excellent, and with a little care in the selection of the line, a road of easy inclination could readily be obtained. The great objection to the hill, arising from the presence of the hordes of pilgrims who infest it, and the constant tom-toming and noise which they make, only exists during the cold weather for a few months in the year. Before April has passed, the hill is entirely deserted by these and their priests, and remains a perfect solitude, until the return of the same season again recalls the priests by the desire of gain, and the pilgrims by their devotion to their faith.

existing circumstances, this field can only be partially worked owing to the extreme difficulty of being able to procure, in the first place, a sufficient number of carts to remove the coal, and, in the second place, a sufficient demand within such a distance as would enable it to be disposed of with a profit. A communication by Rail-road to Calcutta, and to the Ganges, would certainly increase the value of this coal field most materially.

I could not discover any Iron-stone in the Curhurbaree coal field, and I was the more surprised at this from Dr. McClelland's statement of its occurrence.

I regret further being obliged to state that many of the statements in Dr. McClelland's report are entirely inconsistent with the facts as exhibited by nature; the thickness of the beds of coal, the dip of the rocks, and the association of the beds being, in several places, very different from what they are stated to be.

I passed from Curhurbaree again to the eastward by Serampore, Junturra, and Rangoo Changoo, and thence skirted along the northern edge of the Damoodah coal field, which I had not previously examined. From thence we turned towards *Soory*, purposing to get along the Rajmahal Hills to Sikree Gully, if possible. The season had, however, now become too far advanced to admit of our safely entering the Rajmahal Hills. I had been instructed, by His Honor the Deputy Governor of Bengal, to be very careful; and ascertaining that after March these hills were deadly to Europeans visiting them, I, of course, avoided them. I visited a small patch of coal-bearing rocks to the north of the River More, near to the village of Tungsuli, about eight miles from Soory. (*See Map*). Here the rocks are sand-stones of various degrees of coarseness, with few associated beds of black shale, and thin irregular seams of *coal*. There is no bed exposed, which would at all justify the expectation that useful seams would be met with here; and the extent of the associated sand-stone is but small, not stretching for more than a mile or so, in its greatest length.

From this returning through Soory to Synthia, and thence to Dyoucha, Damrah and Bellia Narainpore, we examined carefully the Iron-yielding district of Beerbhoom, referred to in the Despatch of the Hon'ble Court of Directors, quoted above, as one of the localities, represented as likely to be favorable for the establishment of the manufacture of Iron on an extended scale.

This is a very interesting district, both from the manner in which the ore occurs, and from the simple processes adopted in its reduction. At present the manufacture is almost entirely confined to three or four villages, of which Bellia Narainpore is the largest and most important. Next to it in the extent of the workings is the village of Dyoucha, lying about 20 miles to the south of it. At Damrah also, the position of which is intermediate, there are several furnaces at work, and also at Goanpore. But there are few villages throughout that neighbourhood, adjoining which large heaps of slags and refuse of furnace-workings may not be seen, giving evidence of the extent to which these operations had been formerly carried on, and of the long time during which they had been continued.

At Dyoucha there are at present about 30 furnaces at work for the reduction of the ore into Pig Iron, or what is called here *cutcha* iron, and about as many more for refining it, or making it *pucka*; the two operations being carried on by totally different sets of people, and, what is curious, by people of different religions, those who reduce the ore in the first instance being invariably Mussulmen, and the refiners as invariably Hindoos.

From each of these furnaces when at work between 20 and 25 maunds of Pig Iron will be turned out during a week. The furnaces work throughout the year, with only the occasional stoppages for poojahs; that is, provided the proprietor has been able to lay in a stock of ore and of charcoal, previously to the rains commencing, sufficient to last till the weather again admits of the miners obtaining the ore. From each furnace, therefore, a produce of pig-iron of about (1,100) eleven hundred maunds, or nearly (35) thirty-five tons, is annually obtained, say 34 tons. At Dyoucha, as we have said, there are 30 of these furnaces: at Narainpore (a) about as many more; at Damrah four, and at Goanpore about 6, or in all about (70) seventy furnaces. Supposing these therefore to be all continuously at work, we should have a produce amounting to $70 \times 34 = 2,380$ tons of pig-iron in the year; a considerable amount when the rude processes of manufacture are taken into account. This Pig Iron is then sold to the refiners, and in

(a) The exact numbers cannot be stated, as they vary materially, an accident frequently throwing a furnace out of work for months; but the numbers stated above are, as nearly as careful inquiry could lead me to judge, about the average number of furnaces at work at any given time.

the process of re-melting and preparation, nearly one-fourth of its weight is lost : 10 maunds of the *cutcha* iron yielding about 7 maunds, 10 seers of the *pucka* iron. Allowing for this reduction, therefore, there would be a final produce of Iron, fit for the market, of 2,380 tons, minus 595, or 1,785 tons ; an estimate which, however, I believe to be rather too high, and that we may more fairly take the annual produce from the whole district as 1,700 tons.

Under existing arrangements, and with the present mode of conducting the operations of smelting and refining, the cost of this Iron is 1 rupee, 8 annas per maund, at the works, and at this rate it is barely possible for the men employed to derive a subsistence from the employment : that is, for the raw-iron a cost of £4-4s.-0d. per ton. To reduce this into a state fit for any large works, would cost at least one-half more, so that we should have the cost of this Iron brought into a convenient state for European works, about £6-6s.-0d. per ton, a price at which it is obvious that it could not compete with English Bar Iron (a) the quality of which is known. It must be remembered, however, that the quality of the Beerbhoom Iron, owing to the processes adopted and to its being smelted entirely with charcoal, is essentially different from that of English Iron, and though not so valuable for the purposes above alluded to, such as Railway works, is more so for other work, in which toughness and malleability combined with softness are required.

It remains to be considered whether any improvement in the processes of smelting could so reduce the cost as to render it available. Undoubtedly such improvements are possible, and if the Iron is to be used on any large scale, perfectly essential. But there is to my mind a very serious and insuperable objection to the adoption of such a course in the simple fact of the mode of occurrence of the ore.

This ore is an oxide of iron, partly earthy, partly magnetic, which occurs in thin seams, disseminated among and spreading in an entangled manner through the soapy *trappean* clay-stone. The bed or layer in which it occurs is on an average about five feet thick ; but the ore is by no means equally disseminated, but, like all other metallic ores, occurs in irregular bunches or nests. There is no vein ; but only thin disseminated threads or strings of ore passing in every direction across and among the clay matrix, and filling up every fissure in the mass. It is,

(a) Bar Iron (English) at present sells from £6 to £8 per ton in the Calcutta market, (May 1852.)

in fact, an infiltrated Oxide of Iron which has passed into, and been deposited in the little cracks and joints of the rock. Occurring in this way, therefore, it will be obvious that a very large proportionate amount of material has to be removed, in order to obtain any considerable quantity of the ore. In other words, the produce of any one place is soon exhausted, and the scene of operations must be changed, the ore being so scattered, and so little concentrated. With the very limited demand at present existing, this is of minor consequence, although even under present arrangements, the great heaps of refuse adjoining many of the villages, where no furnaces now exist, and where they have not existed within the memory of any of the inhabitants, indicate that this very exhausting process has taken place; that the ore in the vicinity has been worked out, and the occupation therefore abandoned. Where the profit is so small, the addition of a few miles to the distance from which either the raw ore, or the charcoal for its fusion, has to be brought, will be quite sufficient to turn the balance.

This removal is a trifling matter when the whole house and apparatus for the furnace only cost from 12 to 16 Rupees, as is the case with the native furnaces; but it would be of vital importance, and indeed fatal to the success of the effort, with large and expensive furnaces and machinery, such as would be required, were the ordinary European processes of smelting introduced. The difficulty of procuring fuel is also daily increasing. The forests and jungles are disappearing before the axe of the charcoal-burner, and the plough is steadily taking possession of lands but very recently covered with impenetrable wood. No doubt a vast extent still remains unhewn, and fuel, in the immediate neighbourhood of the woods, is still very cheap, but with a bulky article of commerce like charcoal, the expense of carriage is considerable, and the question of distance as regards the supply and the economy of it is therefore an important one.

The absence of economical fuel, therefore, combined with the scanty supply of ore, at once determines the inapplicability of any extended series of operations for smelting and manufacturing Iron in the district of Beerbhoom.

Reverting now to the valley of the Damoodah and its mineral wealth, Mr. Williams has already entered with some detail into the discussion of the question of the manufacture of Iron there. In his Report on the Geology of the Damoodah Valley, (pages 125 to 130), he has made detailed calculations of the expense of the raw materials and of the

smelting and refining of the Iron, and he gives a comparative statement of this in England and in India. His calculation is as follows: for the production of 20,000 tons of Bar Iron, No. 2, per annum, taking South Wales as the standard, he finds that there are required

	<i>s.</i>	<i>d.</i>		£	<i>s.</i>	<i>d.</i>
93,600 tons of Iron-stone @	9	3	.....	43,290	0	0
130,000 ditto Coal @	4	6	.....	29,250	0	0
18,500 ditto Lime-stone, @	3	0	.....	2,770	0	0
Or a Total cost of				£75,310	0	0

for the raw materials in South Wales. As compared with this, he estimates the Cost of Iron-stone in the Damoodah Valley at 3*s.* per ton; of coal at 2*s.* and of Lime-stone at 27*s.* Taking, therefore, as Mr. Williams does, the same quantities in both places, there would be

	<i>s.</i>	<i>d.</i>		£	<i>s.</i>	<i>d.</i>	
93,600 tons of Iron-stone,...	@	3	0	14,040	0	0
130,000 tons of Coal,	@	2	0	13,000	0	0
18,500 ditto of Lime-stone, @	27	0	.....	23,356	5	0
Making a Total cost of				£50,396	5	0	

or a saving of £24,913-15-0 in favor of India, in the cost of the raw materials alone.

After very careful inquiry, I have been led to think that the results here given are too favorable to Indian work. In one important respect they appear erroneous. The Coal of the Damoodah Valley, even granting that it will coke well, which is not the case, is confessedly inferior to good English fuel in the ratio of not less than 20 per cent, which difference must be all added to the cost as given by Mr. Williams. As regards the Lime-stone, I believe it might be possible to have Lime-stone brought to the spot, at the rate which Mr. Williams calculated, *viz.*, 27*s.* per ton; but even this is doubtful, at least from Sylhet, from whence he proposed to procure it, when we consider that the cost of mere transport from the quarries to Calcutta, will be at least 15 Rupees per 100 maunds, or about 8*s.* and 6*d.* per ton, and that this portion of the transport is entirely by water, and consequently most economical. To this cost, the heavy land carriage from Calcutta is to be added, or if sent by water, the uncertainty and danger of the conveyance up such rivers as the Damoodah and Adji, which will materially increase the price of the stone. And again, as regards the Iron-stone, for the reasons

I have already given, I believe that for a considerable time at least after any mines were opened, if not constantly, it would be difficult to raise Iron-stone at the cost stated. From these considerations, I should be inclined to think that 4*s.* 0*d.* per ton would be a fairer cost at which to estimate the Iron ore.

Allowing for these corrections then, the cost of the raw materials for the manufacture of 20,000 tons of Bar Iron, taking the quantities as stated by Mr. Williams, would be

	<i>s.</i>	<i>d.</i>	£	<i>s.</i>	<i>d.</i>
Iron-stone, 93,600 tons, @	4	0	18,720	0	0
Coal, ... 1,30,000 ,, @	2	0	13,000	0	0
Lime-stone, 18,500 ,, @	27	0	23,356	5	0
Add 20 per cent Coal to make up for inferior quality or 26,000 tons, @	2	0	2,600	0	0
Making a Total cost of,			£57,676	5	0

Taking Mr. Williams' statement as correct, regarding the cost of the materials required for the same amount of Iron in South Wales, we would still have a saving of £17,633-15*s.* on the raw materials alone; or, in round numbers, of £0-17*s.*-6*d.* per ton of Bar Iron manufactured. A saving which, Mr. Williams himself admits, would be more than counter-balanced by the great additional cost of furnaces, blast engines, refineries, puddling furnaces, rolling mills, &c.

There remains then the saving, as compared with English Iron imported, of the freight, duty and insurance, which calculating freight at 20*s.* per ton, insurance at 2 per cent and duty at 5 per cent would give a total of £27,000 on 20,000 tons, supposing the value to be £5 per ton; or a saving of £1-7*s.*-0*d.* per ton. (*a*)

From this saving must be deducted the great extra charges for superintendence and management in this country; but there will still remain a considerable balance in favor of India as compared with England, of say £1, per ton.

We have here taken Mr. Williams' data as correct, and simply applied such corrections to them as appeared requisite in order to approximate the result more nearly to the facts. But these calculations having been founded on experience obtained in the working of cold-blast furnaces;

(*a*) Mr. Williams assumed the value at £10 per ton, but I have above taken £5 as being much more nearly the present average value of Bar Iron.

and it being certain that to contend with English Iron in the markets of this country, any manufacture of Iron must be carried on with the aid of all the improvements, which have been successively introduced in Europe, I will here give a brief calculation of the relative cost of manufacturing Iron in the two countries, under these improved modes of operation.

It is well known that the simple introduction of hot air instead of cold by the blast into the smelting furnaces, has caused a reduction in the cost of manufacture, such as was not at all anticipated. The reduction in coal alone has been in the proportion of 6.50 ; 7.0, or 7.80 to 2.00, 2.90, or 3.00 ; and besides this actual reduction in quantity the coal had originally to be coked at a cost of nearly 6*s.* per ton, while under the improved systems, it can be used raw, or uncoked. This difference alone therefore introduced a saving of nearly 40*s.* per ton of Pig Iron. The proportion of lime-stone required as a *flux* has also been reduced from .50 or .65 to .30 or .35 per ton. These differences will make an important alteration in the relative cost of the workings. Let us take, for calculation, the average of the reductions, as derived from the experience in different parts of Great Britain, and from this average calculate the relative cost in the two countries. The proportion of saving resulting from the application of the hot blast varying in each individual locality, according to the quality of the fuel, and of the ore, it will be fairer and simpler to take the *average* results, both as to quantities and as to prices. And comparing both the South Wales, and Staffordshire working with the Scotch, I think the following will be found to be a tolerably correct average result. For one ton of Pig Iron, to be reduced by the aid of the hot blast, there will be required 3 (three) tons of coal ; 2.75 tons of roasted ore, equivalent to 3.60 of raw ore ; and .75 ton of lime-stone. Of these quantities the relative cost will be

	INDIA.			GREAT BRITAIN.	
	<i>s.</i>	<i>d.</i>		<i>s.</i>	<i>d.</i>
3 tons of Coal, ... @	2	0	6	0	..... 4 6
3.60 of Raw Ore	4	0	14	4½	..... 10 0
0.75 of Lime-stone ...	27	0	20	3	..... 4 6
			40	7½	..... 52 10½
Add 20 per cent. of Coal for inferior quality,			1	2½	
			41	10½	

leaving still a balance on the cost of the raw materials of eleven shillings and one farthing (11s. 0¼d.) for each ton of Pig Iron. I have not estimated here for the cost of labour, as this may, I think, be taken at about the same sum for both countries, and will amount to about 14s.

This saving is on the first process in the manufacture, namely, on the production of Cast Iron, in which stage of the manufacture, there is less need for trained and experienced labour than afterwards. In all the subsequent processes, in which the success of the result depends most materially on the skill of the workman, (as in puddling, &c.,) the advantage would undoubtedly be, for years to come, in favour of the manufacture in England. At the first introduction of such works, it would be essential that trained workmen and superintendents should be brought to this country, and this would entail very serious extra expense.

But taking the most favourable view of the case, and supposing that from the first establishment of such works, the other processes of the manufacture (until the Iron were brought into the state of Bar Iron, fit for the market,) could be carried on in this country for the same cost as in England, (which, it must be confessed, is making a very large concession in favour of India), it will yet remain to be considered, whether independently of all this, the actual saving in the cost of the materials, which I have shown above would be about 11s. per ton of Pig Iron, or in other words about one-fifth of the entire cost, or 20 per cent, would be or ought to be sufficient, under the circumstances of the case, to induce the investment of sufficient capital for the effective conduct of this manufacture.

In estimating this, it must be granted, as generally true, that although small additional profits may be sufficient to induce additional investments in a known and established manufacture, the success of which has been proved by previous experience in the same locality, it will at the same time require the prospect of very much larger returns to induce a first trial: and very justly so. The uncertainty of success, the chances of failure from some trifling difference in the conditions of two localities; the great risk attendant on the use of untrained hands, and the expenditure of time and money before the resident labourers become accustomed to, and therefore capable of executing with facility, such operations, all these greater risks demand a well-founded prospect of a very much greater return in the first instance before it can fairly be expected that capital and skill should be withdrawn from other under-

takings known to be profitable, and devoted to a speculative searching for larger returns in untried and novel schemes.

Now, as regards the manufacture of Iron, we may assume that the cost of the actual manufacture, so far as labour is concerned, will not be much less in one country than in another; and that the profits derivable from this manufacture would be about the same in both, plus or minus the difference in the actual cost of the materials, which we have already shown to be about 11s. per ton. This difference would give to the manufacturer in India, as compared with the manufacturer in England, an additional gain of about one-seventh of the entire market price of the manufactured article, or nearly 15 per cent, an additional profit, which, with the certainty of a good and steady market, ought to be sufficient to induce speculation.

The question of the market, however, or of the amount of demand for the manufactured article is an all-important one; such operations to be productive must be carried on on a large scale, and there must be a rapid sale. By a reference to Wilkinson's Commercial Annual, the total amount of Iron imported into Calcutta during the year 1851, (from 1st January 1851 to 1st January 1852), will be found as follows:

	Br. Mds.	Tons.
Total imports from Great Britain, ..	4,57,145	= 16,342
„ „ of Swedish Iron,	5,310	= 195

making the total imports equal to 16,537 tons (*a*). Of this amount only 510 tons were Pig Iron, the remaining 16,027 tons being made up of 8,259 tons of Bar Iron, 2,272 of Bolt and Rod, 1,125 of Hoop Iron, 3,943 of Sheet Iron; and small quantities of Nail Iron. In 1850, the total quantity imported was 19,099 tons, including 955 tons of Swedish Iron, and 110 tons of Pig Iron. Of Bar Iron there were 9,425 tons, of Bolt and Rod 3,383; of Hoop 2,056, and of Sheet 2,931. In 1849 the total quantity imported was 12,111 tons, including 250 tons of Pig Iron and 307 of Swedish Iron, or tabulating these numbers as below, it will appear that the amount of Bar and Bolt Iron imported, was nearly double as much in 1850 and 1851 as in 1849.

(*a*) Fractional parts of tons have been disregarded.

	Bar.	Bolt and Rod.	Hoop.	Sheet.	Nail.	Pig.	Swedish.	Other sorts old iron, &c.
	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.	Tons.
1849	5139	1633	2148	2496	99	250	307	39
1850	9425	3383	2056	2931	207	110	955	32
1851	8259	2272	1125	3943	165	510	195	68

From these details it is evident that the increase in the quantity of the imported Iron, during the years 1850 and 1851, was to a considerable extent due to the increased demand created by the construction of the Railway. If, however, we take the whole amount of imports of Iron during 1851, as a fair annual quantity to supply the Calcutta market, (a) and to this amount add one-fourth as the probable increase from improvement in the arts, and in communication throughout the country, we will have a total demand in Calcutta, and the portions of the country supplied from Calcutta, of about 21,500 tons annually. Or, if we estimate the amount imported in 1849 as a fair average amount for the ordinary annual demand in Calcutta, and to this add the quantity presumed to be annually required for the extension of the system of Railways through the country, (calculated below at 13,500 tons per annum), we will have 23,560 tons as the average annual amount of the entire demand for the supply of this market during many years to come.

If further, we suppose the whole of this demand to be supplied by Iron manufactured in India, (which, however, would certainly not be the case for many years, as the character of the Iron produced in this country, should, like every new article of commerce, be established before it would be purchased with confidence,) but if we suppose that the whole of this Iron were produced in India, there would be required for

(a) As at present intended, the rails to be used on the East Indian Railway are to be 84 lb. rails, equivalent to 132 tons of Iron per mile for a single track, or allowing for extra sidings, double lines at stations, &c. &c., say 150 tons per mile: and supposing that after the delays inseparable from the first commencement of such a great undertaking, 80 to 100 miles should be annually completed, this would require a supply of 12,000 to 15,000 tons annually, say an average of 13,500.

such an annual out-turn, about eleven blast furnaces capable of producing each forty-five tons per week. (*a*)

Let us roughly estimate the amount of capital, which such an establishment would demand. The average cost of such a blast furnace, as we have supposed, would in England, be from £3,200 to £3,500 sterling, and considering the very large proportion of this cost, which goes for fire-bricks (not less than £1,100) for cast and wrought Iron &c., (about as much more or £1,100), and knowing that at the first establishment of such furnaces, these materials must necessarily be imported, we are justified in stating that such a furnace could not be put up well in this country, for much less than one-half more, or for each blast furnace a cost of £5,000 sterling. For this there will be required all the blast machinery, steam-engine, engine-house, &c., which, supposing that for the sake of economy, one large engine is made to do the work of (3) three furnaces, will cost at least £6,000 more (*b*). For three furnaces therefore with blast apparatus, engine, &c., complete, the cost would be £21,000 (*viz.* 3 furnaces each £5,000, £15,000; and blast apparatus, &c., £6,000). Each blast furnace will require *one* finery furnace, and about *five* puddling furnaces, to reduce the Cast Iron produced from the blast furnaces into Bar Iron. Taking these at a cost of £500 each, we have to calculate £3,000 for this portion of the establishment. There are besides required all the machinery for working up this Iron; tilt-hammers, reheating furnaces, rolling mills, mill furnaces, &c., &c., and a steam-engine to drive them. Supposing here also that an engine is taken of sufficient power to drive all these mills, and that they are capable of roughing and rolling, say 135 tons per week, or the entire produce of the three blast furnaces, such machinery would cost at the least, £7,000 sterling. In all, therefore, for furnaces, blast-machinery, reducing mills, &c., capable of turning out 135 tons per week the total cost would be £31,000. To this we must add for spare pieces of machinery, additional rollers, &c., &c., at least £5,000 more, or about £36,000. After four or five years' work, much of these buildings and machinery will require renewal or repairs; and we cannot therefore fairly estimate the interest on this capital expended at

(*a*) I have here estimated for a small size of furnace, as unquestionably at the first introduction of such a manufacture, it would be more prudent to adopt the smaller size.

(*b*) The average yield per horse power per week in Great Britain, may be taken at 2.10 tons. This would require an engine of nearly 65 horse power for three furnaces, yielding 45 tons weekly each furnace.

less than £15 per cent. in this country ; or at £5,400 per annum, which must be paid before any profit can be derived from the workings. To meet this, the return in produce, as calculated above, would be 135 tons per week, or taking 50 weeks' work in the year, of 6,750 tons per annum ; yielding at the saving on the cost of the raw materials, which I have previously shown might be calculated on, (*viz.*, 11s. per ton,) £3,712-10s.-0d. per annum, or deducting this from £5,400, the interest on the capital sunk, &c., there remains £1,687-10s.-0d. of interest on capital to be paid out of the ordinary profits of the trade : or supposing the whole out-turn of 6,750 tons to be sold at £5 per ton ; of exactly one shilling on each ton sold. (a)

We may put the matter in another way, as illustrative of the comparative cost of similar works in other places. An establishment of the kind we have estimated for above would in England cost as follows :

3 Blast furnaces,.. @ 3,500=	£10,500	0	0
Blast apparatus, engine, &c.,	3,500	0	0
Rolling mills, engine, engine-house, additional machinery, forges, &c., &c.,	7,000	0	0
	£21,000	0	0
In India, as calculated above,	£36,000	0	0

In Great Britain the interest on such capital may fairly be taken at £12 per cent per annum ; while in India it cannot justly be estimated at less than £15 per cent. In the one case, therefore, the payment of interest on the capital expended will require only £2,520 ; in the other case, not less than £5,400, a difference of £2,880 ; while the difference in the cost of the materials, and the profit consequent on this, estimated as above, at 11s. per ton, will only amount to £3,712-10s.-0d., leaving only the small sum of £832-10s.-0d. upon an expenditure of £36,000, as the *total of the additional profits*, which might be justly anticipated in this country on such a manufacture. In other words, the relative advantages derived from the saving in the cost of the raw materials are in the ratio of 41 to 52, while the relative expenditures are in the ratio of 36 to 21. The additional cost therefore of buildings, machinery, &c., in this country, nearly counter-balances any advantage derivable from the saving on the raw materials.

(a) In order to give the fullest advantage to the Indian side of the question, we have above estimated the full out-turn of the blast furnaces, as converted into Bar Iron. The loss, however, in the processes of refining, puddling, &c., is considerable, and the 135 tons of Cast Iron would not in reality give more than 105 tons of Bar Iron.

We have here estimated only for three furnaces, and for mills, &c., to correspond, this being a convenient arrangement. But to meet the entire demand of the Calcutta market, as stated above, would require eleven furnaces of the same size, or at the same cost an expenditure of not less than £132,000. It is perfectly obvious that such an amount would never be expended at once, and the growth of an establishment or establishments of that kind could only be very gradual. (a)

Seeing then that any additional gain, which could fairly be anticipated in this country, would be nearly counter-balanced by the great extra cost of machinery, &c., it will be unnecessary to state a conviction that the ordinary profits of the Iron trade, though these are occasionally large, would never be sufficient to induce the investment of the necessary capital for such undertakings.

There is an important point to which we have not alluded above, inasmuch as we calculated on the use of the hot-blast; but which would be a very serious disadvantage in this country, as compared with colder climates, if the old system of cold-blast furnaces were continued: we allude to the well-known fact of the diminished efficiency of the furnaces in Europe during summer, as compared with winter, producing a difference in the amount of ore smelted of sometimes fully one-third of the usual out-turn.

Neither have we taken into account the saving of freight; of insurance and of duty, because we feel satisfied that any advantage accruing to the manufacturer in India, from these sources, as regards the supply of the Indian market, would be fully counter-balanced by the extra risk attendant on the manufacture here, and the extra charges for superintendence, &c.

It appears, therefore, most obviously and clearly to result from these considerations *that, under existing conditions, the manufacture of Iron, on any efficient scale, and on the European system, cannot be undertaken in this district, with a certain prospect of such a return as would justify the great outlay required.*

I say "under existing conditions," because increased facilities of communication, or other improvements, may so alter these conditions, as to render such undertakings remunerative. To give an instance of this, the cost of lime-stone, an essential ingredient, has been given above at 27s. per ton; and has been supposed to be obtained from

(a) Some of the largest Iron Works in England have not more than 10 or 12 furnaces at work.

Sylhet. A much nearer, though at present inaccessible, source of supply would be from the banks of the Soane River. Were a direct line of Rail-road communication opened out from the Damoodah Valley to the Ganges, at Patna, or to the Soane, lime-stone could be brought to the Damoodah Valley for about 10s. per ton, instead of 27s., a very important difference, while the same line of communication would open up all the markets of the North-West Provinces to the manufacturer.

The essential dependence, which the progress in arts and civilization of any country has, on the abundance, cheapness and applicability of Iron, is well known ; but there are few countries, where such progress is more required than in India, where the rich and varied products of the country demand for their profitable conversion the more economical processes of improved machinery, and the more rapid and facile means of transport derived from improved communications.

As yet this glorious land, with all its wealthy towns, its noble rivers, its extensive plains, its uncounted mineral treasures, and its unrivalled natural productions, has scarcely emerged from the barbarous stage of its history, of which the precious metals are in some degree the type ; when wealth is sought for, as a means of displaying the gilded state of its owner, and enabling him to tyrannize over his fellow-men, where the gorgeousness of a semi-barbaric state is at once the offspring and the parent of a besotted ignorance, and a degraded fanaticism ; and where few traces of progress, other than those which have been forced upon the people, can be seen during centuries past. To such a country the importance of opening up a supply of good Iron at a cheap rate, and thus giving an impulse to its ten thousand applications, can scarcely be over-rated, and the advantages resulting from the development of its manufactures, can scarcely be over-estimated.

But such a development, to be successful and permanent, must be gradual ; and in accordance with the established and just principles of commerce. No eager zeal for the country's benefit must be allowed to injure the real success of the attempt by *premature*, and therefore un-availing efforts, while at the same time the true and fitting season must be carefully watched ; and the rich fruit gathered as soon as it is ripe, and fit for use.

No person can be more fully alive to the very great advantages which must accrue to this country from the development of such manufactures ; or more keenly sensible of the disadvantages under which she labours in consequence of the want of them, than I am ; but, after careful

consideration of the subject, I am satisfied, that, so far as the districts which I have had the opportunity of visiting are concerned, the attempt would at present be *premature*, and therefore comparatively unsuccessful.

Such development must follow, and be a consequence of increased facilities of intercommunication, and can never be looked to as a fore-runner, or a cause of such facilities. But the one will inevitably result from the other.

Connected with this subject, and as my attention was particularly directed to it by the Hon'ble the Court of Directors, as bearing on the establishment of Railways in India, I may be excused for alluding to another question, which has been forcibly impressed upon my mind, during the examination of the country which I recently visited; namely, the direction which the line of Railway to be established ought to take, and the point at which its terminus ought to be placed.

From information conveyed through the public papers, I believe that the present arrangement is that the line as far as the neighbourhood of Pundooah or Purrooah, about 10 miles from Bandel, or else as far as Burdwan, should be considered as a trunk line; that from a point near to the latter place, two lines should diverge; one to pass almost due Northwards to or towards Rajmahal; which is to be considered a portion of the main line, and to be constructed with a view to its continuance towards the North-west; and another line, which would be considered as a branch line, and be constructed towards, but not altogether up to, the collieries of the Damoodah Valley.

I have no official or positive information on this subject; but I believe, that such is the arrangement proposed; and I am also under the impression that this arrangement has not been finally sanctioned or determined on, but that the question is still an open one. Under this impression, I venture to express an opinion that such an arrangement is calculated most materially to injure any prospects of success which the proposed line may have.

There are two distinct points which I would consider. *First*, granting that the arrangement at present contemplated be carried out, to consider the proper position of the terminus for the colliery line; and *secondly*, to consider the advantages or disadvantages of the general line selected for the main branch of the Rail-road.

I am informed that the present intention of the Company is to make the terminus of the colliery line on the lands of Buckternagur,

near to the Dák Bungalow, and only a short distance to the South and East of Munglepore. Now I believe the only possible advantage which such a position can claim is, (the rather dubious one for a colliery branch), that it is altogether outside of the present workings for coal ; and that therefore it directly affords no greater facilities or advantages to one proprietor than to another. But I would submit that the object of constructing a Rail-road to these collieries at all, is evidently to assist in developing the valuable and extensive resources of the district, and to meet the traffic arising from the constant demand for this fuel.

Now what are the circumstances of the case? A reference to the Plan, which accompanies this Report. (*No. 2*), will show the position of the several colliery-workings in the district ; and from this it will be seen that the nearest of these collieries will have to transmit their coal to the Railway terminus, a distance of scarcely three-fourths of a mile, while some of the others will have a cartage of not less than (20) twenty miles. If therefore in fixing the present terminus, it were any object to avoid conferring advantage on one party more than another, this object has not been obtained ; as, however indirectly, a most essential advantage is conferred on those collieries which are nearest to the proposed locality.

But there is another, and in my mind a much more important consideration, arising from the facts regarding the present facilities of transport to market of the coal, and those which would exist under a system of Railways.

At present it is well known that all the coal from this district is sent down to Calcutta in boats by the Damoodah, a river, or rather torrent, which is only navigable for a few months in the year, and even then during floods only. At these times, an immense fleet of boats may be seen starting from the several wharfs or ghats along the banks, and stretching in a continuous line for some miles in length. Should the flood continue, these boats, with few exceptions, reach Ompta (where the river becomes sufficiently deep to be navigable at all seasons) in safety, but should the water fall, as often happens before they have accomplished this distance, they are left stranded on some chur possibly to get off again during some succeeding rise of the water, but more probably to be destroyed and lost. Under these conditions, it is necessary that the several proprietors should cart to the river bank and there pile up in large heaps all the coal raised during the months elapsing between the

close of the rainy season of one year, and its commencement in the succeeding one. Much coal is in this way exposed in uncovered heaps to the weather during seven or eight months, after which it may be sent down the river, to be again retained at the depôt for months before it comes to market. Indeed, but little of the coal from this field reaches the Calcutta market till after fifteen or eighteen months have passed subsequently to its being raised from the pit.

Again inasmuch as the quantity sent down, supposing a sufficient number of boats can be had, is altogether dependent on the amount and continuance of the rains, it not unfrequently happens that much of the coal, which has been raised and stacked on the river bank, waiting to be sent away, is necessarily left behind, and remains exposed to all the weather for another twelve-month. Much coal in this way comes to Calcutta market after being exposed for *two years*, quite sufficient most materially to injure the good qualities of any coal; and especially one possessing the peculiar structure of the Damoodah coal. The year 1851 was a remarkably dry one in Bengal, and when I visited these collieries, a few months since, there were many *lacs of maunds of coal* still remaining on the banks of the river, which the proprietors had expected to have been able to despatch during the last rains, but could not.

Another fact of importance is this, that the facilities for the despatch of the coal decrease very rapidly as we go up the stream; so that from the ghata near Raneegunge and Rogonathchuck collieries, it is often possible to despatch the boats when there is not sufficient water higher up the stream at Cheenacoory, or still higher at Chaunch and the adjoining collieries. Indeed the great reason, I was informed, why the collieries of Chaunch, Taldangah, and Doomerkoondah are not now worked, is, that as much coal can easily be raised at Raneegunge as can be shipped in the year, and therefore there is no use in wasting time and capital in supporting the other collieries. The same statements *mutatis mutandis* apply to the collieries which ship their produce on the Adji.

The collieries situated to the west of the river Barackur, being at present full of water and not worked, I was not able to see them myself, but Mr. Williams in his Report states that the coal at Taldangah is superior to any other coal in the field, and that it will *coke* well. Although what I could see did not support this description, it may, I think, be considered fully equal to the coal at present turned

out. Again the coal at Cheenacoory, the most westerly colliery on the Damoodah, before crossing the Barackur, is also of very good quality.

Now it appears to me obvious, if the formation of a line of Railway to this coal field be undertaken with any view to the development of its resources, through the medium of increased facility and rapidity of communication, *that such line of Railway should be carried to the furthest convenient point in the coal field*; and should be made so as to afford aid to those collieries *especially*, which from their position are at present most in need of it: while if thus carried all through the centre of the field, no greater advantages will be conferred on one colliery than on the others.

On the other hand, the adoption of the present proposed position for the terminus will inevitably tend to the development of those collieries only, which are at present most favourably placed; and to the entire abandonment of the others, which, though equally good as regards the quality and cost of the coal, will by their position be deprived of the advantages of the improved system of communication.

The importance of a line of Railway being carried to the Western extremity of this coal district, as bearing on the possibility of economizing its valuable deposits of Iron-stone has been already indicated in a preceding portion of this Report. And we may add here that could such a line of Rail-road be continued towards the North-west so as to open up the markets of that important portion of the country, the value of this coal field would be most materially enhanced.

If these views, therefore, be correct, it would not only be fair and just, but indispensable, that the rail should be continued through the coal field of the Damoodah, and not stop short of it at the present proposed terminus.

This extension would involve an addition of less than 20 miles, in a country very favorable for such works; and where a single line, amply sufficient for all the traffic, could be made for £6,000 per mile; or the 20 miles for £120,000, thus requiring a traffic producing only £6,000 per annum to pay 5 per cent on the original outlay.

The other question of the proper direction of the main line of Railway, with a view to its continuance towards the North-west Provinces, remains to be considered. And in viewing this subject, there would appear to be several facts so obvious, that there can be little hesitation in admitting them as axioms.

Of these one appears to be, that in India for many years to come, the *goods traffic* will be the principal source of revenue on any line of Railway to be constructed. From this it follows that while it is desirable that such gradients or inclines should be obtained as will enable heavy trains to be pulled with facility at a small cost of power, it is not desirable that such an end should be gained at the cost of a great expenditure, or that gradients of such a character should be sought for as would approximate the line to a perfect level, along which the maximum amount of speed could be obtained for express passenger trains. Now it is well known to every Engineer conversant with Railway works, that a gradient of 1 in 300 may for all practical purposes be considered as nearly approaching to a level; in other words, that on such an incline the effect of gravity, in retarding the ascent of a train, is such that it may be nearly disregarded. I would conclude, therefore, that it will be useless to seek for any line, on which the maximum inclination shall be less than 1 in 300. Over a great part of Bengal the gradients would of course be much less than this; but if the maximum inclination be not more than 1 in 300, and that such a gradient can be obtained without any disproportionate expenditure, it must be conceded that such a line would be a most excellent, and as far as the gradients are concerned, an economical working line.

It must also be borne in mind, that certainly the larger portion of the traffic to be conveyed over any line, stretching in the direction proposed, would be traffic tending towards Calcutta and not from it; and therefore that such inclination as the line of Railway would have, due to the gradual and continuous rise of the country towards the North-west would be in the direction favourable for the carriage of the greatest amount of traffic.

I believe it will also be granted that, for many years at least, the *roadside* traffic will be very small. From this it results that but little regard need be had to small existing towns or marts on the line, provided the general direction be favourable; it being more certain that the Railway will itself develop its own traffic, and give rise to towns, and marts in favourable places, than that it will derive much benefit from small existing ones. At the same time the large and established marts of the country must form one great source of traffic and revenue to the line.

In a national point of view, that is, on public grounds independently of the question of profit, it is desirable that as rapid a communi-

cation as possible should be established between the great seats of power in the country, and that, therefore, *the shortest possible line, consistent with other considerations, should be adopted.*

In laying out any line of Railway, with a view to obtaining a return or profit on the outlay, it is desirable, as far as possible, to avoid competing with other and cheaper modes of conveyance, and this more especially where the *goods traffic* will be the most important. It is also desirable that the line should not command only a *one-sided* traffic.

If these views be correct, and I believe they cannot be questioned, I feel satisfied that a better line for the proposed Rail-road can be obtained than that at present contemplated towards Rajmahal. And I have been led to this view, and to the present notice of the question by having passed through a district of country during our late geological examinations which does not appear to have been in any way examined heretofore with reference to the line of intended Railway communication.

On the accompanying sketch map (*No. 3*) are marked *in red* all the directions of the Rail-road, which I have heard spoken of. These lines naturally divide themselves into two groups; one which would take the direct line from Calcutta to Benares or Mirzapore, the other group which would follow the valley of the Ganges, and in order to do so, would wind round the foot of the Northern extremity of the Rajmahal Hills. To the first group, there exists the very strong and insuperable objection of the impossibility of obtaining sufficiently favourable gradients without a very large expenditure of both time and money; to the second group, the very strong objections, from the greatly increased length of line, from its running parallel to the greatest line of water carriage in the country (the cheapest that can be obtained), and from the difficulties of construction owing to the distance of materials and the nature of the rivers to be crossed. In favour of the direct lines there are the greatly diminished length, and some other points; in favour of the Ganges valley line, the extremely favourable gradients, and the certain amount of traffic which the Rail-road is likely to meet at Rajmahal.

Now granting at once that the nature of the country on the direct lines is such as to render the construction of a Rail-road too difficult and expensive, it yet remains to be seen whether there be not some line between this direct line and the Ganges Valley, which should be practicable and which should combine the advantages of both the others.

The great difficulties, as is well known, on the direct line were at and near to Dhunwa Pass, where the line of hills forming a portion of the great range passing North-east towards Curruckpore, skirts the plains of Behar ; and on any line passing in the proposed direction, this range must be crossed. But I believe there exist natural passes through which a more favourable line could be obtained than at Dhunwa Pass, and these I believe should have been examined.

In all the propositions which have been hitherto made for a direct line, Benares or Mirzapore has been the great terminus selected, and the line has been accordingly so arranged as to meet the Ganges, at or near these places. I conceive, however, that the great traffic centering in the large and populous marts lower on the Ganges is sufficiently important to demand attention. The first of these great marts in ascending the river is undoubtedly Patna, a town of some 350,000 inhabitants, and one of the largest and most important markets in Bengal. In fact this town was considered of such importance, that under the former proposition of a direct line to Benares, it was also contemplated to make a branch to Patna, in order to command its traffic. A Rail-road carried direct to Patna, would also intercept there a large portion of the traffic of the Ganges River, in fact *all* the River traffic which the line to Rajmahal can obtain, with the exception of that portion only which enters the Ganges, from the North, between Patna and Rajmahal, and which undoubtedly does not amount to more than one-fifth of the entire traffic passing Rajmahal. And I believe, that it would command this traffic with greater certainty by offering the greater inducement for its transfer to the Rail-road, of the boats escaping the very difficult navigation of the River between Patna and Rajmahal, where the entrance of the Cosi, the rocks of Sultangunge and Colgong, and other difficulties, render it peculiarly dangerous.

As regards distance, these two lines (namely, one from Calcutta to Patna direct, as now proposed ; and one from Calcutta to Rajmahal and thence to Patna), would bear the ratio of 4 to 5, or taking Patna by the direct line as 400 miles, the line by Rajmahal to reach the same point would be 500 miles ; or a saving of 100 miles in 500 ; (a) in other words a saving of capital, amounting at least to £1,000,000 sterling,

(a) It is not intended that these numbers should be understood to express the actual distances correctly, but only approximately, and with sufficient accuracy, the relative distances. Until the lines were actually surveyed, the exact lengths could not be ascertained.

taking £10,000 as the average cost per mile, (an estimate below the present cost) and a saving of probably two years in time of construction, while a return of the very large sum of £50,000 per annum more on the one line than on the other, would be requisite to meet the payment of £5 per cent interest to the proprietors.

Another important consideration is this, that the extension of the proposed colliery branch to Patna, could be made in very nearly the same time which will be required to construct the line to the Ganges at Rajmahal, while it is certain that any goods traffic which it can be expected to meet on its continuation from Rajmahal to Patna, it will meet at the latter place.

With reference to traffic, therefore, I am satisfied, that the line now suggested, direct to Patna would, as far as the coal fields, be under exactly the same conditions as the present colliery line; and if it be desirable to make such a branch now, this branch or portion of a main line would of course be a more paying project then. With regard to the further portion; *viz.*, between the Damoodah coal field and Patna, I may state that there is at present a very considerable traffic along the route which it would take. When passing along we met droves of pack bullocks covering the road for miles each morning and passing to and fro in a continuous stream, carrying up supplies for the extensive district of country between the Barackur River and the Ganges, and bringing down the produce of that district. And undoubtedly much of this traffic would come to the rail (*a*). It would have the additional advantage of going within a short distance of the Curhurbaree coal field, and the mines of Deoghur.

I can only speak from personal inspection of a part of the line now proposed, namely so far as some little distance north and west of Curhurbaree. Thus far however, the country is extremely favourable; and a nearly direct line could be had on which gradients, not exceeding 1 in 300 or 400 could readily be obtained. Northwards from this point until reaching the descent of the ghats into the plains around Patna, even more favorable gradients can be obtained; the country being remarkably level, and in fact a continuous plain, or table land. There remains, therefore, a distance of not more than a few miles, regarding which there can be any doubt, and this doubt could be settled in a

(*a*) Even supposing that a Rail-road should not be constructed here, a great and lasting benefit would be conferred on the district by the construction of a good road.

week (a). The ghats once passed, there can be no difficulty whatever across the level country from the neighbourhood of Guidore to Patna.

Indeed from every inquiry which I have been able to make, I believe that a good practicable line could be obtained throughout at a small expense.

The question appears to me so important, and the consequences of a failure in the first line of Rail-road to be established in this country so fatal to the successful and rapid progress of such works, that I have not hesitated to state my opinion, although not essentially connected with my own immediate investigations. I may also add that this opinion is based upon several years' experience in laying out, and in constructing Rail-roads, and on a practical and not merely general acquaintance with the subject.

I conceive, therefore, that the line now suggested, if found practicable, possesses the following advantages :

1st.—That there would be a saving in the length of the line of one-fifth of the entire distance at present proposed, representing a capital of £1,000,000 sterling, an annual return at 5 per cent of £50,000, and an expenditure of time in its construction of nearly two years.

2nd.—That such a line is infinitely more favourably placed as a trunk line, to be extended to the North-west, than the line now intended to Rajmahal.

3rd.—That the line can be constructed in very nearly the same time as will be required for the construction of the line to Rajmahal, while it will reach a point nearly 200 miles further from the capital, in the heart of the Province.

4th.—That it will render certainly profitable the line now proposed as far as the collieries, while under present arrangements, there is a very doubtful prospect of this branch paying.

5th.—That it must command at least four-fifths of the traffic now calculated on, as to meet the Rail-road at Rajmahal, while at the same time it meets that traffic in a more favourable position.

6th.—That it avoids a dangerous competition with the established and economical communication by the Ganges for a distance of nearly

(a) Should it appear desirable to investigate this point, it is probable that the Officer in charge of the improvements of the present Cart road from Curhurbaree to Soorajgurrah could supply sufficient information to determine the desirability of trial-sections being made or not.

100 miles, while it offers to the larger portion of the traffic passing along that River, a very much greater rapidity of conveyance to market.

7th.—That throughout nine-tenths of its course it is known to afford most excellent gradients, and for the remaining tenth, it is believed to do so also.

8th.—That throughout its course, there is not a single large River to be crossed, while the line to Rajmahal has to cross the Adji, the More, the Dwarka and the Brahminy.

9th.—That it offers every facility for construction in the proximity of the best materials, stone, brick-clay, wood, &c.

10th.—That it passes along a line of country of rich produce, and where there is at present a very extensive traffic existing, which traffic has been developed without the aid of even a common country road.

11th.—That it would open up a district adjoining to which are known to occur a valuable coal field and metallic mines.

12th.—That it would, from the first, command a large portion of the passenger traffic towards the North-west, while the Rajmahal line cannot be expected to obtain a single passenger, with the exception of the few, who may wish to proceed by the River Steamers from thence.

13th.—That it will at the same time form a ready, rapid and cheap conveyance for the coal of the Damoodah and of the Curhurbaree fields to Patna, and the several depôts on the Ganges; thus at once reducing the cost of fuel at Patna to nearly the same price at which it can now be had at Calcutta.

I believe that these considerations are more than sufficient to justify the preliminary examination of the country. And in conducting such an investigation it might be prudent to bear in mind that heavy traffic trains are daily, nay almost hourly hauled up inclines of 1 in 90 and 1 in 100, at home, without aid from second engines, and without any great loss of power, and carefully to consider whether any slight disadvantage arising from a short incline of steeper gradients, would not be very much more than counter-balanced by the great additional length of line requisite to obtain more favourable inclines, and the consequently greater cost of working afterwards.

I have above estimated the cost of the line as at present proposed to be £10,000 or £11,000 sterling per mile forward, while in the proposed extension of the colliery branch it will be seen that I have calculated £6,000 as the cost per mile. In explanation of this difference, I would remark that in the one case I have supposed the bridges, &c., to be

constructed for a double line of Rails while one line of permanent way should be laid down. In the other case, I have estimated for a single line only, which I have no doubt whatever could be constructed for much less than £6,000 per mile.

I believe the important advantages which single lines offer as compared with double ones, have seldom been fairly considered, or at least, seldom fully estimated, more especially as regards districts where the amount of traffic is small, or even doubtful. Many persons have an idea that nothing but a very limited amount of business can be carried on a single line of Railway, and that even this small traffic is accompanied by great risk of collision.

Now, as perhaps the best way of getting rid of such scruples, is to cite an instance in which the supposed difficulties have been already successfully overcome ; I would simply refer to the great line between Amsterdam and Rotterdam. Seventy-five miles in length, it traverses throughout its entire course, a very highly cultivated and a very populous district, it passes the large cities of LaHague, Leyden, Haarlem, &c., containing a population of upwards of 150,000, independently of its two great termini, which together contain nearly 300,000 inhabitants, and one of which, Amsterdam, is one of the most important commercial cities in Europe. *The whole of the traffic of this line is carried over a single line of Railway.*

In Belgium again with its wealthy and numerous towns, and its large and increasing manufactures, and with a population averaging not less than 378 per square mile, the Rail-road traffic is, with very few exceptions, carried on single lines ; and with equal or even greater security from accidents than has yet distinguished the double lines of England ; while at the same time the public derive the great benefit of proportionally reduced fares.

Surely then, if some of the great manufacturing districts of Europe can fully and most satisfactorily accommodate the entire of their traffic on single lines of Railway, the more agricultural country of India would find such amply sufficient for all the traffic that can, by any possibility, be expected for years to come.

In considering the amount of saving which would result from constructing the works throughout for a single line, instead of a double one, as compared with the whole expenditure for a double line, it is obvious, that no fixed ratio could be stated. This saving will vary with the character of the works to be executed, but will approximately vary in

the inverse ratio of the depths of the cuttings and embankments. But in a country, presenting physical features similar to those of India, at least of that portion of India in which it is proposed to construct Railways, it may be estimated as nearly (2-5ths) two-fifths of the whole ; or as giving a saving of 40 per cent, that is converting a stock paying 3 per cent, into one paying 5 per cent, or *vice versa*.

Again, should the necessity hereafter arise from greatly increased traffic, the widening can clearly be effected with greater advantage to the undertaking. To illustrate this ; suppose the saving in the first cost of the construction of a single line, as compared with a double line to be, say, not more than 25 per cent, (it would be much more in India) ; and that after the lapse of (20) twenty years, the traffic on this line should be so increased as to require a double line of rails : every £1,000 originally saved would during that time, at simple interest at 3 per cent, have amounted to £1,600 ; while on the other hand, if this £1,000 had been at first expended simply to provide for a possible contingency of such increase of traffic, it would, taken at the same rate of interest, have abstracted £600 from the profits of the shareholders.

This question is simply one of economy and profit on the one side ; of needless expenditure and loss on the other. Railways have long ceased to be luxuries ; they have become a matter of hourly necessity to any people, who would not be left behind in the great world of commerce. Cost what they may, they must be extended, until the progress of knowledge may discover some more effective and economical means of transport. It is further a trading and manufacturing population that more essentially requires Railway communication to accommodate that rapid and constant intercourse, so essential to success in commerce ; while to an agricultural people it is necessarily a less pressing want, owing to the absence of any great concentration of population in fixed localities ; and to such a people it can only be rendered partially advantageous by opening out the more important, and more generally accessible points in a district.

It is essential then, that the nation should be able to procure this portion of its daily existence at the smallest possible cost.

But entirely apart from the bearings of the question, viewed in relation to the shareholders, is its important bearing as regards the public, in producing *low fares*. This is so obvious, that it need not be dwelt on here. The value of these low fares may, however, be illustrat-

ed by the fact, that in Belgium the proportion of the population who travel, is stated to be five times greater than in England. And there are few countries where it could be more essential to the success of Rail-roads to be able to carry the public at low fares, than India.

There can be no doubt therefore that the capabilities of a single line are most fully adequate to meet the general Railway traffic of India, and that consequently all expenditure incurred beyond this, is only so much capital abstracted from other useful investments, and acts as a dead weight on the value of the Railway stock.

The vital importance of the extension of facilities for communication in this country, whether considered with reference to the possibility of developing its great industrial resources ; of economizing its valuable mineral wealth ; of elevating its degraded population ; or of enabling an extension of the beneficial influence which invariably and unavoidably springs from the presence of Europeans, and from the free intercourse of persons from different districts ; an importance which becomes daily more obvious, and which every hour's experience impresses more forcibly on every thinking mind, will be a sufficient reason for my having entered with some detail, into the facts connected with what appears to me a great improvement in the line of Railway at present contemplated.

And the more so, as I am under the impression that the direction now suggested for a line of Rail-road has not been previously proposed or examined. And at the same time thoroughly convinced that the superior advantages which, if practicable, it would possess, are more than amply sufficient to justify a preliminary examination of the country.

THOMAS OLDHAM,
Supdt. of Geological Survey.

Calcutta, 18th May 1852.

Approximate elevation above the Sea, of places referred to in the preceding Report.

	<i>Feet.</i>
Ahsensole,	306
Belgram,	98
Berhampore,	53
Burrooah,	76
Curbunna, near Bonhaut,	180
Damrah,	138
Doblec,	49
Dubrajpore,	322
Dyoucha,	175
Gobinpore, (from Boiling-point,)	503
Gongpara,	48
Gowkurn,	105
Hylapore,*	876
Juggulea,	44
Jumturra,*	617
Kandee, (Jummoo Kandee),	56
Kishnagur,	46
Mowlisher,	189
Muddoopore,	985
Muddoobund, (N. of Parisnath Hill),	1236
Neamutpore,	427
Nuggulea,	233
Palgunge,*	744
Palmow,*	833
Parisnath Hill, (Summit),	4484
Ditto ditto determined by Boiling-point Thermometer,	4504
Plassey,	74
Pursundpore,	154
Rajgunge,	746
Ringoo-Chingoo,*	775
Sadipore Baharow,	328
Serampore,	920
Synthia,	147
Soory,	233
Taldangah,*	401

The above elevations have all been calculated from observations with a Mountain Barometer, taken synchronously with those at the Surveyor General's Office, Calcutta, and to the results thus deduced the elevation of the cistern of the standard Barometer at Calcutta above the Sea, (namely 18·11 feet) has been added. Those which are marked thus (*), being derived from a single observation, are less to be depended on than the others.

PLAN
showing the Position

of the

COLLIERIES

on the Damoodah

leading to the proposed terminus

of the

RAILWAY

Scale 4 Br. Miles to an Inch

SELECTIONS
FROM
THE RECORDS
OF
THE BENGAL GOVERNMENT.

Published by Authority.

N^o. IX.

R E P O R T

ON THE

TEAK FORESTS OF THE TENASSERIM PROVINCES.

By

H. FALCONER, M. D., F. R. S.,

SUPERINTENDENT OF THE HONORABLE COMPANY'S BOTANICAL GARDENS, CALCUTTA.

WITH OTHER

PAPERS ON THE TEAK FORESTS OF INDIA.

Calcutta:

F. CARBERY, MILITARY ORPHAN PRESS.

1852.

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PREFATORY REMARKS.

THE Government having ordered the following Report on the Tenasserim Teak Forests to be printed, it seemed desirable to append to it, for general information, an abstract of the various proceedings relating to the Forests since they came into British possession at the close of the first Burmese War, in 1826.

Whilst the Summary was in preparation, frequent reference was met with, in the documents passed under review, to the measures in operation in the Teak Forests of Malabar, Canara and Travancore ; to the results—past and prospective; and to the views of the Local Governments of Madras and Bombay, on the general question of Forest administration.

It was in consequence deemed equally desirable to prepare an abstract of the proceedings relative to the Malabar and Canara Teak Forests, so as to place the whole subject in connexion, and exhibit in a single publication, the history and present condition of the principal Teak Forests in British India.

These objects it has been attempted to carry out, in the two Summaries and Appendix annexed to the leading Report, embodied in this number of the Selections from the Records of the Bengal Government.

The documents which had to be consulted or abridged are very voluminous: but endeavour has been made to select from them every important statement, whether of fact or opinion, having a bearing on the subject.

Detailed information on the Teak Forests in the Valley of the Nerbudda and the adjoining Districts is still wanting.

The Summaries have been prepared more with a view to an exposition, in the order of time, of the successive measures adopted in the different Forests, than to a continued narrative respecting any single district.

Bengal Secretariat, 1st January 1853.

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- Map of the Thoung-yeen and Attaran Forests to face page 1.
- Fac-simile of the *Tectona Grandis*. }
Fac-simile of the *Tectona Hamiltonii*. } to face page 54.
- Map of the Goojerat Forests to face page 262.
-

ERRATA.

- Page. 5, line 11, for "forest" read forests.
" 6, ,, 10, for "Eastern" read Western.
" 14, ,, 3, from bottom add "note*—vide Summary, p. 123, foot-note."
" 30, ,, 10, for "while the fruit was still attached to the," read, soon after the
fruit was detached from the.
" 38, line 20, for 484, read 4.84.
" 39, ,, 4, from bottom, insert the word *the*, after, *supposing that*.
" 46, ,, 8, for "greater," read "created."
" 48, ,, 9, and 10. For "*Planta Asiatica*," read *Plantæ Asiaticæ*.
" 67, ,, 3, for "*Melonorrhæa Vernix*," read *Melanorrhæa Vernix*.
" 66, ,, 14, for "*Therea robusta*," read *Shorea robusta*.
" 83, ,, 2, for "wood-roil," read wood-oil.
" 127, ,, 1, for "paragraph 78," read *paragraph 79*.
" 163, ,, 2, for "para. 102," read *para. 105*.

R E P O R T
ON THE
TENASSERIM TEAK FORESTS,

BY

H. FALCONER, M. D., F. R. S.,

SUPERINTENDENT OF THE H. C. BOTANICAL GARDENS, CALCUTTA.

1. The Teak tree of commerce belongs to a genus, *Tectona*, which comprises two species, viz., *Tectona Grandis* and *Tectona Hamiltonii*. The former yields the valuable timber so highly prized for ship-building, and is indigenous to Java, Ceylon, the Tenasserim Provinces, Siam, Pegu, Ava, the mountainous parts of the Malabar and Coromandel coasts, and the valley of the Nerbudda river. The second species, *T. Hamiltonii*, called Tā-lā-hat by the Burmese, has only been met with along the banks of the Irrawaddi in Pegu, and on the sterile hills near Prome, in Burma Proper. It is a much smaller tree than *Tectona Grandis*, and the timber yielded by it is not used in ship-building, or at any rate, is of very subordinate importance.

2. The Tenasserim Teak forests are confined to the northern or upper provinces, extending to the Ye river, in lat. $15^{\circ} 20'$. They have not been met with in the southern provinces of Tavoy and Mergui, along the Tenasserim river, nor in lower Siam or the Malayan Peninsula. This is the more remarkable, as regards the geographical range of the species, since the Teak grows abundantly in Java, yielding timber of the finest quality.

3. In the province of Amherst, Teak has been met with, in more or less abundance, along the course of all the principal rivers and their affluents; but the great sources of supply are the forests on the Attaran and Thoung-yeen rivers. The Teak region extends northwards from the province of Amherst, along the Salween river into the Karenee country; from the delta of the Irrawaddi river up along the course of the Sitang river; and through the heart of Burma Proper, all along the Irrawaddi river, to a considerable distance north of Ava the most productive and valuable forests being upon the Sarrawaddi river, which joins the main stream near the apex of the delta. Teak was observed by Dr. Wallich on Taoong Doong near Ummerapoora, in

lat. 22° ; and it has been also sparingly met with on the Arracan coast along the Kaladyne river, 100 miles inland from Akyab, and at Toung-goop and on the Thaddè stream, in the district of Sandoway.

4. The Teak of the Irrawaddi has for a long period been largely exported from Rangoon, under the name of Pegu Teak, and the forests in Burma are still so productive that the timber at the present day constitutes the most important article of the commerce of that port. The resources of the Tenasserim Provinces have only been drawn upon to any considerable extent since the Burmese war; and in order to attain an accurate idea of the present condition of the forests there, it will be necessary to revert to the state in which they were reported to have been when the country passed into our hands, and to the successive changes which they have undergone;—preliminary to which I shall offer some general observations on the physical characters of the Teak country.

5. The province of Amherst extends from near the Three Pagodas, in lat. $15^{\circ} 20'$, to the confluence of the Salween and Thoung-yeen rivers, in $17^{\circ} 45'$; and its greatest width is between the port of Amherst in east long. $97^{\circ} 45'$ and the Thoung-yeen river, long. 99° . It is bounded on the west by the sea-coast and the Salween river, which flows here nearly from the due north, separating the province from the Burmese district of Martaban: to the north and east it is bounded by the Thoung-yeen river, which flows first from south-east, bending gradually north-westward to join the Salween river; and to the south by the hills which form the sources of the Attaran, separating it from the province of Ye. The superficial area of the Tenasserim Provinces is estimated at about 33,000 square miles, 10,000 of which probably are comprised within the province of Amherst.

6. The physical configuration of the country is that of a mountainous and hilly region surrounding an extensive alluvial plain, intersected by numerous large rivers, which converge to form a common channel between the towns of Moulmein and Martaban, where they debouche into the sea through a narrow break in the hilly boundary which encircles the plain. The water communication of Moulmein with the interior of the province through these rivers is probably unrivalled in any other British possession in the East, of the same extent and hilly character.

7. The greater part of this plain is a dead flat, little elevated above the tidal level, and it has evidently the character of a delta formed by

the silt of the Salween, Ghyne and Attaran rivers, which at a comparatively modern geological period must have emptied themselves into a bay of the sea stretching inland from Martaban and Moulmein. This delta is now pushing out into the gulf of Martaban upon the tail of the large island of Beligeon, at the mouth of the common stream. The largest extent of the plain lies between the Attaran and Ghyne rivers, the Ghyne and Salween, and along the left bank of the Attaran. A great portion of the entire area is occupied by shallow depressions forming swamps, which during the monsoon are converted into extensive lakes. This tract is characterized by grass or swampy reed jungle bearing patches of forest along its borders, and wherever the land rises above the level of inundation ; and a very small portion of it only is under cultivation.

8. Low detached hills of compact blue cavernous limestone rise abruptly at intervals through the great plain. They are chiefly seen along the Attaran river, and between the Attaran and the Ghyne. The common level of the flat is undisturbed at their base, and they were evidently rocky islets of the inland bay, around which the great delta plain was gradually deposited. These isolated hills form a very prominent feature in the physical character of the plain of the province of Amherst, presenting a very bold and rugged outline, with abrupt and craggy scarped sides. They nowhere attain any considerable elevation, being seldom so much as 1,000 feet above the level of the plain.

9. A range of hills, commencing at the point of the Malay Peninsula, stretches northward, forming, as it were, a spine to the Peninsula, and from N. lat. 11° to lat. $17^{\circ} 4'$ separating the kingdom of Siam from the Tenasserim Provinces. This range, at first low, increases gradually in height and development as it proceeds northwards, till about lat. 15° , where it throws off a branch range, composed of a mass of low hills, which proceeds in a north-north-westerly direction across towards the coast, and terminating in inconsiderable elevations at Moulmein. The point where this branch of hills is given off forms a culminating ridge from which the water-shed is directed, on the one hand, due south from the sources of the great Tenasserim river, through the provinces of Tavoy and Mergui, and on the other side, in a north-westerly course into the basin of the province of Amherst, from the sources of the Attaran and Houndrow rivers. The main ridge continues its northerly direction, throwing off numerous spurs, till about N. lat. 17° when it bends towards the north-west,—the water-shed of its eastern slope

falling into the valley of the Thoung-yeen river, and of its western slope into the Amherst basin, by the various feeders of the Houndrow and Ghyne rivers.

10. The low ridge skirting the coast, described above as terminating at Moulmein, leaves a gap for the passage of the united Moulmein rivers, and then re-appears on the northern bank in the hill of Martaban, and is continued northwards till it rejoins the main chain forming the western boundary of the Salween river along the Burmese frontier. Another ridge runs in nearly a parallel direction, forming the eastern boundary of the Salween valley, and separating that river from the Lhang-booa stream. These ridges of hill have as yet received no recognized geographical names by which to characterize them. The greatest height of the main ridge separating the Thoung-yeen valley from the basin of Amherst province, is stated by Dr. Helfer to be about 5,300 feet.

11. The rivers of the province of Amherst belong to two systems, which it is of importance to discriminate, as the distinction is intimately connected with the past history of the supplies from the Teak forests, and with their prospective resources. To the one system belong the rivers which arise within the water-shed of the basin proper of the province of Amherst, as defined by a natural boundary: these include the Attaran, formed of two great branches, called the Weinyo and Zimmé, flowing from the southern side of the province: the Houndrow from the south-east and east, the Daghyne and Lhang-booa from the north-east and north, combining with the Houndrow to form the Ghyne river; and the lower Salween from the north and west side. These rivers indicate the direction of the exhausted forests, or those upon which the great drain of supply has taken place since 1829. To the other system belong the Thoung-yeen and upper Salween rivers, flowing from beyond the natural boundary of the province, and indicating the foreign sources from which the current supplies of the Moulmein market are chiefly derived.

12. The left bank of the Thoung-yeen river, it is true, is territorially within the British frontier, but the valley itself is beyond the high ridge which bounds the basin proper of the province, and the natural line of demarcation would assign it to the Shan province of Siam. The upper Salween comes from the Karenee country far beyond the British frontier, the united streams below their juncture forming the Salween river.

13. Teak has been yielded by all these rivers and their tributaries, but the great productive forests are upon the upper branches of the Attaran river within the basin, and on the Thoung-yeen river beyond it.

14. DR. WALLICH'S REPORTS.—The earliest detailed information regarding the forests within the basin is what is supplied by Dr. Wallich in his reports on the Salween and Attaran Teak forests, addressed to Sir Archibald Campbell in the year 1827. Dr. Wallich had previously gone up the Irrawaddi as far as Ava, and was thus prepared for the forests on the Martaban side. His first report, dated the 23rd March

Report on the Salween. 1827, is upon the Salween forest, north of

of Moulmein. He ascended the river as far as the island of Koa-lung, about 40 miles distant from Moulmein, and within that range met with four Teak forests, two on the Burmese side of the river and two on its eastern bank. The first considerable forest he found near Miyang, which contained about 200 trees with boles having an average girth of 7 feet 11 inches, estimated upon a mean of 11 distinct measurements. A few miles higher up he came upon another forest on the island of Koa-lung, consisting almost entirely of Teak trees, which he estimated would yield 300 good logs. An average of 16 measurements gave a girth of about 7 feet 7 inches, and his people considered that the forest contained at least 2,000 trees of all ages. Dr. Wallich did not ascend higher than Koa-lung, but he was led to believe from the information which he received that more extensive forests existed still higher up the river, and he recommended that the Koa-lung forest should be taken under the management of the Government. These forests, from their proximity to Moulmein were speedily worked, as the demand for Teak increased. Captain Guthrie, in the Statement No. 3 appended to his report dated the 20th June 1846, enumerated six forests upon the Salween, containing only young or small trees, all under the regulation felling standard of 6 feet girth, there having not been one then remaining above that size.

15. Dr. Wallich next examined the forests to the south upon the Attaran river, along its eastern or Zimmé branch, which he ascended

Report on the Attaran. as far as the Mittigate valley, 100 miles by water above Moulmein. He observed no Teak

on the united stream of the Attaran, nor along the lower portion of the Zimmé, within the range of the tide. The first Teak forest that he met with was about 12 miles above the deserted village of Assamee. From

this point upwards he passed through a succession of Teak forests, or rather patches of Teak, stretching along both banks of the river, the timber increasing in size and abundance as he ascended. The principal forests which he described were those upon the Goonjee and the Mitigate creeks. Along the Kyoon-ben Kyoung, one of the lower branches of the latter, he found a magnificent forest covering several square miles, full of Teak trees, and containing at least 2,000 trees of the largest size, averaging 11 feet in girth. Dr. Wallich's exploration did not extend higher up the Zimmé river to the great forests above the Mitigate, nor did his tour embrace the eastern or Weinyo branch of the Attaran: but what he saw satisfied him that the forests, although not inexhaustible, were capable of yielding large supplies of timber for naval and military purposes, under a good system of conservancy. With a view to this object, he recommended the felling of the largest timbers, attention to their re-production, and an extension of the natural boundaries of the forests by the establishment of plantations. Dr. Wallich also recommended that all the Teak forests should be reserved strictly for public use. He adds " unless this principle be acted upon " at the very outset, I will venture to predict that private enterprize " will very soon render fruitless all endeavours to perpetuate the supplies for the public service, and one of the principal and most certain " sources of Revenue will thus be irrevocably lost."

16. The forests were at first worked upon this principle, exclusively on account of the State; but after a trial of two years, it was found that they were worked to a loss, and in 1829, the Government threw them open to the public, on the recommendation of Mr. Maingy, by a system of *lehmat*s or licences, revocable at will, to fell timber under certain restrictions, and on the payment of an *ad valorem* duty of 15 per cent.

17. This measure gave so great a stimulus to the timber trade, and to ship-building at Moulmein, that all the forests easily accessible by water communication were speedily occupied by European and Native traders, and the productive tracts were most actively worked. After being in operation for a period of eight years, the subject was again brought under the consideration of Government, by Mr. Blundell in 1837, with a view to devise remedies for disputed rights, and encroachments caused by keen competition and ill-defined boundaries, and for the perpetuation of the timber supplies, which, under a system of indiscriminate felling, were in danger of being exhausted. Mr. Blundell recommended an immediate detailed survey of the forests, and the appointment of

a competent conservator, with adequate powers, for the preservation and renewal of the forests.

18. Dr. Helfer, in his reports dated the 15th September 1837 and the 23rd July 1838, refers briefly to the condition of the Salween and Attaran Teak forests. Without entering into details, he stated his opinion that the continuance of the existing system " would lead in a short time to the extermination of all the available Teak forests," and he recommended the establishment of Teak plantations on an extensive scale.

19. Early in 1841 the Government, acting upon the suggestion of Mr. Blundell, appointed Captain Tremenheere Superintendent of the forests in the Tenasserim Provinces. But previously to that officer's arrival at Moulmein, Mr. Blundell had deputed Captain O'Brien to examine the Teak resources on the Attaran river, and to construct a map showing the extent and boundaries of the forests. These officers were in company during a part of their tour, and their separate reports agreed in the leading conclusions,—that the extent and timber resources of the Teak forests, upon the Attaran, Houndrow, and Ghyne rivers, had been greatly over-estimated; that most of the timber originally contained in them had been already cut; that the forests leased by the Native traders were completely exhausted; that they were everywhere worked with the utmost waste and improvidence; that the timbers were felled and sawn green and unseasoned; that violations of the forest rules were practised generally and with impunity; that there were no signs of an adequate re-production of the forests by the spontaneous growth of seedlings; and that planting had nowhere been resorted to for the renewal of the cut trees. Both officers urged the necessity of the enforcement of efficient conservancy rules, and of establishing plantations on an extensive scale. Captain O'Brien states that he only met with Teak seedlings, of natural growth, in a single instance during his tour. Captain Tremenheere also framed a revised set of rules for the working of the forests and the reproduction of Teak, which were approved by Government with some modifications, but which do not appear to have been ever promulgated, or acted upon.

20. Captain Tremenheere, towards the end of 1845, was succeeded as Superintendent of the forests by Captain Guthrie, who devoted great attention to the whole subject. His observations and inquiries were submitted in an elaborate report dated the 20th June 1846. Captain Guthrie had personally examined the tracts along the Thoung-yeen,

Lhang-booa and Houndrow rivers. His assistant, Mr. Salmond, was deputed to the Attaran forests, and Burmese agents were employed to report on the lower Salween. Upon data derived from these sources, he endeavoured to approximate to an estimate of the Teak timber, young and old, contained in the whole of the forests, and to the prospective supplies which they could yield. He shows that the forest rules were violated everywhere; that under-sized and green timber were commonly felled; that the large logs were often sawn up into "loozars" (short lengths); that the felled timbers were in many instances left in the forests to be burnt during the periodical fires; and that no attention was paid to the renewal of the tree. He strongly enjoined the adoption of planting on a large scale to ensure the perpetuation of the forests; and as the only effective means of accomplishing this object, he recommended immediate resumption of the whole of the forests by Government. Soon after, acting upon a penal clause in the rules framed by Mr. Blundell in 1841, he summarily resumed large forest holdings, for violation of the rules, backed by the concurrence of Captain Durand, then Commissioner. These measures were entirely disapproved of by Government, on the grounds that the penal clause was of no authority, having never been confirmed or sanctioned, and the Commissioner was directed forthwith to reinstate the ejected parties in their forest tenures.

21. Captain Latter was appointed to succeed Captain Guthrie as Superintendent of the forests, and in July 1848 submitted an elaborate report embodying his observations, chiefly made upon the tracts along the Thoung-yeen river. The report is more especially remarkable for the peculiar views advanced by Captain Latter, respecting the natural conditions which regulate the propagation and spontaneous growth of Teak from seedlings, and the measures which with reference thereto he proposed adopting. Captain Latter vacated the appointment towards the close of 1848, since when the office of Superintendent has remained in abeyance, the duties connected with the forest administration being performed under one of the Commissioner's assistants.

22. Mr. Colvin, in 1847, transmitted an important report to Government, dated the 28th October, conveying his views upon the whole subject of the forest administration, having regard more particularly to the principles and conditions which should regulate the final settlement of the leases to grantees, which had been disturbed by the ejection measures of Captains Guthrie and Durand. Mr. Colvin also took up the consideration of the reserved forests, which were retained

unleased, under orders from the Honorable Court of Directors, and proposed some alterations in the timber duties levied at Moulmein, and a reduction in the regulation size of the trees open to felling. The leading principle advocated by Mr. Colvin was to follow out the views contained in the Despatch of the Honorable Court, dated the 30th November 1842, by recognizing the *leh mats* or licences which were framed originally revocable at will, to represent rights of property in the forest tracts, and to make them the basis of indefinite or long leases of 99 years, giving the grantees entire property in all the products of the forests; the object being, to render the interests of the holders identical with those of the Government, by holding out a sufficient motive for the good management and renewal of the Teak forests by planting, so as to ensure an abundant prospective supply of the timber;—the Government in this manner to be relieved from the responsibility and expense of holding the forests' management in its own hands.

23. But in order to carry out the measure, it was essential to determine, in the first instance, what conditions of reproduction and planting could equitably be enforced upon the forest-holders, so as to secure the attainment of the desired object. The rules framed by Mr. Blundell in April 1841, which under some slight modifications were still in operation, required that *five young trees* should be raised for every tree felled, under pain of resumption if neglected. Captain Tremenheere proposed the substitution of *three* instead of *five*, but it was a notorious fact that this rule was a dead letter, and that there was no evidence of a single young tree having been raised by any of the grantees, European or Native. The four Government nurseries or plantations established by Captain Tremenheere, in 1843, had proved an utter failure, a single plant only having been found in 1846, at Nat-choung, growing out of the many thousands which had sprouted. The Teak trees still standing in the forests were annually loaded with fruit, which ripened well and yielded good seed, millions of which annually strewed the ground: yet, while the Government surveyors and grantees alike agreed that the forests were rapidly advancing to exhaustion, it was equally admitted, that in the valuable and extensive Attaran forests, there was no appearance of young trees rising to replace, in adequate numbers, those which were felled. Captain O'Brien during his careful survey had only remarked a single instance of well-marked spontaneous growth of young plants. Captain Tremenheere, and other

Government officers gave statements to the same effect,—the only observation to the contrary having been made by Mr. Salmond, a subordinate officer employed by Captain Guthrie, and his statement required confirmation. The last officer, (Captain Latter,) who had reported on the subject with the experience of his predecessors, and the ample information contained in the forest Superintendent's office, before him, gave it as his deliberate opinion, that healthy adult Teak did not yield good or germinating seed; that it was only the seed of trees which were in the state of decrepitude and decay that was capable of germination; that nurseries and transplanting would prove a failure, and that the periodical recurrence of scorching by jungle fires was not detrimental to the ultimate vigorous growth of the young plant. Under these circumstances it was a moot point among the grantees, whether it was *actually possible* to renew the forests by artificial means, and until this point was settled, any penal condition for neglect of planting must have remained inoperative as it had been before.

24. While such was the complexion of the information regarding the forests along the rivers, within the basin proper of the province, in which alone leases were to be granted, it appeared from the reports of Mr. Maling, Captain Guthrie, and others, that the forests along the Thoung-yeen river beyond the basin, which were worked for the Government by annual tenders, for the removal of a specified number of logs,—that these forests, in many places, showed a fair proportion of young trees, promising to replace those which were felled. The Commissioner was therefore desirous to get some professional opinion upon the subject, founded upon an actual examination of the forests, and upon Mr. Colvin's application I was deputed by Government to proceed to Moulmein, in January 1849, upon this duty.

25. I shall now submit the results of my observations and inquiries on the forests.

26. I arrived at Moulmein on the 19th January, and having placed myself in communication with the Commissioner, I received a memo-

randum of instructions,* dated the 22nd

* Appendix No. 1.

January, from Mr. Colvin, indicating the principal points to which my attention was to be directed. Captain Berdmore, of the Madras Artillery, Assistant to the Commissioner and in charge of the forests' office, was joined with me in the tour, one of the objects of his mission being to investigate the boundary with the Shan country, near the heads of the Thoung-yeen river.

27. The memorandum of instructions directed us to proceed in the first instance to the upper part of the Weinyo river, to examine the Thengan-nyee-Nyoung reserved forest, its resources, and capabilities for the artificial culture of Teak by planting ; thence to visit the forests on the upper waters of the Zimmé river, and to examine the condition of the Kyoon-Geown, Megwa, and Mittigate forests. The upper Mittigate or Kyouk-Taga, an important reserved forest, was indicated as a special object of inspection. From the Attaran river we were directed to proceed across the hilly country to the Thoung-yeen river, along which we were to descend as far as the Winsaw creek, and thence return to Moulmein.

28. We started for the forests on the 30th January, our route being along the left bank of the Attaran. We ascended the Weinyo river to near its sources, and on the 7th February arrived in the Thengan-nyee-Nyoung forest, where we remained for five days. Thence we proceeded across the hilly country separating the valley of the Weinyo from the Zimmé, and on the 15th February reached the Kyoon-Geown forest, upon the banks of the Zimmé, where we remained four days. Thence we descended the Zimmé to the Megwa Kyoung, and halted on the Megwa forests four days. From the Megwa we proceeded, on the 23rd February, and reached the Mittigate Codoogway valley on the 24th, where we halted three days. Thence we made for the Mittigate forest on the 27th, and from that ascended the Mittigate creek to the reserved Kyouk-Taga, or upper Mittigate forests, where we halted two days. From Kyouk-Taga we descended the Mittigate creek, and penetrated the tract of forest lying between it and the Goonjee Kyoung. On the 4th March we reached the Karen village of Toung-Wyn, on the banks of the Goonjee creek, where we halted till the 6th. The examination of the Attaran had occupied so much time, that the season was now much too advanced to admit of an examination of the distant Thoung-yeen forests. I was at the same time attacked with indisposition to such an extent as disabled me from walking, and returned to Moulmein on the 9th March ; having passed through the Goonjee Teak forests, and the patches intervening between that creek and the Nat-choung Kyoung, I was thus enabled during the tour to inspect all the great forests upon the Weinyo and Zimmé rivers.

29. The Tenasserim Teak forests, as they are commonly called, are not, like the Pine and Oak forests of Europe, extensive tracts covered

by a single species of tree,—but forests composed of many species, of which the Teak is by no means the most common or prevailing form. Gregarious forests of one species are nowhere met with in India at low altitudes: the exceptions geographically, occurring at considerable elevations in the Himalayah, in the region of the Pines. The Teak tree where most abundant grows intermixed with other large forest trees, and it is never seen in the Tenasserim Provinces in the same numerical proportion to the other trees that Saul is in the Saul forests of Hindoostan, or Sissoo in the forests where that tree abounds. During the whole of my tour I never saw a patch of any extent composed of Teak trees alone. Exceptional cases have been mentioned by others on the Lhang-booa; but the instances are so partial as not to disturb the general application of the observation. Where the Teak is most numerous, it is mentioned, in previous reports to Government, that it rarely exceeds 1 in 10 of the surrounding trees, and my own observation confirms the statement. Ordinarily, in a Teak tract of any extent, the proportion is not so great. Many of the associated trees attain a larger size, and occur in greater numbers. The Teak has therefore, during the whole of its existence, to maintain a struggle with numerous competitors of other species, to retain its hold in the forests. Where a tree perishes, or is cut down, the readiest grower among the surrounding species will most probably be the one which will occupy its place.

30. Nor do the so-called Teak forests, that is to say, forests containing occasional Teak, occur continuously along a great stretch. The tree is usually found in patches or belts along the great rivers, but more especially up the courses of their feeders, the creeks, or Kyongs as they are locally named in the province. These patches are often interrupted for miles, where one passes through a dense lofty forest, without meeting a Teak or only an occasional straggling tree.

31. The favorite habitat of the tree is in the uplands, near the sources of the great rivers, or their affluents, upon the flat or shelving banks of streams, along which it occurs in dense tree forest within a belt of 150 to 200 yards. It is rarely seen so far as a quarter of a mile from running water. It grows most vigorously in the rich and moist soil of the bottoms of the upland valleys, where not exposed to protracted inundation. In the Zimmé and Weinyo forests it is rarely seen on the slopes of hilly ground, the only remarkable exception we met with having been in a patch of young Teak in the Mittigate Codoogway, growing on the side of a low eminence. In the Thoung-yeen forests it

is described as occasionally growing on steep cliffs, and its favorite habitat on the Malabar coast is on the sides of the hills. The next prevailing site of Teak is upon the steppes of forest skirting the main streams, where the trees are more open, and growing intermixed with grass jungle. The timber in this case does not draw up to such a height of trunk, but grows with a more expanded crown, yielding short logs, crooks and bends. It decreases in abundance as we descend lower along the streams towards the delta plain, where the country becomes still more open with heavy grass jungle, forming probably not more than 1 to 30 or 40 of the surrounding trees, and the timber here is usually stunted or deformed. It ceases altogether in the low swampy tracts liable to submergence during the monsoon.

32. The trees occurring in the forests in which Teak grows are very numerous, consisting of species of *Dillenia*, *Lagerstræmia*, *Nau-
clea*, *Conocarpus*, *Dipterocarpus*, *Hopea*, *Vatica*, *Bombax*, *Paritium*, *Sterculia*, *Inga*, *Acacia*, *Pterocarpus*, *Butea*, *Dalbergia*, *Pongamia*, *Cathartocarpus*, *Cassia*, *Gordonia*, *Calophyllum*, *Garcinia*, *Millingtonia*, *Uvaria*, *Gutteria*, *Jambosa*, *Careya*, *Pterospermum*, *Elæocarpus*, *Grewia*, *Diospyros*, *Tetranthera*, *Croton*, *Röttlera*, *Gynocardia*, *Trewia*, *Pierardia*, *Melauorrhæa*, *Blackwellia*, *Quercus*, *Castanea*, *Antidesma*, *Ficus*, *Artocarpus*, *Myristica*, *Aglaia*, *Bignonia*, *Calosanthes*, *Spathodea*, *Cratæva*, *Toddalia*, *Dalrymplea*, *Agathis*, *Cyrtophyllum*, *Psychotria*, *Heynea*, and many others. The more open part of the jungle abounds in Bamboos, some of which attain an immense size, while the denser parts near water abound in *Zalacca* and *Rattans*.

33. The Teak attains the largest size and yields the finest logs in the shady dense forests. The tree is then obliged to draw up, with a long cylindrical trunk, in order to push its crown into the light, and to such a stately height does it grow, from this cause, under favorable circumstances, that I have measured trees with 63 feet of length of trunk before the off-set of the first branch,—the stem straight and clean, with 13 feet girth near the base and 10 feet girth at 27 feet. The density of the shade precludes the growth of grass jungle, and these forests escape the periodical visitation of annual fires, to which the more open forests are exposed. This is a consideration of great importance with reference to prospective planting operations. I have seen cases of fallen logs in such forests, which had lain at least 10 years, and probably much longer, on the ground, without a symptom of decay, and without an indication of charring: while in the open forests, hundreds of logs

felled the previous season, but for which there were no means of removal at the proper time, have been observed utterly destroyed by the fires propagated through the grass jungle in March and April. So great a waste of timber was there in the forests from this cause, that a penal regulation was enacted, compelling the removal of timbers the same season in which they were felled.

34. The Attaran Teak, from the upper forests of the Weinyo and Zimmé, has yielded the logs of the best quality and largest scantling that are brought to Moulmein. The timber is even and open in the grain, strong and elastic, and the logs are more free from defects and clefts than those from the Thoung-yeen and Lhang-booa rivers. The Thoung-yeen Teak is more stunted in the growth, more uneven in the bole, and more curly in the grain. It is often deformed by buttressed ribs, rising from the base, forming fluted or channelled logs, which cause great waste and loss of scantling in the conversion into squared logs. On the Malabar coast on the contrary, the mountain or slow-grown Teak is the most prized, as more dense, durable, and oily.

35. Malabar Teak is by common consent ranked higher for ship-building than Tenasserim or Pegu timber. The cause of its greater durability, and power of resisting dry-rot, appears to depend chiefly on its more oily or resinous quality, and the greater density arising from its slow growth on the sides of hills. When H. M. ship the "Carnatic" was broken up, some of the timbers presented an appearance which the master shipwrights of the dock-yard considered to indicate dry-rot. A specimen was forwarded to an eminent English botanist, who on examining it found the timber to be sound, and that the appearance was caused by numerous tubular, slender reservoirs of a concrete resinous substance, the abundance of which probably constituted the reason of its durable quality. On the Bombay side, the Malabar timber is considered to be from 20 to 30 per cent. better than Pegu Teak, and the reason assigned for the great difference in the Bombay dock-yard, and forest reports, is the destructive practice, which is said to prevail on the Burmese coast, of extracting tar and oil from the Teak. So current has been the belief in this practice, that Dr. Gibson, the Conservator of the Malabar forests, alludes to it in a late report. But no such practice exists anywhere, so far as I could learn, in the Burmese or Tenasserim Provinces. The timber as it grows there does not contain oil or resin enough for the purpose, and the impression has probably originated in the circumstance that the

Kunyen or *Dipterocarpus levis*, with other species, is universally tapped in the Burmese provinces for the useful balsam, or "wood oil," which it yields on incision,—the oil known in the Bengal provinces by the name "Gurjun." Mr. Monro, the Conservator of the Travancore forests, in one of the Madras reports, states that the mountain Teak, after being girdled, and standing to season for one or two years before felling, is so full of oil, that the logs will not float till five or six years afterwards. Saturation with oil is never seen in any of the Teak timber of the Tenasserim rivers. After girdling they stand one or two seasons before felling, and are then fit to be floated in rafts, or in single logs, down the river. Logs felled green, without girdling, will not float.

36. But although one or two years' seasoning, after being killed by girdling, is considered sufficient to bring the timber into a merchantable condition, and fit for ship-building, the wood takes a much longer time to desiccate thoroughly. This has been well shown by a series of specimens in the interesting museum attached to the Admiralty Surveyor's office at Somerset House, which I have examined. Blocks of Teak, forming one foot cubes, derived from Java, Malabar, and the Burmese coast, have been weighed annually, and the decrements recorded on the blocks, the result showing that Teak timber goes on drying and shrinking with loss of weight, for at least four or five years after its arrival in England.

37. The same result has been yielded by observation on the timber brought in different states of seasoning from the forest. Captain Guthrie mentions (para. 42), that some of the close-grained fine timber from the Attaran had been found as heavy as 22 *cwt.* to the measurement ton of 50 cubic feet, while dead timber from the Thoung-yeen, that is to say, timber which had died by natural causes or been uprooted by storms, had proved as light as 16 *cwt.* to the ton. The timber in the latter case had probably lain for many years on the ground and become thoroughly desiccated.

38. The mixture of this light dead timber, with unseasoned logs which have been felled green, and logs flawed with holes and clefts from the Thoung-yeen, in the shipments made to England, is generally considered to have been the cause of the bad repute into which the Tenasserim Teak has fallen at home for ship-building, as compared with Malabar timber. The two latter circumstances had probably more to do with the result than the first.

39. Another circumstance deserving of remark is, that the core of Teak timber is not so compact as the hard wood outside of it. The

duramen, or hard wood, is pretty uniform till it approaches the pith, when it becomes more spongy, and liable to flaws and unsoundness, especially near the but of the log. This circumstance is duly attended to at Moulmein when the timber is sawn up into plank or slab, and a careful selection made as to quality. The centre slab, occupying about four inches in thickness of the core, is put aside and reserved for inferior purposes. It is not improbable that these two circumstances, *viz.* the shrinking and desiccation of the timber, long after it is considered fit for ship-building, and the inferior quality of the central slab, may have had something to do with the disrepute into which Teak has fallen for gun-carriage and ordnance purposes, in latter years, as compared with Sissoo. I understand that the joint Ordnance Committee from the three Presidencies reported so unfavorably of Teak for gun-carriages, as to lead to the general discontinuance, or very partial use only, of the timber for that purpose. At Moulmein it is still used in the Ordnance Commissariat yard, making a careful selection of well-seasoned and long-dried Teak, and excluding the core timber; the gun-carriages thus constructed are there considered in every respect equal to the best that are made of Sissoo in Bengal. Should the conjecture hazarded here prove to have a foundation, the subject might be open for reconsideration with reference to the great demand for suitable timber for ordnance purposes.

40. The Teak in favorable ground shoots up rapidly during the first 8 or 10 years. I have cut down a young tree measuring 25 feet in height, with a slender stem of 11 inches in girth near the base, which showed 8 concentric rings, indicating 8 years of age. After this the growth is much slower, and the tree does not attain the timber size of 6 to 8 feet in girth under from 80 to 100 years: varying greatly according to situation, soil, and exposure. On the Attaran river, trees of 88 years have been found to attain 12 feet in girth, while on the upper parts of the Houndrow, the same dimensions have not been exceeded in trees 218 years old, the timber in the latter case being close-grained, compact, and sound to the very core,—while the quick-grown timber is often affected with unsoundness. The largest scantling, which I observed during my tour, was in the Thengan-nyee-Nyoung forest, where an old-standing tree measured 22 in girth at a height of 5 feet above the root.

41. The tree during its growth does not seem to suffer much from the ravages of parasitical insects. Captain Tremenheere mentions that the stem is attacked by a beetle in the Thoung-yeen, which bores

Teredo-like holes. I observed no marks of the operations of such an insect in the Attaran forests, where the great injury done to the growing Teak is caused by the annual fires. Capt.

* Report dated 26th June 1846.

Guthrie* has remarked, (para. 14,) that in the Thoung-yeen it is more liable to suffer from

large parasitical creepers than any other tree, and Captain Latter has

† Dated 17th May 1848.

expatiated at length upon this point in his report,† (paras. 24 and 29.) He states that,

“ in the middle and upper Thoung-yeen the greatest enemy to the Teak trees is a species of parasitical Ficus. It is curious to see the process by which this plant entirely destroys a tree. At first, under the guise of a slender and graceful creeper, scarcely the thickness of a finger, it appears only to appeal for support. In its second stage, it may be seen spreading out the woody structure of its stem, and shooting its light foliage far above the original tree, yet appearing, however, to vegetate with it, as it were, on equal terms; till last comes the closing scene,—the parasite has entirely enveloped the original tree in its deadly folds, and absorbing all the juices of its life, nothing remains but the projected stump of some withered arm to show that any other plant had once been there. Yet this parasite appears never to attack trees of a perfectly vigorous and healthy growth; and thus it is that I have never seen an instance of its presence in the forests of the Attaran, or of Kamokla and Kyokhet.”

42. The epiphytic species of Ficus referred to by Captain Latter form large trees, which abound in the Attaran forests with the habit of the *Ficus religiosa* and *Ficus cordifolia* (the Peepul and Assoud of Bengal), and we met with them frequently on the Attaran, upon the Teak trees of the Upper Mittigate and Thengan-nyee-Nyoung, enclosing them in their embrace, in the manner described by Captain Latter, except that they are not true parasites, and do not suck the juices of the trees upon which they grow, using them merely as fulcra of growth. They chiefly fix upon very large trees, and infest other forest species besides Teak, in the course of time smothering and destroying the finest timber in the forests. The reason of their being so frequent on Teak I believe to be this: the Tenasserim forests abound in two large species of Buceros; these birds feed largely upon the fruits of the Nyoung-ben, or wild figs: they are very timid and wary in their habits, and generally perch upon the highest branches of the loftiest trees having any tendency to deciduous leaves. The tall Teaks are, in consequence, their

favorite haunts : and the fig seeds after digestion are dropt by them, in the most favorable condition for germination, and are caught in the forks of the large branches, whence, after germinating, they send down their long roots along the trunk to the ground, and ultimately envelope the tree. As these parasites infest only the largest trees, the obvious remedy is to fell the timbers upon which they make their appearance.

43. The injury caused by the fires in the Spring is very great, and has been strongly insisted upon by almost all previous observers. The grass jungle in the open forests grows very strong and rank, and after the monsoon, when dry and withered, it burns with the utmost violence and rapidity, forming sheets of fire extending over large surfaces, according to the direction of the wind. These fires envelope everything that they meet in their progress. The underwood is burnt up, and the smaller sized trees have their stems and branches scorched, and are either destroyed or receive a severe check. The larger trees suffer less in proportion to their height, but the flame often rises to the lower branches, while the trunk, by successive repetitions of the injury, gets charred at the base, leading eventually to flaws and hollows, which render the timber unsound and destroy its value. The stumps of felled trees and strewn logs are often seen burning for days after the flame has passed by. The only dissentient opinion to the injurious operations of these fires has been advanced by Captain Latter, who considers that their destructive effects have been exaggerated: he thinks that "each successive destruction of the stem throws accumulating vigour into the root, till at last, aided by the ashes of its former self, the plant is enabled, during the interval of visitation, to shoot itself beyond the influence of the destroying element." But this view is open to numerous grave objections.

44. I shall now submit my observations on the different forests, in the order in which we inspected them. Along our line of route up the Weinyo, we met with hardly any Teak until we reached the Thengan-nyee-Nyoung. The forest maps indicate numerous patches along the Pakaa-booai, Phabia, and Croongwoant creeks, and Captain Guthrie, in statement No. 6 appended to his report, dated 20th June 1846, enumerates 18 forest holdings on the Weinyo, most of them in the hands of native traders. Almost the whole of these have been worked out, and little remains to indicate that they had formerly bore Teak, besides dead stumps and an occasional unsound tree which was not worth removing.

45. The Thengan-nyee-Nyoung forest extends along both banks of the stream of that name and the Meyee-toh-Kyoung, and between them and the Weinyo till the confluence of their united waters with that river. This forest was first explored by Captain O'Brien, in 1841. He found then that about 500 of the finest trees contained in it, some of them 16 feet in circumference, and with perpendicular trunks 60 feet high, had been killed the previous year without a licence. Captain O'Brien does not state the number of trees he considered to be still standing upon it, but on his representation the forest was reserved by Mr. Blundell, permission having subsequently been given to a neighbouring forest-holder to remove the killed trees. Captain Guthrie, from the information submitted to him, estimated that in 1846 it contained about 3,000 timbers above the regulation size of 6 feet girth, and nearly 4,000 young trees. But this estimate I considered to have been very much in excess, more especially as regards the large trees. On examining the forest in every direction, during the five days we halted there, I was greatly disappointed in the quantity of Teak which I expected to have found. So far from being reserved, it has been actively worked. Regarding its general aspect, it is one of the finest forests in the province,—all the species of trees growing in it attaining the largest size, the soil being rich, free, and sandy; but the Teak trees bear but a small proportion to the other species, and are widely scattered throughout the forest, except on occasional patches, where they occur in greater abundance. Teak here reaches the most magnificent growth; one which I measured was 22 feet in girth; but the timber was in many cases unsound, with a hollow core above the root. We observed a considerable show of half-grown trees, but very few young seedlings, although there was abundance of good seed on the trees, which I proved by examination on the spot, and subsequently getting them to germinate. I consider the Thengan-nyee-Nyoung forest to be well adapted as a locality for artificial culture of the tree by planting, and the spot which I would indicate for the purpose is the point near the confluence of the Thengan-nyee-Nyoung with the Weinyo. The unsoundness of the large standing timber, I consider to have been caused by the natural decay which sooner or later affects all old trees that are left to stand too long after they have attained their maturity, and that it constitutes no objection in this case to renewal of the forest by planting. Mr. O'Reilly* who visited the same forest, independently, a short time before, has given a very

* "Observations," dated 15th April 1849, para. 3.

unfavorable opinion of its resources, and does not consider that more than about 200 sound timbers are remaining. He regards its "value as a reserve for future supplies as of the lowest scale of importance."

46. We ascended the Thengan-nyee-Nyoung river above the Teak forest, in our route to the Zimmé, but observed no Teak timber. On the 15th February we passed through a forest upon one of the feeders of the Mezelee Kyoung, worked by natives; and here for the first time I saw a well-marked instance of the spontaneous growth of young Teak seedlings, under favorable circumstances for the observation. So much has been asserted about the total absence of seedlings on the Attaran rivers, that I shall extract the remarks as entered in my notebook. "On the left bank of the stream we came suddenly upon a considerable patch of Teak seedlings, under and about 8 years old; cut down one measuring 25 feet long with 11 inches girth, which showed eight concentric rings of annual growth. A large Teak tree, close by, and embraced by an epiphytical Ficus (Nyoung), was the parent stock; six stumps of felled trees were in sight close by; and I counted twenty seedlings under eight years growing thick around. The spot open, no covering of leaf-mould, soil free and sandy, on a rising ground, well drained. Abundance of bamboos growing in the neighbourhood."

47. We next examined the Kyoon-Geown forest, upon the upper waters of the Zimme river. This forest, belonging to the Nathmoor estate, occupies an irregular steppe upon the eastern bank of the river, extending about $1\frac{1}{2}$ to 2 miles inwards, when it terminates in a series of low hills. It has been estimated to include an area of about eight square miles. In its general aspect, it differs very much from Thengan-nyee-Nyoung, being open, with abundance of grass jungle mixed up with the trees. It was first reported upon in 1841, by Captain O'Brien, and was then so rich that he estimated that there were about 10 or 12,000 full-sized timbers upon it, with abundance of half-grown trees. Since that time it has been so actively and continuously worked, that all the finest timbers, and a large quantity of under-sized trees, have been cut down; what remains upon it now, consists chiefly of defective timber or small trees. While we were there, a party of Burmese were at work under the orders of Messrs. Mackey and Co., and the head man stated that he expected that season to get about 800 logs; but the felling had been so vigorously followed up before, that most of the trees upon which they were now at work were unsound, and had not been considered worth felling while better timber was to be had. The great number of

stumps showed that the proportion of Teak in this forest to the other trees was unusually large. We did not observe any young seedlings in the Kyoon-Geown. Their absence here was readily explicable, from the great force of the annual conflagrations, of which we saw striking marks everywhere, in burnt strewn logs and charred stumps. The forest is so open, and the grass jungle so abundant, that the native woodsmen, employed in felling and girdling, are compelled to make a clearance by fire to enable them to move about with safety, and patches were daily set on fire by them while we were on the spot. The Kyoon-Geown forest must be considered to be in an advanced state towards exhaustion, so far as regards current supplies, and the rising stock of young trees is insufficient for its adequate renewal. The former richness of the forest would indicate it as an eligible site for planting operations; but the liability to fire renders it unadvisable to propose any general system of planting throughout it. There are spots which are less open to this contingency, and as the most favorable of these, I would indicate the eastern branch of the Kyoon-Geown creek, about a mile above its confluence with the Zimmé river.

48. From Kyoon-Geown we descended the Zimmé to the forests on the Megwa creek. These forests also, upon the Nathmoo estate, present characters very closely resembling those of the Kyoon-Geown. They are estimated to cover an extent of about 18 square miles. When visited by Captain O'Brien in 1841, there was abundance of the finest timber upon every part of the stream; but they have been most actively worked since, and will in the course of a few years probably be cleared out.

49. The forests upon the different branches of the Mittigate creek were the next that we visited. They are of great importance, and were pointed out in Mr. Colvin's memorandum as special objects of inspection. They consist of three great forests, the Mittigate Proper, the Mittigate Codoogway, or branch Mittigate, and the Upper Mittigate, occupying an extensive tract of wooded country lying between the Weinyo river and the Toung-Wyn range of hills, the western drainage of which falls into the Weinyo.

50. We first ascended the Mittigate Codoogway, or southern branch, and proceeded to near its source. The lowest part of the original forest commences about $3\frac{1}{2}$ miles above the junction of the main creek with the river, and extends about 2 miles up the stream, but

this tract is now entirely cleared of Teak timber, the workings upon it having been actively carried on by one of the European licence-holders as far back as 1835, and hardly a standing tree has been left. The forest is then interrupted for some distance, but abounds in magnificent trees of other species, such as Kunyen, Peema, Gyoung, Peengadoe, Thengan, &c. The finest Kunyen, oil trees (*Dipterocarpus levis*), which I met with in the province were along this part of the Codoogway. We then entered upon another patch of forest, containing Teak trees of large growth, thinly scattered along the banks of the stream, but observed no young seedlings. This tract had been also worked several years before, without a licence, and the finest trees killed. The luxuriance of the forest vegetation continued as we ascended towards the sources of the Codoogway, and a few miles higher up we came upon a succession of low eminences, upon which there were young Teak trees growing in abundance, promising eventually a large supply of fine timber. Captain Guthrie has computed the number at upwards of 5,000, from data furnished by his native establishment, but this estimate can only be considered as approximate, and is probably considerably in excess. We had now reached the base of the Toung Wyn hills, upon which we ascended for about two miles through dense tree forests of the most stately growth, but entirely devoid of Teak, till we were arrested by the precipitous gorge through which the Codoogway escapes from the hills.

51. The Mittigate Codoogway forests, after having been worked by the early traders, were resumed by Government, and held for some years as reserved; but in the beginning of 1849 they were leased out to Messrs. Mackey and Co., by Mr. Colvin. The resources of standing timber for current supplies are limited, and will soon be exhausted; but I consider that the capabilities are very great for the growth of young trees, by planting along the Codoogway creek, for about 8 or 10 miles above its confluence with the main stream, (Mittigate Kyoung.) The soil upon the banks of the creek and its feeders is good, being free and sandy, with a copious mixture of leaf-mould, while the low eminences along its upper portion have a covering of sand and clay, admitting of every variety of growth.

52. From the upper part of the Codoogway, we proceeded northwards over a series of low knolls covered with bamboo and grass jungle, but devoid of Teak; and after a march of 10 or 12 miles, we entered the upper division of the Mittigate Proper. This forest is estimated to

cover about 24 square miles, nearly the half of which bears Teak. The Teak-yielding tract commences near the confluence of the Codoogway, and extends almost continuously for about 8 or 10 miles up the main stream on its northern banks. A very rich patch lies upon the banks of a small affluent, the Kyoon-ben-Kyoung, so called from the prevalence of the tree. I did not examine the lower part of the forest, as my companion Captain Berdmore had been specially deputed upon the duty by the Commissioner, during a distinct tour made a few weeks before. The upper portion stretches in a belt of about 200 yards wide along the very tortuous course of the creek, chiefly upon the right bank, on undulating dry ground. The forest is very open and full of grass jungle, the Teak occurring in detached or occasional trees, straggling at intervals along the banks.

53. The Mittigate appears formerly to have been one of the richest forests in the province. When visited by Dr. Wallich in 1827, it was described as containing many thousand Teak trees, of the largest size, and finest quality of timber. In the interval between that date and 1835, it was actively worked by Captain Warwick. It then passed into other hands, by whom the drain upon its timber resources has been conducted with equal vigour. The Mittigate forest has therefore been 20 years continuously under the full operation of the axe, and the greater part of the large timber has been cut down; along the upper portion of the creek nothing remains but unsound or deformed trees, which were not worth felling. During my examination of the forest I observed no appearance of young seedlings, the abundance of grass jungle, and the great prevalence of fires throughout it, affording in this case a sufficient reason for their absence. No planting has yet been attempted by the grantees. Captain Tremenheere established a nursery upon the banks of the creek in 1843, but from want of sufficient protection the plants were destroyed by fire, and not a vestige of them remained after a couple of seasons. Captain Guthrie in 1846 estimated the number of large trees standing at 4,000, with an equal number of young; extensive fellings have been carried on since, and the Mittigate forest is rapidly approaching to exhaustion, while a long period must elapse before its timber resources can be replenished.

54. From this forest we ascended the creek to the Kyouk-Taga, or Upper Mittigate, the only great forest now held reserved for Government on the Zimmé river. The upper waters of the Mittigate pass through a deep and narrow gorge, in a spur sent off from the

Toung-Wyn hills, dividing the valley into the Upper Mittigate and Mittigate Proper. The stream in its course through the defile is blocked up with rocks forming a succession of rapids, called the Kyouk-Taga—a name applied, in consequence, to the forest beyond them. About half a mile above the upper termination of the gorge, the valley expands in an irregular plateau of large area, and the main stream receives from the north a small tributary called the Koon-Kyoung. The Teak forest extends along the course of the two streams, and between them for about a couple of miles; and although it has not escaped the ravages of the axe, it is the one which, of all others on the Attaran side, best exhibits the characters of a great forest in the natural state. Teak trees of the largest size and most stately height are seen in every direction, and in an unusually great proportion to the other trees. The timber is of straight growth, cylindrical, compact, and of the best description, and the ground is strewn with a number of fallen logs of the first class. The majority of these yielded a girth varying from 11 to 13 feet, and some of them were 63 feet long in the clear to the offset of the first branch, and perfectly sound throughout. These logs, notwithstanding the reservation of the forest for Government, had been sawn across into short lengths, yielding two logs of 27 and 33 feet respectively, by trespassing parties detached from the working establishment of the Mittigate grantees. Along the upper part of the main stream, a great number of the largest trees have been uprooted, and now cumber the ground. A hurricane would appear to have passed through the forest many years ago, and struck them down. I observed in several instances that epiphytic Nyongs (parasitical fig-trees), themselves of enormous dimensions, which had fixed upon the most stately trees, had been torn up by the roots, and levelled along with the trees that sustained them. The forest still exhibited the same appearances in this respect as described in Captain O'Brien's report of 1841, when he found the trees in the same fallen state. The timber in most cases, although it had lain so many years on the ground exposed to successive monsoons, was still perfectly sound: this was shown well by sections afforded by logs which had been sawn up into short lengths. The absence of charring was equally remarkable, and proved alike the durability of the timber, and that parts of the forest had not suffered from the destructive ravages of fire during many years. This result is attributable to the nature of the under vegetation. The forest is very dense and shady, especially upon the lower part on the

Koon Kyoung, near its confluence with the main stream, and precludes the growth of grass jungle. Had the same logs been strewed in the Kyoon Geown or Megwa forests, they would long since have been charred to the very core. Although the large trees are so numerous, I did not observe young timber in the same proportion, and very few seedlings.

55. The Upper Mittigate is in every respect the finest forest upon the Attaran rivers. It is admirably adapted for planting operations, and the locality which I would specially indicate for this purpose is the angle between the Koon Kyoung and the main stream, and along the banks of the former. The chief difficulty will be experienced in the want of hands and the expense of keeping an establishment on the spot, there being no resident population in this part of the forests.

56. From the Kyouk-Taga we returned to the Mittigate, by the same route through the defile, and after emerging from it we proceeded in a northerly direction, through a dense and nearly impenetrable forest, intervening between the Mittigate and Goonjee creeks. This forest, in the heart of which we halted one night, was utterly devoid of Teak, which disappeared, upon our route, soon after we turned aside from the Mittigate creek. The following day we reached the Karen village of Toung-Wyn, upon the upper part of the Goonjee Kyoung. This stream descends from the northern extremity of the Toung-Wyn range, passing through an undulating tract composed of a succession of low rounded sandstone eminences. The upper part of the creek formerly bore a fine forest, stretching for about 5 miles along both banks, but it has been constantly worked for the last twenty years, and all the large timber has been cut down. A considerable show of half-grown trees is seen along the banks. Captain Guthrie has estimated the number at upwards of 5,000 along the whole course of the creek.

57. From the Toung-Wyn village, I proceeded in a north-westerly direction across the courses of the Goungelee, Thengan, and Nat-choung Kyoungs, to the Karen village of Nat-choung, meeting occasional patches of young Teak thinly scattered and chiefly upon the undulating ground, through which the small feeders of the Goonjee run. Upon the Nat-choung creek, which is the largest, a considerable forest stood formerly, yielding stunted or deformed timber, used for crooks and bends. This forest, from its accessibility and close proximity to Moulmein, was early worked, and has now been nearly cleared out. The circumstance of there being a settled Karen village at Nat-choung

holds out an inducement for planting operations in the Nat-choung forest, but the timber grown here is of an inferior description, and the grass jungle throughout the forest is so strong and rank that great difficulty would be encountered in protecting the young plants against fire. The nursery established by Captain Tremenheere in 1843 was destroyed by this cause.

58. The Teak-yielding forests terminate at the Nat-choung Kyoung, with the exception of a small patch upon the Dallee Kyoung, lower down the Zimmé, of little importance, and yielding inferior timber. From this point the delta plain extends in a continuous flat to Moulmein. I took a canoe at the village of Ayeen Kayeen, on the Dallee Kyoung, and returned to Moulmein on the 9th March.

59. The general result of my tour of inspection may be summed up thus: the Teak forests upon the Weinyo and Zimmé rivers are in rapid progress to exhaustion. The forests which were in the hands of native license-holders have been in most instances entirely cleared out both of large timber and of under-sized trees, approaching the regulation standard. The large forests towards the heads of the rivers, held by Europeans of capital, have been actively worked for nearly 20 years, and are also either in the same condition, or will speedily be exhausted. Of the three reserved forests formerly held for Government, the Mittigate Codoogway has been leased out, and is now under the full operation of the axe; its resources having been largely drawn upon before it was held in reserve. The only two now reserved, *viz.*, the Thengan-nyee-Nyoung and the Upper Mittigate, instead of being intact forests, have been partially worked by trespass, by the adjoining forest-holders,—the former to a large extent, the latter in a less degree. Both forests contain standing Teak timber of large scantling, the Upper Mittigate in particular abounding in the finest trees. So general and indiscriminate have been the fellings upon the Weinyo and Zimmé, that but for the timber in these two reserved forests, it would now be a matter of record only, that Teak of large size has ever been produced on the Attaran.

60. Young timber is nowhere rising in adequate quantity, either to renew the forests or to keep up the supply. The reason of this having been that the forest regulations up to 1846 were unoperative, and under-sized trees were felled equally with the large timber,—the greater facility of dragging them through the forests, and the ready sale met with at Moulmein, having held out an irresistible inducement for their consumption.

61. The forests have been worked, even by grantees of capital, entirely with a view to immediate or speedy returns ; their maintenance for future supplies, and the creation of prospective property, have in no case been attended to. The owners have rarely, or only at long intervals, visited their grants : they have been in the habit of carrying on their operations by means of native agents, who have conducted them with reckless waste and improvidence. The most destructive agent, after the axe, I consider to have been the periodical fires ; and these are referable in most instances, in the remote forests on the Attaran, to conflagrations purposely caused by the working parties, so as to clear the grass jungle, and enable them to move with safety about the forests. I believe these fires to have been much more prevalent since the country passed into our hands than they were when the forests were in the state of nature. Planting young trees, or raising nurseries from seed, has in no instance been attended to by the grantees, or if there has been a solitary exceptional case, the attempt has been made with so little effort to attain success, that there is probably not a young tree in the whole of the forests that owes its origin to the hand of man.

62. Although young seedlings of spontaneous growth are occasionally met with, as in the instance mentioned in para. 46, they are, generally speaking, rare in the Attaran forests, and bear no proportion either to the vast quantity of good seed annually produced, or to the trees which have been felled, or are still standing, and consequently to the requirements of the forests for renewal.

63. In the above summary I have only added the testimony of a fresh and later observer to the statements which have already been made in the reports of Captains O'Brien, Tremenheere, and Guthrie, and in the forest records of the Commissioner's Office.

64. The disappearance of the large and under-sized trees is readily intelligible from what has been stated in the preceding paragraphs as to the wasteful manner in which the forests have been worked. But the general absence of young seedlings on the Attaran, with no motive to destroy them, is not of such obvious solution. And this is the more remarkable, as the concurrent statements of most observers agree in the fact that young seedlings are not uncommon in the forests upon the Thoung-yeen river. Mr. Maling even states "that
 "in some parts, as near Meerawaddi, the
 "young Teak is seen to spread for miles,
 "and often unmixd with other trees."

Report dated 4th September 1844.

65. Various reasons have been assigned for their absence, such as 1st, the natural inaptitude of the seed for ready germination; 2nd, the prevalence of the periodical fires; 3rd, the peculiar opinion advanced by Captain Latter, that it is only trees under the influence of decrepitude and decay which yield germinating seed; 4th, over-saturation with water during the rains.

66. The fruit of the Teak is a nut about the size of a small hazel-nut, covered with an exceedingly hard shell, the outer surface of which is spongy and woolly. The nut does not split, and is invested with a loose inflated bladder-like bag, (the enlarged persistent calyx of the flower,) which with the spongy coat of the shell renders it very light and buoyant. It is divided into four cells, in each of which a solitary small seed is lodged; one or more of these cells is frequently abortive, so that the nut may contain only one, or any number up to four of ripe seed; or all the cells may be empty. The common axis of the hard plates forming the partitions of the cells is perforated lengthwise, by a slender open canal. This is the natural structure, and it is necessary to notice it here, as I have heard persons who were interested in the subject of the forests at Moulmein, refer to it as the work of an insect, which thus drilled its way in and destroyed the seed,—which is not the case. The seed is small, and the germ or embryo is not invested with a coat of albumen. Nature has thus endowed the Teak seed with the capacity of long retaining its vitality, and at the same time, with great inaptitude for ready germination, caused by the mechanical difficulties presented by the structure of the nut.

67. The tree comes into flower about the beginning of the monsoon, most of the trees flowering freely, and the majority of them annually, after they attain 25 or 30 years of age; and the nuts ripen, about the close of the rains, forming copious loose bunches at the tops of the branches, all over the crown; so that an immense quantity of Teak nuts is annually produced in the forests. They drop during January, February and March, when the ground under the trees is covered with them. At this time the soil is dry, smooth, and hard; the seed retains its vitality, but is not placed under conditions calculated to develop its germination, by shade and continued moisture. It remains in a torpid state, till destroyed by the periodical fires prevalent during February and March, or till the sudden and abrupt commencement of the monsoon, when the country is deluged with heavy rains, and the nuts are swept off the ground by the flood, and drifted into the creeks, whence to find

their way by the great rivers to the sea, their naturally light and buoyant structure presenting unusual facilities for their removal. The *rationale* of the process has been clearly pointed out by Captains O'Brien and Tremenheere in their reports, and I have great satisfaction in giving my testimony, founded on personal examination of the country, to the pains-taking care and fidelity which characterize Captain O'Brien's report throughout. The great mass of the nuts is thus either destroyed by fire, or carried off by water, before the seeds have had time to germinate. Should a mechanical obstruction occur in the form of a pit or cleft, or any other inequality of the surface, to arrest the nut and give it the combined conditions of shade and moisture, the chances in favor of its producing one or more seedlings are very great: but the young seedlings which have thus sprouted by accident are exposed to destruction by the recurrence of fire during the following season. To the combined operation of these agents, *viz.*, the natural structure of the seed, the season at which it ripens, the yearly recurrence of fires immediately after, and the floating away of the nuts during the monsoon, I attribute the general absence of young seedlings in the Texas. serim Provinces.

68. In order to appreciate to its full extent the effect which the inherent inaptitude for speedy germination in the Teak seed has, in retarding its dissemination through the forests, it may be well to refer to what happens with other trees, the seeds of which are of an opposite nature, *viz.*, having short-lived vitality and great facility of germination. The Pines of Europe or the Deodar of the Himalayah, furnish illustrations from temperate regions. Their seeds are naked, and the young germ is embedded in fleshy albumen. If they fall upon wet moss, under shade, or are soaked by a shower of rain under the same condition, after 8 or 10 days they will sprout by thousands, and the ground under the parent stem will be sheeted with a crop of young plants. The Saul tree of Hindoostan extends in a nearly unbroken belt of forest along the Terai, from the Ganges at Hurdwar to the Burrampooter, and it is felled to an extent unknown even in the most wasteful parts of the Teak forests. Young and old of every scantling, from the sapling of 6 or 8 years to the full-grown tree, are cut down indiscriminately, and the forests are protected by no conservancy rules whatever. Many lacs of the youngest trees are annually removed as "bullees" to form posts and roofing for native houses: the next larger size, *viz.* those which are too heavy to be dragged by bullocks, are sawn

up longitudinally into "kurrees," while the larger trees supply the "luttas" or logs universally used for the public works and private houses of the Upper Provinces: yet with such a vast yearly consumption, and drain upon their resources, it is hardly possible to exterminate the Saul forests. The seed has the utmost susceptibility of germination, with a vitality so limited in duration that it will not survive many days unplanted. The Saul seed ripens at the commencement of the rains, and after the first shower, falls *actually sprouting* from the tree. I have frequently seen, in the forests near Hurdwar, the radicle of the germ protruded (that is, growing,) while the fruit was still attached to the parent tree. In consequence, young plants come up in the utmost profusion, and very often so thick as to choke each other: they form patches of forest, which are literally impenetrable, till the woodsman removes them as "bullees" or "kurrees." In this manner the forests are maintained, wherever a tree remains standing, to perpetuate the stock. With the Teak it is the reverse in every respect: the seed, when sown under favorable circumstances, "will retain their vegetating power in the ground even as far as 18 months, and many will remain until the commencement of the second rains, nay even the third, from the time they were sown: however, this is rare." (Dr. Roxburgh.)

69. Dr. Wallich attributed the absence of the seedlings *entirely* to the fires: and Captain O'Brien expresses the same opinion, although he observed how apt the buoyant and light nature of the seed rendered it to be floated away during the rains. But that fire alone is not a sufficient explanation is proved by the observations made in the Upper Mittigate, and other forests similarly situated, (*supra*, para. 54,) where the trees are very dense and shady, without grass jungle, and where the sound condition of the fallen timbers showed that the tracts had not been ravaged by fire for many years. Under these circumstances, young seedlings were still uncommon. But the amount of destructive agency which is exercised by the fires, is proved by the *prevalent age* of the young and under-sized trees which are met with in the exhausted forests, the majority of them being about 20 or 25 years old, dating in fact from the period immediately preceding the time when the forests began to be worked and to be systematically burnt. Seedlings, or young trees under that age, are comparatively very rare.

70. The singular opinion put forth by Captain Latter, that it is only trees in a state of decrepitude and decay which yield good or vegetating seed, requires to be noticed, from the official position which that

officer held as Superintendent of the forests, affording excellent opportunities for observation; and from the great weight which he has rested upon it, in his printed report, which has been widely circulated. After explaining his view of the *rationale* of the process by which decrepid or old trees propagate the species, Captain Latter adds, "I do not mean by this to say that a Teak tree in its prime does not produce seeds; on the contrary it does so in abundance, but they never come to anything till the individual shall have reached the decadence of such prime," (report, paras. 22, 27 and 80.) But this view is entirely at variance with the observations which have been made by others, whether in the Tenasserim Provinces, on the Malabar coast, or elsewhere. The oldest Teak trees in the Botanic Garden are not more than 63 years old, yet they have fruited freely for the last 25 or 30 years, and yielded good seed. During my tour I gathered seed from the trees on the Attaran, without selection, which germinated freely during the months of March and April. In August 1848 Captain Latter transmitted 55 seers of Teak nuts from the Tenasserim Provinces to the Botanic Garden, where they were sown and came up abundantly. The nuts were superior in size and development to those produced about Calcutta,—1 seer (21½s.) of the Botanic Garden produce having contained 2,823 nuts, while the same weight of Tenasserim produce comprised only 1,575, giving an excess of nearly 50 per cent. in favor of the latter in size and weight. It appears to me that Captain Latter's view has arisen from partial or erroneous observation.

71. Captain Tremenheere attributed the result to the nuts absorbing more water in the rains than the seeds can assimilate before they get covered with soil, and thus causing them to rot. There is no doubt that Teak nuts, exposed to constant soaking and light and heat together, would be destroyed in this manner: but they require constant humidity in the soil to excite them to vegetate, and I do not attach much weight to this assigned reason, as it practically operates in the forests. In the Malabar nurseries, the nuts are soaked for 36 hours before their sowing.

72. Assuming it to be an established fact that Teak seedlings are more numerous upon the Thoug-yeen than upon the Attaran river, the only reason that I can assign for the difference, is, that the Teak on the former grows in a hilly country, upon elevated steppes or cliffs, or hill-sides, where the nuts meet with more chances of entanglement from irregularities of the surface, so as to arrest their removal and

lodge them in pits or cracks, or under stones,—thus giving them the accidents favorable to germination, while the parent trees are in many situations so difficult of removal, that they are allowed to stand. In the Teak plantation formerly attached to the Botanic Garden, the surface of the ground is very broken and uneven. Spontaneous Teak seedlings have been constantly observed to be more numerous there than in the cultivated parts of the garden, where the trees stand upon smooth and well-mowed lawn, although the parent trees are alike in every respect. I do not think that difference of soil has anything to do with the asserted difference between the Attaran and Thoung-yeen rivers, as regards their relative production of Teak seedlings; for the Teak grows upon a wide range of soils, occurring equally in the black heavy cotton soil and rugged cliffs of Malabar, Canara, and Travancore, and on the moist rich bottoms of the upland valleys, or sandy banks of the creeks on the Attaran rivers. Soil will affect the growth of the tree and the quality of the timber, but it will not determine the numerical production of seedlings.

73. It may be asked, with so many alleged inherent obstacles to the propagation of Teak, how were the forests kept up in the state of nature, and why have they fallen off so much now? The reply to this is, that although the forests in their virgin state produced myriads of seeds, they show now, by the unfrequency of large Teak trees, that few of those seeds met with the concurrence of accidents favorable to their growth into young plants, whereas since they have been worked by man, the number of adverse conditions has been augmented by the agency of fire, at the same time that the source of the supply of seeds has been vastly diminished by the active felling of the adult trees.

74. But the inaptitude of Teak seed for the propagation of the species only applies to the wild state. If aided by the application of a few simple means, the seed will come up with as much certainty as any other, and grow into the most stately tree. In fact, the early cultivation of Teak is very easy, for the plant grows quick when young, and after a few years it may be left with safety to itself. All that is required, is to collect the nuts when fully ripe, before they are shed; to reserve them till near the commencement of the rains; to sow them in prepared beds of ordinary good soil, about half an inch below the surface; to cover the beds with a layer of straw or dry grass, or leaves, so as to prevent evaporation and the caking of the soil; and to keep the earth around them constantly moist, by watering every evening. Most of the good seeds, under

this treatment will come up in from 4 to 8 weeks ; some of them will remain dormant till the following rains ; and a large portion, consisting of bad or abortive nuts, will not come up at all. If the sowing has been well-timed, they will sprout about the commencement of the rains, and escape the risk of being dried up by a burning sun and protracted drought. It is the subsequent stage where the difficulties are encountered, in warding off destructive agents, such as elephants and other wild animals, and fire in trackless jungles that are annually enveloped in flame. To these, in the Attaran forests, are added the absence of a resident population, the migratory inhabitants even forming but a thin sprinkling over the forests, and the unhealthy condition of the forests, during the rains, from malaria. These combined, constitute most formidable difficulties in the way of rearing the plant by culture in the Teak forests, and have been the reason why no progress has hitherto been made thereto, after working them for so many years.

75. Planting operations have recently been conducted on an extensive scale, and apparently with great success, on the Malabar coast, in the Canara and Malabar districts, and I may be permitted to refer briefly to the proceedings there, with a view to ascertaining whether and how far they are applicable to the Tenasserim Provinces.

76. The Malabar timber has been for a long time in great repute for its excellent quality for Naval and Ordnance Commissariat purposes. A large demand, with high remunerating prices, led, as in the Tenasserim Provinces, to an excessive drain upon the forests, and a Conservator was appointed by the Government to regulate the fellings, and secure the forests from exhaustion. The regulations were considered by some to encroach upon the just rights of the native landholders ; and the subject came under the consideration of the Madras Government during the administration of Sir Thomas Munro, who, in a Minute dated the 22nd November 1822, abolished the office of Conservator, and forest restrictions, upon the broad principle in political economy that the increased demand would lead to a corresponding augmentation of the supply, that self-interest would induce the people to grow Teak or any other profitable wood, and that no regulation was wanted but a free market. These measures led to indiscriminate felling, alike of the young and old trees. It would appear, that the logs were classified under six heads, according to size, the 1st class including trees above a hundred and twenty years' estimated age, and the 6th class descending to under-sized trees of not more than 35 or 40 years, being much below

the standard ever permitted by the Tenasserim forest rules. The trade yielded large profits, stated in some of the Madras reports as high as 200 per cent. No attention was paid to planting or replacing the cut trees, and the forests were threatened with extermination. Timber of large scantling became scarce, and the price rose from Rs. 7-3 per candy in 1815, to Rs. 12 in 1828-9, and to Rs. 15 in 1840, being respectively Rs. 18, Rs. 30, and Rs. 37-8 per measurement ton of 50 cubic feet. The daily increasing difficulty of procuring suitable timber for the public wants, even at enhanced prices, brought the subject again under the consideration of the Bombay and Madras Governments. In 1843, Mr. Conolly, the Collector of Malabar, commenced operations with great zeal, and during that and the three following seasons, raised and planted out several lacks of seedlings, in bared forest lands purchased for the Madras Government. In September 1846, the plantations were reported as being in a very satisfactory condition, containing 2,35,000 plants, which in 1848 had been increased to between 4 and 5 lacs, in different stages of growth, from $\frac{1}{2}$ a foot to 20 feet high. The most noble the Marquess of Tweeddale, in his Minute dated the 8th December 1846, after personal inspection, expressed a most favorable opinion of these plantations. In 1847, Dr. Gibson, Superintendent of the Botanic Garden, Dapooree, was appointed Conservator of Forests in the Bombay Presidency, since when great attention has been paid to raising young Teak: but 60 or 80 years must elapse before the trees will be available for consumption.

77. While the Malabar and Canara forests were in full progress to exhaustion, the conterminous forests of the Travancore Rajah, abounding in excellent Teak, were under a provident system of management, which yielded large supplies of timber yearly, while at the same time suitable provision was made for the certain perpetuation of the forests. Of every ten trees fit to cut, *two* were left standing for seed; and for every tree felled, ten young trees were planted,—the management conducted by a Conservator, under the control of the Resident at Travancore. Captain Cortland Taylor states that a million of young trees were planted during the time of Colonel Newal alone. Mr. Monro, the Conservator, in a report addressed to the Resident* says,

* Mr. Monro to Colonel Fraser, dated 12th August 1837.

—“The system of throwing open Teak forests to all who wish to cut, or giving them to contractors, is in the highest degree ruinous.

“They cut indiscriminately all that comes in their way; any range of

“forest, however extensive, would be destroyed if left to their tender mercies. They never think of planting, and all that such speculators calculate on is present profit or loss, without troubling their heads about depriving future generations of the benefit *they now enjoy*. “The Teak forests in Malabar are, I am told, in this predicament, and if “the British Government do not oblige them to plant, and also leave “some large trees here and there for seed, this valuable tree will be “extinct. There are two ranges of hills in our forests that were formerly rented to a Parsee, and if the contract had not been taken “from him, before it was too late, he would not have left a Teak tree “standing. It will take 40 or 50 years before the forests recover the “effects of his avarice.” Mr. Monro mentions in the same letter that he estimated that there would be upwards of 100,000 trees fit to cut that season, and with reference to the quality of the Travancore timber, Captain Cortland Taylor states, that a large quantity of selected Teak had been contracted for at Allepee in October 1837, for the Ceylon Government, at Rs. 81½ per measurement ton, and that the price was expected to rise during the season to Rs. 100.

78. The reflection which naturally arises, on the consideration of these facts, is, that if the same measures were applied to the Tenasserim Provinces they would lead to the same results. But in the practical application of them lies the difficulty. I shall consider the subject, 1st, with regard to the forests which have been worked by licences by private parties, and 2nd, to the forests which have been either reserved or worked by Government.

79. Following up the principle advocated by the Hon'ble Court in the Despatch dated 30th November 1842, Mr. Colvin has recommended that the licences in the Attaran forests should be converted into leases in perpetuity, with a penal clause of resumption unless the grantees shall have, at the end of 10 years, planted one-half or one-third the number of trees that have been removed, on the average of the last 10 years, and that the tenures should include a right of property in all the trees and products of the forests,—the object being to relieve the Government of the expense of their renewal and management, and to give the holders such a permanent interest in them, as to induce them to perpetuate the forest by planting. The only doubts entertained by Mr. Colvin were, as to whether it was *really practicable*, with reference to the experience of past failures, and the circumstances of climate and country, to renew the forests by artificial culture, (paras. 18 and 25.)

He adds that he "was by no means confident that we should prove more "successful in our endeavours than Captain Tremeneere did."

80. That the forests can be renewed by planting, I consider to have been fully established by what has been detailed in the foregoing statements, and by the results attained on the Malabar coast; but I entertain grave doubts whether this can be reasonably expected to be accomplished by the grantees under the provisions of the proposed leases.

81. The experience of the last 20 years has shown that the forests have been worked solely with a view to immediate returns, and with no regard to the future. The licences have passed by transfer from hand to hand, and few of them have remained with the original holders. The timber trade has been carried on naturally with a view to make the most of a profitable article, while it lasted. As one source of timber became exhausted, other more remote tracts were explored, until the traders went beyond the boundaries of the Province, and drew their supplies from the Shan States upon the Thoug-yeen, whence the greater part of the timber is now derived. Fixed capital never appears to have been invested in any part of the forests, with a view to operations extending beyond the duration of the timber then standing or in prospect of being speedily available for use. The holders were fully awake to the impending exhaustion of their grants, but in no one instance was a steady effort made by them to maintain the value of the property for the future by planting. Instead of this, the future was anticipated by felling every tree approaching the regulation standard. It is true that the tenures, originally held, were simply licences revocable at will, and conveyed no permanent right of property,—but I do not believe that this circumstance had much effect practically in influencing the operations of the holders, for during the period from 1829 to 1846 they were never disturbed in their possession; the ejection measures resorted to by Captain Guthrie were immediately discountenanced by Government, and large sums were paid for the transfer of the licences, showing the feeling of security that was placed in them. The trade, as has been aptly stated by Mr. Colvin, was conducted in a spirit of gambling, with a hazardous outlay of capital and very uncertain returns. The ultimate gains to most of the forest-holders have been small, and the profits of the traffic would appear to have remained with the prudent capitalists at Moulmein, who purchased their consignments on the spot from the adventurers who had brought the timber to the market.

82. If such have been the results of the past, when the forests were covered with abundance of valuable Teak timber, what reasonable grounds are there for expecting adequate measures of renewal from the grantees, now that they are bared? If the leases had reference to virgin forests stocked with Teak wood, conditions of renewal might have been enforced, and the Government could have had the full guarantee that the provisions were carried out, by periodical inspections, and by forfeiture wherever planting was neglected. But with exhausted forests, where the prospects of return are nearly a century off, how can it be expected that capital will be invested by private parties, with annual outlay, in so remote an adventure? Fixed capital in the province of Amherst has still to be created: there is none available at present for such an enterprise; and the only party who can be looked to for undertaking it is the Government itself, for the prospective maintenance of its timber revenue.

83. It may be urged that as the proposed leases convey rights of property in the other woods and products of the grants, some of these ought, in the interim, to yield profitable returns. But on the other hand it may be stated with more effect, that the demand for timber at Moulmein is at present entirely confined to Teak; that for other woods, it has still to be created; while at the same time there is no resident population in the Attaran forests to work upon the miscellaneous products.

84. It appears to me that the principle of the new leases, however sound in the abstract, is like that acted upon by Sir Thomas Munro with reference to the Malabar forests, much in advance of the existing condition and prospects, for many years to come, of the country to which it is proposed to be applied. But there was probably no other alternative open, besides taking the whole of the forests into the hands of Government under a general system of management, with compensation to the licence-holders for their existing rights; or granting them leases in perpetuity, on condition of renovating their tenures with Teak timber.

85. The renewal of the trees being the main object of the lease, the first point is, to determine upon what principle the number of young trees to be raised by the grantees ought to be fixed, so as to attain the desired result, without exacting more than could be reasonably attainable. In Travancore *ten* young trees were planted for every full-grown one cut. Mr. Blundell, in the forest rules of April 1841, required *five*, which Captain Tremenheere, in the rules

of 1842, proposed reducing to *three*. Mr. Colvin suggested that the grantee should be made to show, at the expiry of 10 years, "that he has " within his limits Teak seedlings growing up, say to the extent of a third " or a half of the whole number of trees which have been taken from the " forest on an average of the last 10 years." Besides the discrepancy in the numbers, these proposals are open to the objection, that the ratio of planting would vary in the different localities and bear a proportion more to the activity with which the forests had been worked, than to their capabilities for raising timber. Mr. Colvin's plan appears further to leave a loophole for evasion, as the lease-holder might, when the term of inspection approached, at a small outlay, crowd a great number of plants into a corner of his grant, without making any beneficial alteration in the general character of the forest. The most eligible plan would probably be, to fix a uniform numerical ratio upon the areas of the forests generally.

86. The extent of the great forests upon the Attaran, proposed to be leased, has been approximatively estimated at 228 square miles, 110 of which are reckoned to bear Teak, very unequally distributed among them. Supposing the forest trees, large and small, to stand 30 feet apart, there would be 484 to the acre, or 30,976 to the square mile; and assuming 1 in 10 to be Teak, there would be 3,097 to the same area, and 3,40,736 over the whole extent of Teak-yielding forest. This number is considerably in excess of any returns that have been made of the actual contents of the Teak forests upon the Attaran rivers, which Captain Guthrie fixed as low as 93,458 large and small, but excluding very young trees upon an extent of $140\frac{1}{2}$ square miles. The rate here given, however, is low for the area, as it would allow less than five Teak trees (4.84) to the acre, and it is not much in excess of what some of the best forests have been supposed to bear. Captain O'Brien considered that there were from 10 to 12,000 full-grown Teak trees fit to cut, upon the Kyoon-Geown forest, in 1841, with an unusual abundance of young trees. This forest, which in the returns is fixed at 8 square miles, had been at that time worked for 10 years, and if we adopt Captain O'Brien's estimate as nearly approximative, and assume the young trees to have only equalled the full-sized ones, there would have been from 20,000 to 24,000 Teak, large and small, on the Kyoon-Geown. The same area (8 square miles) with 4.84 Teak to the acre, would yield 24,780 trees, and it does not appear to me that an adequate and beneficial renovation of the forests, so far as the interests of Govern-

ment and the well-being of the Province are concerned, could be well fixed at a lower rate. The objection at first sight is, that it is framed too low.

87. In order to carry out the principle, I consider that the leases should contain conditions that the grantees should show, at the end of 10 years, that one-half of the area of their forest-holdings was either planted out or bore spontaneous young Teak, at the rate of 4·84 per acre, or 3097·6 to the square mile, estimated upon the whole of the grant, exclusive of full-grown trees. This would leave half the area at their disposal for occupation otherwise, and imply 9·68 young Teak upon the acre of the moiety under Teak culture. Assuming the area of a forest to be 1 square mile, or 640 acres, the grantee would have to show at the end of 10 years 320 acres planted throughout with Teak, and bearing not less than 3,097 trees, which would be at the rate of 32 acres annually planted out with 310 trees.

88. The proportion of surface brought under Teak planting, appears to me to be of much more importance with reference to the efficient renovation of the forests, and their ultimate productiveness, than the mere number of plants raised in a crowded spot. There is a great deal of specious appearance in the array of figures, shown by planting operations carried on on a great scale. In Malabar, Mr. Conolly planted out 4,50,000 young Teaks, in the course of the five years between 1843 and 1847, being more than the entire number contemplated in the above scheme for 110 square miles in the Attaran forests. But the Malabar seedlings have been planted at 8 feet apart, being at the rate of 680 to the acre, so that the whole of the young plants do not occupy above 662 acres, being little more than a square mile. Mr. Conolly calculates that only one-fourth of the whole will remain for timber, as the rest will require to be cleared in thinnings, leaving 170 to come to maturity per acre. But first-class Teak cannot be grown at a less distance apart than 40 feet, or 27·2 trees to the acre; or for useful timber of smaller scantling, 30 feet interval, giving 48·4 or, in round numbers, 50 trees to the acre, which would reduce the number from four and a half lacs, originally planted, to 33,100. A large return would of course be derived from the thinnings, in a densely-peopled country, where timber of small scantling is in demand. Supposing that Attaran leases contained no requirement of planted area, but simply a condition to show a certain number of young trees within his grant, the holder of a forest of 8 square miles, like the Kyoon-

Geown, could, by following the Malabar system, include the required number of 24,780 plants within 36.5 acres, leaving the remaining 5083.5 acres unimproved. The intention of Government in giving the lease would, in this manner, be frustrated. I consider therefore a condition of *planted area* in the leases to be essential. If one-half after 10 years should be considered to press too heavily on the grantees, the proportion might be reduced to one-fourth, maintaining the same ratio of planting calculated upon the whole extent of the grant, at 4.84 trees per acre.

89. Close planting is not desirable in the Tenasserim Provinces for the grantees. Elsewhere it is practised with advantage, making a provision for partial failures, and for the selection of the strongest and best formed plants to remain, while the thinnings periodically yield a profit. But in the remote forests of the Attaran, the thinnings for the first twenty years would be worthless, as they would hardly pay the expense of rafting them to Moulmein, where, from the abundance of bamboos, timber of slender scantling is of little value: and the grantee would be obliged to keep up an establishment for thinning and pruning, to save the young trees from injury by over-crowding. The object with him would be, to get the plants at once placed at the distances best suited for their growth to maturity.

90. The raising of a lac of seedlings in a nursery bed before the commencement of the rains, in the manner practised in Malabar, or as recommended by Dr. Roxburgh, would be a comparatively easy matter. To plant them out in quincunx order, at intervals of 20 feet apart, so as to allow for the failure or subsequent removal of every alternate tree, would require preparation of the ground, and the partial removal of grass or any other interfering jungle, and the girdling of a proportion of the large trees, so as to enable the grantee to put in the ground 109 seedlings per acre: for it would be to his interest, without materially increasing the expense, to raise at once as many young trees as the surface would bear when they came to maturity. All this would have to be effected by indolent Burmese labourers sent from Moulmein at Rs. 15 each per mensem, and Rs. 30 for an intelligent overseer. The coolies of the Madras coast would be less expensive, but they have been found to be unsuited for the forests, where their health breaks down, after the commencement of the rains, from jungle malaria. Labour is nowhere procurable in the neighbourhood, in the remote forests upon the Attaran. The only inhabitants are a few migratory Karens

who change their locations after every three or four years, and often remove to a great distance. So limited are they in number, that during the time we were occupied in passing through the different great forests on the Mittigate creek and its branches, from the 24th February to the 4th March, we did not once fall in with a human being, or come across a village clearance. When the monsoon fairly set in, all operations would cease; the Burmese would return to their homes, and the plantations during the rains would be left to their own resources. Supposing the plants to thrive well, the only danger to be apprehended in the first instance would be from elephants and other wild animals. But from December on to April, the grantee would have to provide annually against risk of fire. A wandering Karen in passing through the forest, or a Burma woodsman, might at any time, by accident or design, cause a conflagration which would be propagated through the grass jungle to the young plantation. Mr. O'Reilly in his observations remarks,—“The practicability, therefore, of propagating the tree on its “original sites, where the composition of the soils as described are “unobjectionable, must be sufficiently evident: but unless a *cultivation* “be carried out to the fullest extent of its import, and measures be instituted to prevent the Karens from spreading their devastating fires “through the jungles annually, such an undertaking in the localities “under notice is not to be contemplated.” But in such extensive uninhabited tracts, no amount of supervision could be exercised adequate to effect this object, and injunction merely would be useless. The only feasible way of preventing the ravages of fire would be to cut down the grass jungle in a belt encircling the plantations, and to dig trenches, and raise earth embankments around the most exposed parts. These operations would entail considerable expense; the grass would require to be cut down annually, until the young trees had attained such a size that they could take care of themselves, and in the aggregate, they constitute such a formidable array of difficulties and expense, that I do not see how the grantees could be expected to encounter them. Captain Guthrie remarks upon this subject,—“Private persons here are not likely to “incur any outlay in planting for a benefit to be obtained after very “many years. They would be very apt to argue, that each plantation “before it attained the age of five years would (from destruction of “young plants by wild animals and other causes) cost some 2 Rupees, “and that it would yield a better profit other ways than waiting 50 “years for a Teak tree, which would then *perhaps* yield a profit of 10

“Rupees.” I fully concur in these observations. The grantees will work the forests as long as they are productive; they will then retain hold of them, as “block,” so long as the Government will allow them, trusting to natural growth for their renovation; but they will not incur the expense of renewing them upon any adequate system of operations, and sooner or later the forests will lapse to the State, unless Government is content to let them remain unproductive.

91. It was proposed by Captain Tremenheere, that failing the planting of young trees by the licence-holder, it should be done by Government at his expense. But I entirely agree with Mr. Colvin that this is unadvisable. The grantee should be alone responsible for his own failure or success, and the Government officers ought in no wise to be mixed up with his operations.

92. Every plan that has been proposed is more or less liable to the above objections: and the best thing that can be done under the circumstances, is, with reference to their existing rights, to offer the grantees such equitable terms as will enable them to renovate the forests if they are willing and able to incur the expense; or failing that, to terminate the present unsatisfactory state of things, after giving sufficient time for a fair trial, and by resumption of the leases, to take the forest into the hands of Government.

93. The same measures, and the same conditions of lease, would apply to the forests upon Houndrow and Lhang-booa. Upon the former, according to the statements contained in previous reports, the timber resources are very limited, but Mr. O'Reilly mentions having come upon a forest, on his route, in which he concluded there were 5 or 6,000 available trees of all sizes. The Lhang-booa forests are chiefly in the hands of native holders, and it is not contemplated that they would undertake leases involving outlay for planting.

94. Next with regard to the reserved forests on the Attaran, now limited to the Thengan-nyee-Nyoung and Upper Mittigate,—I consider that they are well worthy of being retained, and I have stated in a foregoing part of this report (paras. 45 and 55), that they possess great capabilities for conducting planting operations advantageously, on a large scale, while the Teak borne upon them is not in proportion to their extent. Both forests have been worked, more especially the Thengan-nyee-Nyoung, in open defiance of their reservation, showing the difficulty of enforcing rules in the forests, and preventing trespass. It seems to me in every way expedient that they should be

brought up to their full capabilities, both as prospective sources of supply of the best timber, and as a practical illustration to the lease-holders of what may be effected by a judicious system of operations, and a sufficient outlay. The grantees may, with some justice, expect that Government will take the lead in showing the practicability of the conditions, which it is proposed to render imperative upon them.

95. The plan which I would recommend would be this.—In the Upper Mittigate, to select 32 acres of the best ground between the Mittigate creek and the Koon Kyoung, and up along the banks of the latter stream, (as indicated in para. 55,) as free as possible from grass jungle; to clear the under-wood, and cut down all the small trees, always excepting Teak, and to burn them on the spot. This is of great importance with reference to the vigorous growth of the young plants, and the production of timber, from the alkaline materials supplied by the ashes.—To girdle or bark one half of the large standing forest trees exclusive of Teak, assuming them to be 40 feet apart (or 27·2 upon the acre), leaving the other half, consisting of 13·6 trees, for shade and protection to the young plants.—The girdled trees to be left to decay standing, unless especially wanted, and the other moiety to be girdled afterwards during the progress of the plantation to maturity. Where the forest was more open, less girdling would be required, observing the same ratio of standing trees left for protection. No other general preparation could be afforded to the ground, besides digging small pits for the reception of seedling plants, and clearing the soil near them from grass roots and weeds.

96. The seeds to be collected off the trees, before shedding, in the month of January, when fully ripe, and sown in narrow raised beds, carefully prepared as nurseries, early in March. The plan of sowing

Appendix No. 2.

which has proved so successful with Mr. Conolly at Nelumboor in Malabar, ought to be adopted in preference to all others, as it is founded upon experience, *viz.*, steeping the nuts in water for 36 hours, then sowing them in holes, 4 inches apart, about half an inch under the surface, and covering the beds with straw and grass litter, so as to prevent evaporation. The beds thus prepared to be gently watered every evening so as to keep the soil constantly moist around the nuts, which will sprout in from 4 to 8 weeks, that is so say, such of them as are capable of germination. Mr. Conolly's memorandum states a shorter period, probably caused by the preliminary steeping. In order to guard against accident from over-soaking, at

the outset, in the Tenasserim nurseries, half of the nuts might be sown dry. A little experience would soon indicate which plan was the best.

97. In selecting the nuts, the largest and best formed to be chosen, and for every 1,000 seedlings required 30 or 40,000 nuts ought to be put in the ground, so as to allow a wide margin for failures in germination, and for the selection of good plants. Where two or three stems sprouted from the same nut, such plants ought to be rejected, if the nursery is well filled, or the superfluous shoots lopped off, leaving only one to grow. If the sowing has been well-managed, the plants will have attained from 4 to 6 inches early in the rains, when they ought *at once* to be transplanted into the holes prepared for their reception. Repeated transplantations are injurious to the vigour of a seedling, besides being additionally expensive.

98. I would recommend the plants to be placed quincuncially at intervals of 20 feet apart, instead of 8 feet, as practised in the Nelumbo plantations. The reasons for this I have stated above, (para. 89.) It would save expense in subsequent thinnings and prunings, where the thinnings would be of no value. Intervals of 20 feet apart would give 109 to the acre, allowing each intermediate tree to be felled in course of time, so as ultimately to give 40 feet apart to the trees intended for first-class timber. During the first five years, wherever a plant failed, its place ought to be supplied by a fresh seedling.

99. In some localities it might be desirable to grow medium-sized useful timber intended for felling before the tree attained its full dimensions, in which case, the only alteration that would be required, would be to plant the seedlings at intervals of 15 feet apart. This would give 193·6 to the acre, and by felling the alternate trees afterwards, the standing timber would at last be 30 feet asunder,—nearer than which I do not consider that sound timber trees could be grown: this would allow 48·4 to the acre. The planting in both cases would be so managed that the trees, when full-grown, should stand in alternate lines. After five years, the young trees might be expected to have attained from 15 to 20 feet in height, when they might be left to themselves,—making suitable provision against fire, where the plantations were exposed to that contingency.

100. The following year the same operations to be repeated upon 32 additional acres, and so on for 10 years, when 320 acres, or half a square mile, would have been planted out: and supposing 160 acres to have been planted at 15 feet intervals, there would be 80,976 young

trees on that moiety, and 17,440 upon the other planted at 20 feet, or in all 48,416 young trees. But as only one-fourth of each were destined to arrive at maturity, being 7,744 of the former and 4,358 of the latter, the planted forest, when well-advanced, would contain 12,102 adult trees. The calculation supposes that there was no other Teak of earlier growth in the forest, to disturb it. The assumed areas have been founded on the supposed operations of the grantees, (para. 87.) The Government plantations might, however, be carried out on a much larger scale.

101. Operations of the same kind would have to be carried on at the same time in the Thengan-nyee-Nyoung reserved forest, which is of much greater extent, the area being estimated in the returns at 12 square miles. Of this tract probably one-fourth, or 3 square miles, could be advantageously brought under Teak culture, so as to yield large supplies of timber hereafter. By placing one half of that area, or 960 acres, under trees intended to be 30 feet apart when full grown, 46,464 second class timbers could be raised, and 26,112 on the other moiety, with the trees growing ultimately at 40 feet apart, so as to produce first-class timber. I have indicated the spot where I consider that the commencement should be made, *viz.*, at the angle near the junction of the Thengan-nyee-Nyoung creek with the Weinyo, and thence up along the banks of the former stream.

102. I am not in possession of data to justify me in framing an estimate of the expense which would be incurred by these operations. A chief part of it would be in the preliminary preparation of the ground, by removing the underwood, cutting down small trees, and girdling the large ones. The nearest approach to outlay of this kind on this side of India, with which I am acquainted, is what is known of the operations of the Tea Company in Assam. The Tea nurseries were established in *Barees*, in dense forest, part of which was entirely removed, forming bare clearances: in other parts, the underwood was removed, and the small trees cut, leaving the giant trees standing. Where a total clearance was effected, the cost was not less than Rupees 100 per *poora*, equal to about $1\frac{1}{2}$ acre, and the partial clearances were estimated at Rupees 25 per *poora*. On the Attaran forests the clearances would only be partial, but as labour is dear, the cost could not be reckoned at less than Rupees 25 per acre, or Rupees 8,000 on 320.

103. Mr. O'Reilly in his "Observations," dated the 15th April 1849, after an examination of the Attaran and Houndrow forests, suggests that it would be better to plant along the coast, than to attempt the renewal

of the Teak forests in the interior. His words are,—“ But in preference “ to propagating the Teak at a distance from the seat of Government, “ and in localities fraught with fever for six months of the year, offer- “ ing almost insuperable obstacles to an effectual supervision, I would “ suggest the employment of all the unoccupied forest lands on the banks “ of the various rivers and creeks which occur at short intervals “ throughout the coast line, &c.” Mr. O’Reilly thinks that “ a new “ system of Teak forests would be greater, affording the prospect of “ future supplies of a material superior in every respect to the un- “ cultivated tree of the present exhausted localities.” It does not seem advisable, however, to abandon the known favorite habitat of the tree, for localities of which the capabilities are merely inferential, and still remaining to be determined. But the suggestion might with advantage be adopted on a small scale, with a view to ascertaining how the Teak tree would succeed on the sea coast. There are great facilities near Amherst for a trial, and the cost would be comparatively trifling, from the circumstance that convict labour would be available from the Prison depôt established there. I would recommend that 40 or 50 acres behind the Pagoda Point should be laid out in Teak plantations. The plants might be tried thick set at a distance of 8 or 10 feet apart, as in the Malabar experiments, and reduced by subsequent thinnings. The tract here mentioned is in a great measure cleared of heavy jungle, the soil rests upon Laterite, and there would be the great advantage of easy and frequent supervision by the Government officers at Moulmein from its proximity to Amherst. A small Teak plantation might also with the same view be established, as suggested by Mr. O’Reilly, on the small island of Kalagouk, on the coast between Amherst and Ye. The soil is reported to be good, and to bear Thengan trees, (which are often associated with Teak) of the largest size.

104. An opinion advanced by Dr. Helfer in his printed report, dated the 15th September 1837, has frequently
 Vide Appendix No. 3. been quoted in the forest reports in disparagement of any system of planting, and it has been recommended that Teak seeds should be sown over large surfaces, without regard to system or arrangement, and without any preliminary preparations of the ground to receive them, so as professedly to imitate the process of Nature. But when these opinions were advanced, it was overlooked that Nature, in most cases as regards Teak seed, fails to succeed in the process unaided, and that nurseries and transplanting are intended to provide against

failure. To sow seeds in the manner proposed was simply aiming at an object, without regard to the conditions which were essential to success. Forest trees raised in a suitable locality by culture, if it has been properly conducted, are in no respect more delicate than the same trees grown in the wild state.

105. In order to carry out any measures of renewal of the Teak forests in the Tenasserim Provinces with success, I consider it to be indispensable that a qualified conservator be appointed, who should have no other duties to attend to besides the charge of the forests. The officers who have filled the appointment since 1841, have most of them held it in conjunction with other responsible avocations, requiring their presence in Moulmein, and although they have evinced much zeal and ability in the general administration of the forests, they could not be expected to be possessed of the theoretical and practical knowledge of arboriculture required in an efficient conservator, and which were essential for conducting renovation operations to a successful issue. To this cause I attribute the failure of the nurseries established in 1843, and the want of any subsequent effort to replace them. These officers, from the circumstances above noticed, had not probably that weight and influence with the grantees, which their office ought to have carried along with it. The practical administration of the forests since 1848 has been made over to the Commissioner's Assistants, and a sufficiently well organized system is in operation for regulating the felling of timber on the Thoung-yeen, and for the collection of the Timber duties of the province, but the "Conservancy" of the forests, properly so called, is entirely unprovided for, and I would not recommend that any measures of renewal be commenced upon till the vacancy is suitably filled up. The Government would then have the assurance that they were conducted with professional skill and a thorough knowledge of the subject. Errors and causes of past failure would be avoided; or where committed, they would be speedily remedied. The grantees would have a qualified authority on the spot to refer to for information and advice, which I consider to be of great importance.

(Signed) H. FALCONER, M. D.,
Superintendent Hon'ble Company's Botanic Garden,
Calcutta.

H. C. BOTANIC GARDEN, }
 CALCUTTA, }
 23rd January, 1851. }

LIST OF APPENDED DOCUMENTS.

- No. 1. Copy of the Commissioner's Memorandum of Instructions.
,, 2. Ditto Method of Planting Teak Trees in the Nelumboor Plantations in Malabar.
,, 3. Extract of Dr. Helfer's Report.
,, 4. Map of the Tenasserim Teak forests, accompanying Captain Latter's Report printed in the Agri-Horticultural Society's Journal.
,, 5. Drawing of "Tectona Grandis," the Teak, copied from Dr. Roxburgh's series.
,, 6. Drawing of the "Tectona Hamiltonii," from Wallich's *Planta Asiatica*.

No. 1.

Memorandum for Captain H. Berdmore and H. Falconer, Esq., M. D.

It appears to me that the first inquiries should be regarding the Thengan-nyee-Nyoung forest, on the upper part of the Weinyo branch of the Attaran river,—that forest being supposed to be the only unoccupied forest yielding Teak on the Attaran streams, other than the Upper Mittigate forest on the Zimmé branch, or other tracts, the resources of which are yet unknown, on or near the same or Zimmé branch of these streams.

2. Captain Berdmore will make on the spot every inquiry, through the parties attached to the forest establishment, employed under his personal direction, as to the actual resources and condition of the Thengan-nyee-Nyoung forest, and will take measures as he may see to be necessary for the effectual prevention of any encroachments which he may find to have been attempted in that tract. I would suggest to Dr. Falconer, that he should make it an object of special investigation whether the forest in question is one in which endeavours may, with probable advantage, be made for the reproduction of Teak by artificial culture.

3. From the Thengan-nyee-Nyoung forest I would recommend that the party proceed to the upper waters of the Zimmé branch of the Attaran river. It is particularly important, that Captain Berdmore should ascertain whether sufficiently clear limits can be laid down for insertion in a Memorandum of Grant to be issued for the Kyoon Geown and Megwa forests, which have been held by Messrs. Cockerell & Co., in like manner as has been proposed for the Grants on the Mittigate creek to Messrs. D. C. Mackey & Co. Information given to me by Mr. Salmond, late Head Assistant in the forest department, stated the following results:—

8 SQUARE MILES.—Kyoon Geown Forest. Whole area 8 square miles occupied by Teak trees.

18 SQUARE DITTO.—Megwa ditto ditto,—18 ditto ditto ditto

There was no original description such as would now permit of any specific limitation as to the extent of the forest workings, for which a licence was at first issued in those places; but the fairest principle to adopt would apparently be, that certain streams and their tributaries should be named, the drainage into which should mark out the boundaries of each tenure. Captain Berdmore will however receive any statement on this subject which any one now interested in the Kyoon Geown and Megwa forests may desire to offer for his information. It is specially to be understood that no working of Teak *to the East* of the Thoug Wyn range, as on account of either of those forests, is believed to be in any way admissible.

4. Dr. Falconer perhaps may find, that the conditions which he may think the most favorable to the growth of Teak by culture are to be found in some of the private forests on the Attaran streams. If so, I would recommend that he make a careful note of the locality, and of the limits which he would wish to have at command for the purpose. I do not doubt that private holders would readily make over a sufficient area to the public officers for the prosecution of such an experiment.

5. A paper of practical directions by Dr. Falconer as to the circumstances and manner in which, after full local observation, he would advise experiments for the artificial growth of Teak to be made, would be especially valuable for general communication to the forest-holders.

6. From the Kyoon Geown and Megwa forests, it will probably be best that the journey should be continued to the forest of the Mittigate creek, so that Captain Berdmore may have the opportunity of giving the directions that are required for the protection of the interests of Government in respect to the trees already felled or killed above the Kyouk-Taga Pass, and that Dr. Falconer may have an opportunity of judging the capabilities of the forests in the direction of the Upper Mittigate.

7. From the Attaran river Captain Berdmore and Dr. Falconer may proceed across the country, so as to strike the course of the Thoug-yeen river at the highest convenient point. Inquiries upon every subject of interest can then be made. In descending the course of that river, Mr. Smith and Mr. Hobday, officers of the forest department, will be found there engaged in inquiries for the practical management of the business

of the department during the present season. In this (or the Thoung-yeen) range of forests, I would particularly request of Dr. Falconer that he should advise as to the number of trees which he may think may, without injury, be killed and tendered for sale, in the several surveyed divisions, in each year; as to the measures, if any, which he may judge requisite for rendering most available, at a future date, the natural growths of young Teak, and as to the particular tracts in which it may appear to him that efforts for raising Teak by culture, either in forests now nearly exhausted or elsewhere, are at present required and may be attended with a reasonable prospect of success.

8. Captain Berdmore has already received instructions in regard to an investigation relative to the boundary with the Shan country on the upmost streams of the Thoung-yeen.

9. Captain Berdmore and Dr. Falconer may, I think, follow the course of the Thoung-yeen downwards as far as the Winsaw creek, and then return to Moulmein by the route of the Dawnat Pass.

10. Dr. Falconer will require 3 elephants for his own use, and for the transport of his personal establishment and baggage. These can be provided at the expense of Rs. 150 a month, allowed in the letter of Government to this office No. 22 of the 8th instant; 3 more elephants can be provided for his office establishment at a similar cost, as authorized by the same letter. Captain Berdmore will probably require for his own accommodation, for that of the subordinate forest officers, and for the carriage of provisions for the whole party in the forest country, in which there is often no means of making any purchases, 4 more elephants, making 10 in all, the charge for which may be submitted in contingent bills,—the charge of Dr. Falconer's personal account at Rs. 150 per mensem, and for the travelling expenses of his establishment at the same rate, being shown separately from the disbursements incurred by Captain Berdmore, as here sanctioned.

(Signed) J. R. COLVIN,
Commissioner, Tenasserim Provinces.

(True Copy,)

(Signed) H. FALCONER, M. D.,
Supdt. H. C. Bot. Garden.

MOULMEIN, }
22nd January, 1849. }

Method of Planting Teak Trees in the Nelumboor Government Plantations.

1st. The soil in which the Teak trees are to be planted should be of a good clayey nature, covered with wood, and on borders, if possible, of a river or nullah. On such ground, the extent required to be planted during the space of one year should be cleared of all the jungle and trees,—a process which should be commenced with in the beginning of the month of $\frac{\text{Dhanoo.}}{\text{December and January.}}$ About 30 days after the trees, &c., have been cut down, they should be burnt, according to the state of their dryness, but should any of the trunks or branches, &c., be not perfectly burnt, they should all be collected in one place and burnt over again, and the place so thoroughly cleared as not to have even any grass growing thereon, by the end of the month of $\frac{\text{Meddom,}}{\text{April and May,}}$.

The Teak seeds become ripe, and begin to drop off by the month of $\frac{\text{Makarom,}}{\text{January and February,}}$ but before they commence to do so, people should be sent upon the trees, and the best seeds gathered; they should then be cleared of their outer coating and all other particles on them re-

This is only the outside pod not the spongy covering of the seed, which must not be removed.

removed by friction and sifting, afterwards they should be well dried, and kept carefully so as not to be exposed to humidity or white ants.

Of these seeds a portion should be sown, about

the end of $\frac{\text{Menom,}}{\text{March and April,}}$ and the remainder at two or three different times in the beginning of $\frac{\text{Meddom.}}{\text{April and May.}}$ The sowing should be in

beds or nurseries, measuring 3 feet broad, and as long as may be necessary, prepared after a careful examination of the ground at such places where the soil is of the best (or Pashma) kind, and where it is found that the fire had sufficiently heated the soil; the ground should also be made as level as possible, so as to allow water when poured on it to run evenly all over. The quantity of seeds required to be sown in

these beds should be put *in a vessel filled with* water, and they should be allowed to remain in it for about $\frac{90 \text{ Nargars,}}{36 \text{ hours,}}$

after which the seed should be thrown over some straw, spread in a place where they will not be exposed to the heat of the sun, and a little rotten straw strewed over them. Over this straw a quantity of earth, just enough to cover it, should be strewed, and then water poured over gently, so as to give a uniform humidity. The

seeds should remain in this state two days, when they are to be sown in the bed prepared to receive them, which should be previously gently watered, and the earth well-broken and spread, at such distances as that the seeds will not touch each other; they should then be covered up with earth to the thickness of about half an inch, and over the earth old straw spread also to the same thickness, and in order that the same moisture may always continue, a particular time should be fixed for watering the beds once every day. Thus the seeds will begin to germinate after 14 days, and when they are found to do so, the straw should be removed carefully so as not to injure the seedlings. All the grass, &c., growing in the beds containing the seedlings should also be removed as soon as they are discovered, and until the rainy season shall have set in, the beds should be watered so as to keep them in a uniform state of humidity. In this way by the month of Eddavavona,
May and June, when the monsoon shall have fairly set in, and rendered the ground sufficiently moist, the seedlings will have attained about 6 or 7 inches height, and be fit to be transplanted. Should the ground where the seedlings are intended to be transplanted to, be by this time over-grown with brushwood or grass, &c., it should be removed, and the seedlings planted in quincunx order, at a distance of 8 feet from each other. The holes intended to receive the plants should be dug one foot deep and two feet in breadth, after being cleared of all the grass, and earth should also be raised around the holes in such a manner as not to allow an excess of water getting into them. As these plants easily wither away from the heat of the sun, they should be protected against this evil by branches of other trees, having abundance of leaves, being put up around the plants, but in such a position, as that they will not touch and injure the latter. Seven days after this, the plants will have taken firm root, when the branches &c., put up to keep off the sun, should be removed. By the time the whole extent of the ground is thus planted, grass will have grown in the places where the planting was first commenced with, and the earth put up around the plants will also have been more or less washed away by the rain. All the grass, &c., should therefore be removed with care from time to time, and the earth at the foot of the plants gently turned up, and a little fresh earth put round the foot of the plants. In Thoolam,
October and November, OR Vrischigon,
November and December, soon after the rainy season, and before the earth becomes dry and heated, the ground between the plants should be turned up. It is very injurious to the

growth of these plants to allow grass, &c., to grow near them, or even the lateral branches of the plants to remain during the first year; it is, therefore, necessary that these should be removed : the same process must also be observed after the first year, whenever necessary, in a manner not to hurt the plants, by cutting off all such side branches growing on the lower part of the stock, as would prove injurious to the plants. It is necessary that the grass and jungle growing near the plants, and the creepers which coil round them, should be removed for 3 or 4 years with reference to the growth of the plants. By this time they will have attained a good height, and the branches will meet each other, and prevent grass and jungle intervening between them. After this time no particular attention on this point is required.

Extract from Dr. Helfer's Report, dated 15th September, 1837.

Teak plantations, therefore, will be of the greatest importance, and this not only in places where Teak already existed before, but also in localities which in regard to chemical composition of the soil and other circumstances are equally well-fitted.

Government possesses such vast tracts of country in these provinces, that a choice of land to accomplish this cannot be difficult, and how could the land be better employed than by preserving that source of wealth, which has manifested itself already by such striking proofs.

But in the method of cultivation, I would deviate from that adopted by the Dutch in Java. It is an old experience, that forest trees do not thrive well if they are treated like fruit trees, or other more delicate plantations. The system of Nature should be imitated. No nursery beds and no transplantations should be employed. After having cleared the jungle in the chosen places, and after having loosened the soil sufficiently to receive the seed and to be able to cover it with a little earth, I would advise the seeds being disseminated without any further care. The plantation must, of course, be enclosed to prevent the disturbance of any kind of wild animals. After two or three years, the plants, when sprung up too close to each other, ought to be thinned, besides jungle parasites and other impediments carefully removed.

This easy operation should be annually repeated in different parts of the country over wide tracts. Localities affording facilities for the transport of timber, such as rivers and nullahs, ought of course to be the first chosen.

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SUMMARY OF PAPERS

RELATING TO THE

TENASSERIM FORESTS.

1. The Tenasserim Provinces were ceded to the British Government by the Burmese, under the treaty of Yandaboo, early in the year 1826, since which time their resources and physical characteristics have been subjects of interest and enquiry to the Government. Soon after the cession of the Provinces, Captain Grant and Lieut. DeMontmorency were employed to survey the newly acquired country, but before those officers could complete the work, or make any material progress, Captain Grant fell ill, and was compelled to quit the Provinces, when the survey was discontinued. Another survey, of a portion of the Provinces, appears to have been conducted by Lieut. Scotland, as a map of his "Survey to the three Pagodas" is extant, but no papers have been traced regarding these two surveys.

2. In the following year, 1827, Dr. Wallich, the Superintendent of the Hon'ble Company's Botanical Gardens at Calcutta, was deputed to examine and report upon the botanical features of the Tenasserim Provinces, and while he was at Moulmein upon this mission, he was desired by the Government of India* to take advantage of the opportunity "to acquire the fullest and most complete

information" of the resources of the country, in regard to both "botanical science and military and commercial objects," as it was believed that the whole of the Tenasserim Provinces presented "a most favorable and abundant field for botanical researches, and that the productions of timber for military and other purposes" were "not only ample but of very superior quality."

3. In compliance with this order, Dr. Wallich left Moulmein on the 10th March 1827, and proceeded on his tour of examination. He first ascended the Salween River for about forty miles, and on his return from thence he started, on the 25th March, up the Attaran River, penetrating the country to the distance of a hundred miles. On his

return from these excursions, Dr. Wallich submitted* to Govern-
ment his journals or reports, and the copy of two

* Letter, dated 25th
April 1827.

letters which he had addressed to Sir Archibald Campbell, the Political Agent in the Tenasserim Provinces, relating to matters which he "had no fit opportunity of introducing or of sufficiently explaining in the body of the reports." These papers will be briefly noticed, for though they are now of very old date, yet they afford much valuable and interesting information regarding the Provinces.

SALWEEN RIVER.—4. Dr. Wallich left Moulmein on the forenoon of the 10th March 1827, and crossing over to Martaban, he entered the Salween River, of which he writes:—

"The Salween is a large river, which unlike the Attaran, becomes perfectly clear and fresh within a few miles of its mouth, beyond which the sea water does not extend. In consequence, its banks, instead of being overgrown with the sort of jungle peculiar to the influence of salt water, are covered with a vegetation of a widely different description. They are shelving at first, but soon rise and become sufficiently high to appear perfectly exempted from inundation from the river. Above Martaban the river side is covered with high grass and Erythras, intermixed with betle-palms and occasional clumps of plantain trees. Behind, at a short distance, runs a range of short hills, sparingly covered with vegetation. On one of these I could distinctly see a number of the trees which yield the well-known Thetsee or varnish, covered with their numerous clusters of red-winged fruit. The course of the river is at its mouth due north, and it continues in that direction to its source almost, with frequent turns to the east and west."

5. Higher up the river, the banks are more steep and the country more hilly and woody. The hills consist of hard, rich limestone, with occasional veins of quartz. On one of them Dr. Wallich saw two kilns, in which lime had been burnt from the rock. The lime appeared to have been of the best quality. The hills are more or less covered with shrubs and trees; in some of them there are caves containing sonorous stalactites, and opposite the village of Trugla, is the "celebrated cave colled Kogun." It was full of gilt images of Boudh of all sizes, "some of an herculean size," made of marble or brick and mortar.

6. At this season of the year, March, heavy fogs prevail: they "tend very materially to fertilize the soil and invigorate its vegetation," and contribute to cool the nights and mornings "to an extent sometimes exceeding 20° of Fahrenheit." The jungles are burned down at this time of the year to allow of the cultivation of rice. Dr. Wallich walked through a recently burnt field of about two and a half miles in extent, on which the ashes were lying to the depth of "some inches," and he was

covered with soot, "for the conflagration of the rank grass, consisting of the wild sugar-cane had spared the tall stems, though it had thoroughly blackened them." Dr. Wallich had "no doubt that the ashes produced by the universal practice of burning the jungles during the dry season must have a very salutary effect on the soil as a species of manure."

7. A little beyond the village of Trugla, the flood-tide continued perceptible, the river being subject to "a considerable rise during the spring-tides; the banks here become more hilly, and there are several islands, some hilly, others flat, though sufficiently raised not to be overflowed." On these islands cotton was cultivated, and in fact throughout this part of the Provinces Dr. Wallich found the shrub. He says of the produce,—

"I do not recollect having ever seen finer cotton than what I procured here; the pods were large, the wool beautifully white and silky, and of good staple. Indeed I think that it exceeds in those respects even the Barbadoes cotton which I cultivated at Tittyghur, near Barrackpore, while it was in my charge as a branch of the Botanic Garden at Calcutta, and which, in the opinion of the Court of Directors, officially communicated to me in 1824, was superior to any in the London market. The plant is 3 to 4 feet high, and annual, though I dare say, like all the other kinds of cultivated cotton, it may be hardened so as to become triennial or even perennial, as is the case in the West Indies. At Trugla, this cotton sells at 30 rupees (Madras) per hundred Viss, equal to 365 pounds avoirdupois, if I rightly compute the equivalent of the Viss."

8. Dr. Wallich met also with a yellow cotton.

"Some of the plants, but only very few, bore a yellow cotton of the same description as that I have seen at Sagaen, opposite to Ava, but I was told that this was a matter of accident; indeed the villagers seemed hardly aware of the difference in the product when I pointed it out to them."

9. On the 13th March he reached a village called Phanoë on the right bank of the Salween, in the neighbourhood of which "there was a grove of 60 to 70" Teak trees, but,—

"The best trees had evidently been removed long ago, and what remained was short in stem and of irregular growth, branching out low down. At this time of the year the tree is almost destitute of leaves, still it may be recognized by the large panicles of fruit which terminate the branches, though it requires some practice not to confound it with the *Nauclea*, another timber tree, which is common everywhere. But there are some other trees which have been repeatedly mistaken by new comers for the teak, namely, a sort of *Careya*, and several species of *Dillenia* and *Lagerstræmia*, all of which are like the teak, deciduous, and grow to be forest trees of very considerable dimensions."

10. Dr. Wallich measured nine of the Teak trees at this place, selecting them at random from among such as had attained a mature

age, and the result was an average of 9 feet $\frac{2}{3}$ inch in girth, and 12 feet $5\frac{1}{2}$ inches in height. He explains that,

“ By the girth, I mean the circumference of the trunk taken at 4 feet above the level of the ground, unless the contrary is explicitly stated. This precaution avoids including in the measurement the frequent irregularities of projections and crevices which certain trees, and the Teak among them, exhibit towards their base. In the next place I include in the height that part of the stem only which is undivided, and which has still a tolerably good circumference, not too disproportionable to the lower girth.”

11. On the 14th March, Dr. Wallich arrived “ at a village deriving its name from an island called Koa Theyn Geun (Geun signifying an island,) at the upper end of which it is situated.”

“ The village is small, and chiefly occupied in the cultivation of tobacco and cotton, —two objects of agriculture which, together with the sugar-cane, coffee and many others, would, I imagine, succeed extremely well on a large scale on this river. Of the superiority of the cotton and its cheapness I have already had several opportunities of speaking; and the cane must thrive where the cotton thrives, because both require the same exemption from inundation, and the same sort of soil, which is here an impalpable sand, mixed with a proportion of clay and containing some iron.”

12. The island of Koa-Lung belongs to the British Government, as it lies nearer the British side of the river. In the village, which was occupied by Burmese and Talayens, Dr. Wallich saw a loom at work manufacturing a piece of coarse cloth, and about the huts were cultivated several cucurbitaceous plants. Some fish was procured at this place, which Dr. Wallich had “ no opportunity of examining”; however, in flavour, it was like the *bekty* of Bengal. There was lying off the village a float of 6,000 bamboos of the small sort called Woa Tew, which had been brought from Miyang, where they cost 10 rupees per thousand, and were being taken to Moulmein, where the price at the time was 3 rupees per hundred. Dr. Wallich afterwards met with this bamboo in full flower, and he describes it as “ a curious bamboo with the stem as thick as a moderate sized arm, elegantly marked lengthways with irregular white stripes like the leaves of the striped grass.” A little beyond the island the flood-tide failed entirely.

13. About four miles south-west of the island of Koa-Lung, near the village of Miyang, there was a forest of Teak trees, which stretched only a little way along the left or British bank of the river, and as far as could be ascertained, did not appear to extend far inland; it was estimated to contain about 200 good trees; on measuring eleven of these trees, the result was an average girth of 9 feet $10\frac{9}{11}$ inches, and an ave-

rage height of 19 feet $9\frac{7}{11}$ inches. The soil in this forest was of a grey color, and seemed "to consist of fine sand, clay, and a small proportion of vegetable mould." Several trees that had been felled appeared quite sound, the wood was dark colored, and compact. An examination of the bark and the sapwood (alburnum) gave the following results :—

"The thickness of the former was with very little variation $\frac{3}{4}$ of an inch, that of the latter from 1 to $1\frac{1}{2}$ and even 2 inches; there was no perceptible difference in these diameters, with regard to the point of the compass at which they were measured."

14. Dr. Wallich writing of the felling of the Teak trees by the wood-cutters observes that,

"Nothing could be worse than the miserable mode adopted here, of felling the trees, in no instance below and generally above three feet from the base. Whenever an ant-hill or an accidental impediment from a trunk of wood or the like, which might have easily been removed, came in the way, the axe was applied so high as four, or even four and a half feet above the ground. * * * * But if this be the state of things in our immediate vicinity, much more must it exist at a distance from any direct control or check. Few forests can be fairly said to be inexhaustible until they are placed under salutary laws; and those of teak have been too long and too constantly laid under contribution not to require prompt and vigorous measures for their redemption. Among the produce of the land on which we may with safety rely for reimbursement of a great proportion of the expenses for the support of the Provinces lately ceded to us, there can, I presume, be no doubt that the Teak stands foremost. In my humble opinion, not a single tree ought to be touched, not a stick of that valuable wood ought to be allowed to be carried away for any purposes whatever but those of the Government, without their express sanction; and that to declare all such forests in our territories the property of the Company, will be an indispensable step towards saving, and as far as it is practicable, reclaiming these forests."

15. On the 16th March Dr. Wallich visited a third Teak forest about three miles from the river, and on its right or Burman bank. This forest was almost choked with climbers and underwood, and contained a variety of other trees. Some of the Teak trees were of a good size and well grown, but those which were of large dimensions generally had decayed trunks. The measurements of twelve trees gave an average girth of 7 feet $10\frac{1}{2}$ inches, and an average height of 25 feet $9\frac{1}{2}$ inches. The site of this forest is rather elevated above the adjoining jungles; the soil was the same as that of the last-noticed forest. The best trees stood on the margins of nullahs which run through the forest; these nullahs originate from the neighbouring hills; they were quite dry at the time of Dr. Wallich's visit; their

beds were filled with "pebbles of indurated clay and sandstone, the sides consisting chiefly of clay." Although three miles from the river, no great difficulty would be experienced in transporting the trees, as the ground was sloping and even towards the river, and a sufficient opening could easily be cut through the bamboos and jungle; besides which, in the rains, the nullahs would afford facilities for floating the timber to the river's edge. One of the other trees growing in this forest which Dr. Wallich noticed, is the Thengan (*Hopea odorata*) or canoe-wood tree.

"This is, next to the Teak, the finest timber tree in this Province; it attains the most extraordinary size both in height and circumference, far beyond the dimensions which the Teak ever acquires. The natives prefer it to the latter for boat-building, and I have a notion that it may be advantageously substituted on some occasions for other purposes. It is nearly allied to the Saul of Hindustan, (*Therea robusta*), and like that abounds in rosin or dammer. It delights in elevated situations near the sea. I understand on the Coast of Teuasserim it is found in the greatest perfection. Here it was of very middling size, and greatly inferior to the gigantic trees of it which I have seen below."

16. About six miles from the south point of the island of Koa-Lung, on the British or left bank of the river, there is another forest of Teak, which was visited also on the 16th March by Dr. Wallich. This forest is on a very high and precipitous bank, which was then gradually falling down, and thus gave Dr. Wallich the opportunity of examining the substratum of the soil. "It consisted of coarse quartz sand and clay, becoming brown, and strongly impregnated with iron as it descended"; the upper soil was the same as that of the two forests last visited. The measurements of sixteen Teak trees gave an average girth of 7 feet $6\frac{9}{16}$ inches, and an average height of 26 feet 7 inches. The forest extended considerably inland; that part which was lying on the bank of the river contained about 300 capital teak trees. The natives stated that there were about 2,000 trees, great and small, in this forest; it was the best of those which Dr. Wallich had seen, and he strongly advised its being placed under the care and management of Government officers.

17. Besides the Teak and Thengan, or canoe-wood tree, there are several valuable forest trees throughout the Province, but excepting the varnish tree, Dr. Wallich does not mention any particularly; he however obtained "several botanical curiosities," of which some were altogether new to him, and on the second day of his excursion he

met with the tree which he has named the *Amherstia nobilis*. Of the varnish tree he says :

“ I saw here a very large varnish tree, which I call *Melonorrhæa Vernix*, measuring in girth 11 feet 5 inches, and in height 40 feet, with a clear stem of 12 feet. Neither from this nor from any of those at Martaban had the varnish been extracted, owing, I am informed, to there being in these places none of those people who apply themselves to that work. The process I had an opportunity of ascertaining at Prome, where the tree is found in abundance ; it is very simple. Short joints of a small kind of bamboo, sharpened at one end like a pen, are thrust into holes cut into the bark in a slanting direction. In the course of 24 hours one-half or less is filled with the varnish, when it is removed ; 100 to 150 such bamboos are sometimes put into a tree at once.”

18. The forests are infested by buffaloes, tigers, and elephants. The villagers informed Dr. Wallich that they had no fear of tigers, as they seldom attacked anybody who did not enter the jungle quite alone ; and “ as a reason for this abstemiousness on the part of the tiger, they said that the population was so small that the beast had not yet become acquainted with the taste of human flesh.” Regarding the elephant, Dr. Wallich says :

“ There can be no doubt that the productiveness of these parts in elephants might be rendered a source of great advantage, not only with reference to the army, but in various other respects likewise, not to mention the value of the ivory as an article of commerce. It is a question whether it would not be practicable without incurring any very great expense to convey these animals in their youth to Bengal by sea, or to the still nearer S. E. parts of our continental possessions. At any rate, it would be extremely desirable to establish a regular system of catching them either in Kyddas, or folds, as is done in some parts of Bengal, or in Obies, or pit-falls, which are used in Oude. Unless the number of these enormous consumers is reduced, it would be almost in vain to think of attempting any agricultural scheme of any extent. A sugar plantation would, under existing circumstances, have no chance of being reaped by the owner. Another consideration not to be altogether disregarded perhaps would be the probability of our falling in with some white elephants, a variety sometimes found in these forests.”

19. Poultry abounded in the jungles, where they were caught by the simple contrivance “ of nooses attached to a string scarcely thicker than a packthread” ; the villagers supplied Dr. Wallich with several fresh fowls’ eggs, which were of “ a remarkably small size.”

20. On the 17th March Dr. Wallich commenced his return to Moulmein, which place he reached during the following day. On the 23rd March he submitted a copy of his journal to Sir Archibald Campbell,

and in explaining that he was prevented by the lateness of the season from extending his examination beyond the Island of Koa-Lung, added,—

“ I have reason to believe that extensive Teak forests occur farther to the northward, within our own territories, extending and probably improving as they recede from the Salween in an easterly direction. That the Province abounds in natural forests of that valuable wood, all the accounts I have been able to procure combine in asserting, and that the forests on the river just visited must at least at one time have been very productive, may easily be proved from the vast quantity of timber which has been consumed in the construction of the Stockades at Martaban, and the numerous religious and other buildings, existing both there and at many other places along the banks, which it is very unlikely have been supplied from any distant source.”

ATTARAN RIVER.—21. On the 25th March 1827 Dr. Wallich again started from Moulmein, and proceeded in the gun-boat “ Berhampooter” towards the Attaran River, which he reached in about half an hour, as the tide was very rapid. He was accompanied by Captain Montgomerie, of the Madras Artillery, who was associated with him in this excursion by Sir Archibald Campbell. The general course of the Attaran is from S. E. to N. W.; at the outlet it is deep and wide. The water is salt, and continues so for some distance up the river, and the banks are low and thickly overgrown with the sort of jungle belonging to such localities. In these respects this river differs entirely from the Salween, which has sweet water and high banks at its very mouth, and produces a vegetation of an opposite description. Among the numerous trees which cover the low banks there are several sorts of mangroves, and a great abundance of rattans. “These plants gradually rising from the size of small shrubs near the water’s edge, where their growth is retarded by the overflowings of the tides, to that of large trees, produce a very pleasing effect, the banks appearing as if planted by art.” The entrance to the Attaran is marked on its right side by a small hill with a pagoda at the top, which, together with a similar object at Moulmein, continue in sight a good way up. At a distance varying from two to six miles from the left bank, and running nearly parallel to it in a south-easterly direction, is a range of low hills, which commence at Moulmein and extend twenty-six miles in length. These hills consist chiefly of primitive limestone, and resemble the hills on the Salween, excepting that on the Attaran they are confined entirely to one bank, sometimes approaching close to the water’s edge, and at other times receding to a moderate distance;

while on the Salween they occur on both sides. Their average height is calculated to be about 400 feet.

“One of these hills, called Pabung, is remarkable on account of its being perforated by a nullah, which runs right through it. It is of a lengthened form, its greatest diameter extending N. and S. along the river, to which it presents a precipitous and almost perpendicular wall. Towards its southern extremity it gradually shortens into a small eminence, surmounted by a little pagoda, and having a Kyoum at the base. It is at some distance from this end that the above-mentioned excavation occurs, forming a vaulted canal, which traverses the solid rock, and is about 40 feet long and 20 feet wide; the depth of the water on the first rise of the flood being 8 feet, and the height above the surface to the roof about 12 feet. This latter is vaulted, and in most parts covered with massy but short stalactites, variously tinged with green and yellow, partly from decomposition, and partly from a minute cryptogamic vegetation. In the interstices between these, the vault appears curiously scooped out into small faces, forming one vast concave polygon.”

“At a distance of about 8 miles higher up the river, is a hill remarkable on account of a hot spring which issues a mile from the foot of it. We visited this remarkable spot on the 28th January, walking from the mouth of a small, nearly dry nullah below the former village of Attaran, through a thick grass jungle, in which there was no other path than that made by elephants. After proceeding about $1\frac{1}{4}$ mile, we came to a shallow expanse of water, which was sufficiently hot to prevent our visiting the spot from whence the spring itself rises. The water was tasteless, and covered with a frothy calcareous deposition; the thermometer, which in the shade was 98°, rose on immersion immediately to 132°.”

22. On proceeding farther, the river was found to be narrower and more tortuous, while its banks gradually rise several feet above high water mark, and are frequently precipitous and broken. The stream becomes perfectly clear, and is very rapid and impetuous, especially at places where it is interrupted by islands, rocks or sandbanks. Behind the banks are extensive plains, which had been densely grown with reeds, but these at the period of Dr. Wallich's visit, were being burned. “The massy volumes of smoke and the crackling of the flames which rose far and near, and sometimes to an awful height, bore ample testimony to the effect of a scorching sun, and the diligence with which the scanty population are endeavouring to rid the ground at once of jungle and of wild beasts.” Dr. Wallich fell in with two or three species of *Dischidia* on the third day after leaving Moulmein; one of these which he calls “curious,” he describes thus :—

“Like all the rest, it climbs upon old trees, rooting along the rough bark of the trunk to a considerable extent. The character which renders this plant extremely remarkable consists in its producing along the stem, reservoirs or bags three inches

long and one and a third broad, of an oval compressed form, and of a somewhat leathery texture, green on the outside, but deep purple and shining within. Each of these is attached to the stem at the base, close to a small thickened orifice, and through this orifice, or mouth, is always found entering a root issuing from the stem, and branching out into many fibres within the cavity of the bag, which is nearly filled by them. Can this singular apparatus possibly be designed for the protection of the tender roots until they acquire sufficient vigour to adhere to the tree, at which time the covering bag would gradually decay and disappear?—Or is it to be supposed, that the root fibres imbibe from the inside of the reservoirs some nourishment or support only secreted there? In the latter case we should have an unique instance of a plant feeding as it were on itself."

23. On the 28th March Dr. Wallich reached a deserted village called Assamee, and about a couple of miles above it he got to a small island, the first which occurs above the mouth of the river; here the flood-tide failed, and the river was so very shallow that he found it useless to attempt pushing on any further in the gun-boat; his party accordingly got into canoes, with which they had provided themselves at Moulmein, and proceeded up the river, but Dr. Wallich says,—

"Our canoes, although of the smallest description which could be procured or used by us with any sort of safety, got frequently aground; we were obliged in many instances to employ all our men in dragging the boats over sandbanks, which had scarcely half a foot of water on them, and we were more than once under the necessity of making the people walk forwards and backwards to establish a sort of temporary channel, through which we had to pull the canoes. Frequent and tedious impediments were also occasioned by the large trees, which had tumbled down from the precipitous banks, and which were not rarely seen lying bodily (root, trunk, and crown) across the bed of the river, barely admitting us to pass between them and the shore; at times we had even to cut our way by dividing large trunks which were obstructing our passage. I need not say that all these impediments cease during the monsoon, in which season the largest floats may be conveyed down, and all sorts of boats carried far up the river and its branches."

24. Elephants, buffaloes, deer, and other animals were numerous in this part of the Provinces; Dr. Wallich writes,—

"The marks of elephants became exceedingly numerous, especially ghauts, or paths as accessible and cleared of jungles and rubbish as they could have been made by the hands of man, by which that sagacious animal is in the habit of going down to the river in order to drink or bathe, or to ford across it; it was therefore not unusual to see two such ghauts, the one directly opposite the other. The deep and fine sand on the banks generally conceals quantities of tortoise eggs, which our Burmese showed much dexterity in discovering, by walking about and at each step pushing a small stick into the sand to a depth of one to two feet, (the distance from the surface at which the cautious animal deposits its eggs.) By means of this sort of probe they soon find out

by the touch or sight whenever they have broken an egg, when they immediately set about digging down with their hands, until they come to the hidden treasure. Near these places grow a Lycium-like Ehretia and a Buddleia. Jungle fowls, peacocks, rhinoceros-birds, divers, snake-birds, and kingfishers were very common. We saw only once the trace of a tiger in the sands here. I had an opportunity of examining a mongoose, differing, I think, from that of Hindustan, and a large innoxious snake, nearly six feet long, and probably the same as the Dharaes of Bengal; it is called Limoe by the Burmans, who eat its flesh.

25. On the morning of the 29th March, Dr. Wallich reached a Teak forest which was on the right bank of the river; before this he had passed a few Teak trees lower down, but they were stragglers, occurring seldom, and growing at some distance from the river; this forest Dr. Wallich therefore considered to be the first regular Teak forest on the Attaran. It contained about 40 excellent Teaks, a few that were more or less decayed, and several small trees. It had been worked shortly before Dr. Wallich's visit, in order to meet the wants of the civil department of the Province, and he had an opportunity of examining and measuring the timber which had been taken from it. Half a dozen logs gave an average girth of about $4\frac{1}{2}$ feet, and an average length of about 30 feet; the average girth, however, was thought to be below the true dimension. Having been informed that higher up the river, on the opposite bank, there was another Teak forest, Dr. Wallich visited it the following day, 30th March, and gave the following account of his visit:—

“ Early this morning we crossed the river, and ascended the high and steep bank at a place, overgrown with bamboos, surrounding a small dilapidated pagoda. Within 40 yards from the river we had the gratification of finding that we were in a fine forest, consisting chiefly of teaks, and those of a superior description. Many of them were very large, and of these the plurality had been affected more or less at the base in consequence of the fires which had taken place here formerly. Yet in no case was the damage so extensive as not to leave untouched a sufficiency of sound wood, adequate often for the largest purposes, even on occasions where the trees had completely died. In few instances did the damage extend beyond the sap-wood, and in no single case did it exceed the outermost layers of the centre-wood, which had only become somewhat paler than those within, but not less oily and scented. While writing this I have before me musters of wood which we cut out on the spot from the lower part of two trunks that had been burnt unusually much, so as to be almost perforated, yet though their surface is charred, the substance is as sound and fit for use as ever teak was. We all know that piles and similar timbers are generally charred in order to preserve them against the injurious effects of water and insects; but I will venture to say that very few trees besides teak would resist, under similar circumstances, the consequences of exposure to several successive monsoons; for it was evident

that the jungles had not been burnt this season, and probably not the last either. The Thengan or canoe-tree (*Hopea odorata*) rivals the teak for marine purposes, and in all probability surpasses it in durability in fresh water, but it cannot stand its exposure to the atmosphere; and the wood-oil tree, another giant of our forests here, which contains more of an essential oil than either of these, is little fit for wet and totally unfit for dry exposure. Some trees had fallen down in consequence of violent winds or of fires, which had injured the base so much as to be unable to support the weight of the tree itself; others, though not many, had been cut, and we saw a good-sized canoe made of teak lying on the ground, and wanting only to be widened in the usual way by the application of heat. It was perfectly sound, except in the bottom, where it had shared the fate of many of the trees in being partially burned."

26. This forest extended along the bank of the river for about a mile, where it reached a swampy nullah, but it recommenced a little higher up, and beyond the nullah. Dr. Wallich computed that he saw 180 to 200 capital Teak trees within half a mile in one direction, and three quarters of a mile in another direction, on high and even ground. The average girth, taken from twenty-seven measurements, approached nearly to 10 feet. He thought it was extremely desirable to fell in this forest "as much and as soon as possible, in order to avoid the contingency of future fires, which would soon ruin the forest." Rattans of great length were very common in this neighbourhood.

27. From this place up to the Mittigate creek, which Dr. Wallich reached on the afternoon of the 1st April, he saw a "constant succession of Teaks on both sides of the river." In some places at intervals along the banks, the tree formed regular forests, growing down to the water's edge, and then receding a little way inland; it was also found frequently scattered among other trees, and occasionally for a short distance it disappeared altogether, but as Dr. Wallich ascended he observed that the Teak trees became more numerous, and the timber improved in quality. In the neighbourhood of the Mittigate creek, Dr. Wallich found a vast number of rattans and bamboos, both of the best description, and he writes thus of the latter:—

"The bamboos were of the finest, though not the largest, that I have ever seen, and belong to the thorny very straight kind called Woah-Kyah. They were from 60 to 70 feet long; at the base their average circumference was 15 inches, and at 54 feet it was 10 inches; the thickness of the sides, 1 inch. We were told that a man could only cut and clean 30 stems per diem by the usual process employed by the natives, namely, by dividing them at 10 or more feet from the ground, instead of felling them at the base, which would require much more labour in consequence of the intricate

manner in which the stiff and thorny branches embrace and entwine each other. At the above rate a man would be able to hew down 900, or say 800, in a month, ready for being floated down, in which state they would cost only 15 Madras Rupees, supposing the laborer to receive 8 annas a day. I should think the transport to Moulmein of the number just quoted could not cost beyond 10 or at the utmost 15 Madras Rupees, which would give a total of 30 Madras Rupees. In Calcutta I have been in the habit of giving from 25 to 30 Sicca Rupees per hundred of the best sort procurable there, which, however, is not to be compared to those I speak of; so that even admitting that they were equally good, the difference of price would amount to 800 per cent., a circumstance well worthy of serious consideration, because stems of a size adequate for commissariat purposes have for many years past not been procurable in Bengal, and constitute a great desideratum from hence."

28. Shortly before reaching the Mittigate creek, Dr. Wallich and his party were obliged to quit their canoes and march through the country, as the river became very shallow, and the obstructions in it more frequent and more difficult to overcome. In the afternoon of the 2nd April, after walking through a "narrow lengthened valley confined between two parallel ranges of small hills entirely covered with Teak," Dr. Wallich halted near the Kyoon-ben-Kyoung, "or Teak-tree Nullah." This rivulet runs WNW., with a clear stream, which, notwithstanding the advanced state of the season, had two feet water in the middle, and was about 36 yards wide, with banks sufficiently high to defend the adjoining lands from inundation. The botanical features of the country here were the same as in other parts lower down the river; the soil for the most part consisted of sand and clay of a yellowish color, remarkably dry and arid, especially in the vicinity of the Teak forest. Of this extensive forest Dr. Wallich writes,—

"Of all the forests which I have seen, this is by far the largest and most deserving of the name of a teak forest. It extends 5 or 6 miles from the above-mentioned valley, until it comes quite close to the rivulet, which it follows for a considerable distance on both sides, disappearing towards a range of hills which are visible to the south. The ground here is in general high; at a few places it is broken and ravinish, at others intersected with nullahs, which fall into the Kyoon-ben-Kyoung. This rivulet and its branches would unquestionably be quite adequate to convey with ease all the timber to the Attaran, and it would, I apprehend, be difficult to find any spot more than two or at the utmost three miles from its bank or from one of its branches. It is quite unnecessary to expatiate on the important advantages accruing from this circumstance alone, and I shall content myself with observing, that some thousands of teaks, far exceeding the greatest size required for gun-carriages, might be hewn down here, and conveyed to Moulmein with ease. Our inquiries being especially directed to the examination of these forests with reference to their employment for military purposes,

we did not enter into any particular examinations as to their capabilities for maritime uses. But we saw enough to warrant the assertion, that the forest in question would yield plenty of very fine mast and keel pieces, a fact which will be evident from the different measurements which will be subjoined. In order to prove how numerous the trees are in some parts of this forest, it is only necessary for me to remark, that during our return from a visit to that part beyond the Kyoon-ben-Kyoung, in a line of less than two miles in extent, we counted somewhat more than 250 excellent teaks, including only those that were standing within forty yards of our path.

“ The proximity of this fine forest to the frontiers of Siam, a country of which the inhabitants are much dreaded by the Burmese, will sufficiently account for its having remained almost untouched up to this day, and at freedom to attain its present degree of perfection. Only a small number of trees had been felled, but none within the last two or three years, and a few had seemingly been blown down. One of the former measured 9 feet by 64 feet, one of the latter 11 feet 8 inches by 20 feet of clear stem. The forest is about 22 miles distant from the three pagodas and a hundred from Moulmein, to which station floats might be conveyed during the proper season in a week's time. The innumerable bamboos, of the very finest description, which abound in the neighbourhood of the forest might be employed to great advantage for the support of the floats ; at the same time they would prove very valuable, not only at the Military station, but also for transmission to Bengal, as I have already explained in a former part of this Report. But above all things would it be desirable to employ a number of elephants for the conveyance of the timber to the nearest nullahs. I have on a preceding occasion, in my Salween Report, taken the liberty of suggesting the expediency of adopting speedy measures for catching elephants in our acquired Provinces. I shall therefore only observe in this place, that with people properly accustomed to that sort of work, a sufficient number of that useful animal might be caught in one season for all our timber forests. Buffaloe carts might also with great ease be employed in these forests, the ground being for the most part even and unbroken.

“ A number of the trees had been more or less injured at the base from the effect of the burning of the under-wood and jungle which grows among them. The effect of a fire near the root of a tree is in the first instance superficial and trifling ; it is confined only to the immediate spot, which has happened to be in contact with some dry material. The effort of nature, however, soon heals the injury by the production of a fresh layer of bark to supply that which has become affected. But if a succession of fires take place in one or more seasons the injury does not confine itself to the bark ; it next attacks the sap-wood, which decaying, any subsequent conflagration will hurt the tree permanently. It is thus the noblest trees are sometimes seen partially or totally excavated at the bottom, and yet, such is the strength and durability of this admirable tree that, even in the worst cases, where the portion of the trunk nearest the ground had become hollow quite through, with the inner surface converted into charcoal and nearly dead, scarcely an instance occurred where the remainder of the trunk was not perfectly sound. It is obvious that the prevention of this sort of mischief would be an object of great importance in the management of these forests ; but at the same

time, I am far from thinking that fires do any essential harm unless on occasions when, from the cause I have alluded to, a partial injury has already been sustained. I think that it would almost be impracticable to clear these forests from the gigantic under-wood which fills them, and which acquires renewed vigour and strength each monsoon, without the aid of fire, which, while it clears the ground from jungle, produces a beneficial manure. All that is required would be to remove from the vicinity of the trunks any dry piece of wood or the like, which might continue burning longer than the grass jungle generally does."

29. The results of Dr. Wallich's measurements in this forest were an average girth of 11 feet 4 inches, with clear stems of 25 and 30 feet, and sometimes of 50 and 60 feet. One tree had a girth of 24 feet 3 inches, divided at 8 feet into "three mighty limbs," and was the largest trunk Dr. Wallich had seen. Having examined this forest, which he considered the principal one on the Attaran, he commenced his return to Moulmein on the morning of the 4th April. On passing near the Kyoon-ben-Kyoung he had the curiosity to measure a wood-oil tree of great size; its girth was 24 feet 6 inches at two feet, and 21 feet 4 inches at six feet above the ground; its trunk, 60 feet up to the first branch, and as straight as an arrow. There was no appearance of oil having been extracted from it or from any of the other trees of this sort which Dr. Wallich passed. About this place was seen "a number of small grey tail-less monkeys, performing astonishing leaps, and emitting a singular plaintive sound." Capt. Montgomerie shot a "large flying squirrel, differing from two kinds" which Dr. Wallich had met with in Nepal and Singapore. A large lizard was also shot down from a tree, "it resembled one of the Guanoses of Bengal;" and Dr. Wallich's men killed "a very curious animal of the cat tribe."

30. Dr. Wallich had not met with the Soondry tree on the Attaran, though he looked out for it; but it appears to be common in these provinces, for he says of this valuable tree:—

"It grows to a size in these parts far surpassing any that I have ever heard of in Bengal. On Beligeon the common girth at 5 feet above the base, where it throws off large buttresses, is 7 to 8 feet. In the estuary of the Irrawaddy, called Panlang, I got a trunk measured by my people, which had a girth of 12 feet 3 inches at the base and 6 feet at 6 feet above the ground. This disparity of dimensions would make one hesitate almost in considering the tree as the identical one of the delta of the Ganges and the Berhampooter, if they did not in all other respects appear extremely like each other. Be this as it may, the wood, I doubt not, will be found equally good with the Bengal sort, which stands unrivalled for elasticity, hardness and durability, and which, if it is not extensively employed for the construction of naves and felloes of gun-carriages, it is solely because pieces of adequate dimensions are not procurable there.

The charcoal made from it is better than any other sort for the manufacture of gun-powder, and as a mere article of fuel it is excellent, and is universally employed in Bengal for burning bricks. The tree is called Kounyoo by the Burmese, and is much employed for posts in house-building."

31. The Report concludes with the following remarks :—

" Our return was rapid, and unattended with any circumstances that need be mentioned. The Attaran is far more scantily peopled than the Salween, but it is to be hoped that the settlement of the Taleyen Chief on that river with many of his people will soon reverse this state of things. At present there are but very few villages, the inhabitants of which occupy themselves principally in fishing and in cutting bamboos. We did not see a single Cotton or Indigo plant, so common on the Salween. After passing the old Attaran village we hardly met with a canoe, and during our march to the great teak forest we did not fall in with a single human being. In short, these beautiful healthy and fertile tracts, together with most of the other parts of the Province, seem to have been entirely abandoned to Nature by that despotic and thoroughly bad Government from which we have wrested them ; and it requires not much sagacity to predict that, under the British sway, they will rapidly rise to that importance to which their wonderful natural capabilities so fully entitle them. In this last respect our ceded Provinces are second to no other part of the Honorable Company's possessions with which I am acquainted ; in point of timber forests they stand altogether unrivalled. I trust I have already advanced grounds in my Reports sufficient to warrant this assertion, and I pledge myself to substantiate the fact on a future occasion beyond the probability of refutation."

32. Dr. Wallich and his party reached the gun-boat " Berhampooter" in the evening of the 6th, and arrived at Moulmein at sunset of the 8th April. On the 25th April, Dr. Wallich submitted his Report to Government, and at the same time forwarded a copy of it to Sir Archibald Campbell, whose attention he called particularly to the value and importance of the Teak timber resources of the Province, and to the necessity of measures being adopted *by the Government* for their preservation and extension. On these subjects, the opinions and suggestions of Dr. Wallich are especially deserving of notice, as they show that he foresaw how the forests would be exhausted by the very causes which afterwards produced that result. His views and suggestions will be found in the following paragraphs which have been taken from his letter to Sir Archibald Campbell. After stating that the forests contained extensive supplies of excellent Teak, which had been proved by experiments to be better adapted for gun-carriages than the Teak of Malabar and Java, and that the country afforded very great natural facilities by land and water for transporting the timber to the sea-ports, Dr. Wallich wrote :—

“ No forest exists which can with propriety be called inexhaustible,—at least none that is liable to constant and extensive demands for timber. The quantity of teak used for public purposes, both military and naval, is so great, and it will go on increasing to so great an extent in proportion as new sources of supplies are opened, that the Martaban forests, ample as they are, would be soon impoverished, unless they were placed under a vigilant and strict superintendence, their supplies regulated with economy, and their extent gradually augmented. I hope I take a correct view of the case if I consider all the teak forests which grow in these Provinces as the exclusive property of the State, applicable only to public use, and not to be interfered with by any private individual whatever. Unless this principle be acted upon from the very outset, I will venture to predict that private enterprise will very soon render fruitless all endeavours to perpetuate the supplies for the public Service, and one of the principal and most certain sources of revenue will thus be irrecoverably lost. The most important step towards establishing a proper system for the management of the forests, and without which all others can be of no avail, will be a public declaration to the above effect strictly prohibiting all persons, not duly authorized, from cutting down any of the trees. But this done, the detail of the further management may be accomplished with comparatively trifling expense, and with little trouble.

“ In the first instance it will be proper to cut down all the full-sized teaks as soon as ever it is possible, in order that a large consignment of valuable timbers might be speedily realized, and room afforded for supplying fresh additions to the number of trees in the forests. All the young and undersized trees should be allowed to stand unmolested, and their growth facilitated; any individual among them which was found decayed should be at once cut down. Every other description of trees in the least interfering with the teak ought to be removed, so far as this would be compatible with safety, with reference to the necessary shelter from high winds. The places vacated by all these thinnings and fellings ought to be forthwith supplied by seedlings, which will spontaneously spring up under the teak trees in every direction, and which should be allowed to grow up, only removing from time to time such among them as stand in the way of others, or do not promise to become good trees.

“ I will go one step further, and recommend that the limits of the natural forests themselves should be extended, and that some of the high tracts of land, so well adapted for the growth of teak, which are to be met with in such abundance along the rivers, should be converted into plantations. It may at first sight perhaps appear premature to propose the adoption of an undertaking, the expediency of which is not supported by immediate urgency, and the ultimate benefit of which cannot be realized within half a century or more. To these two objections the answer is very simple. The first of them applies to many other public undertakings, which would prove the more beneficial for not being procrastinated until the arrival of the unwelcome day of necessity. The second objection is applicable to plantations of all other sorts of timber trees, with this advantage in favor of plantations in India, that they are reared with less expense and trouble than those in Europe, and become in general available in half the time required by them. Millions of money would have been saved to Great Britain, if, by early attending to the importance of reinforcing and enlarging the internal resources of timber,

the necessity of foreign importation had been superseded. Surprising as it may be, the fact is not the less true, that our Indian forests of standard timber have within the last 20 years become very perceptibly deteriorated ; the forests which were looked upon as holding forth the prospect of unceasing supplies, have become exhausted, and even the vast saul forests of Hindustan have begun of late to fail. It is a circumstance worthy of being remarked here, that this tree, the saul, grows perfectly wild at Moulmein."

33. Dr. Wallich concluded his letter to Sir Archibald Campbell with the following further account of the bamboo :—

" I have repeatedly had occasion to mention that bamboos of large size for Commissariat uses are not procurable in Bengal, and less so in the Western Provinces. With respect to this article, the province is fertile to an extent which I should have hardly thought possible, had I not personally witnessed it. It abounds everywhere in that most useful material, of every size and quality. I have in the accompanying Report mentioned those in particular which we met with in the direction of the teak forests, and which I consider especially fit for military purposes. There is no country in the world which produces bamboos in the perfection and of the size which they attain in Pegue. I omitted to mention in the body of the accompanying Report, that on my previous tour I saw bamboos of the largest sort, called Woah-Boh, near the Needung Hills, 70 feet in height and 25 inches in circumference at the base. Those on Beligeon are still more ample ; I have in my possession a stem brought from thence which measures near the base the enormous girth of 33 inches, giving a diameter of 10½ inches, with sides 1½ inch thick. The Thag-Woah, or male bamboo, is 9 to 10 inches thick, and either quite solid or very slightly perforated. The small sort used for roofing, &c., grows everywhere, and in the utmost abundance."

34. In submitting his Report to Government, Dr. Wallich referred to his letters to Sir Archibald Campbell for the opinions he entertained and the suggestions he had made regarding the Teak forests ; he however urged on the attention of Government, also, the importance of reserving the whole of the Teak forests for the use of the State exclusively, and of making a modified reservation in respect to some other trees, such as the Thengan, Soondry, and Bamboo ; and he strongly advised the establishment at Moulmein of a Commissariat timber-yard for half-wrought materials, by which he believed a great saving would be effected not only in the charges for freight, but also in the expenditure of timber. Shortly after this Dr. Wallich proposed going again to the Attaran River, to procure a supply of Teak timber, and despatch it to Calcutta in order to enable the Government of India to decide on the expediency of having at Moulmein such an establishment as that which he had recommended. Sir Archibald Campbell approved of the

proposed excursion, and having placed at Dr. Wallich's disposal an Artillery Serjeant and six Pioneers, to assist him in the object he had in view, the party started for the Attaran river on the 10th May, 1827. Although a month only had elapsed since Dr. Wallich's last excursion on this river, its appearance and that of its banks had completely changed. The river had swelled considerably, and the banks become proportionately low from recent heavy rains, which indicated the beginning of the monsoon. In place of obstacles, such as sand-banks, shallows, and fallen trees, which had been encountered in the former trip, were now experienced other difficulties from the rapidity and force of the current, which in some places, especially above the influence of the tide, had become very impetuous. The vegetation along the banks had also strikingly altered, more particularly as regarded the prevailing deciduous trees, the Jarrol, Cuddum, and Simool, (*Lagerstræmia*, *Nau-
clea*, and *Bombax*); these trees at the period of the former excursion were leafless, but on this occasion they were in a state of the most luxuriant foliage, and "in short," Dr. Wallich says, "everything around me pointed out the actual presence of the monsoon; it was evident even that the latter had commenced earlier up here, than lower down; at any rate the season for felling timber had passed by." He could not proceed higher up than about twelve miles beyond the village of Assamee, in consequence of the great strength of the current. The rise of the river in the neighbourhood of this place was so sudden and rapid as to overflow the ground on which the tents of the party had been pitched, and the adjoining bank, to a height of eight feet, in less than twenty-four hours. Under these circumstances, Dr. Wallich resolved to return to Moulmein without effecting his object, (the collection of timber,) but on his way back, having fallen in with a few Teak trees close to the river on the right bank, about a mile and a half from the former village of Attaran, he availed himself of the opportunity which thus offered of felling the largest tree, measuring 17 feet 3 inches in length of trunk, and 14 feet 9 inches in girth, and by this means obtained nearly 300 cubic feet of most excellent wood "exceedingly fine, of a dark color and strong scent." The operation of felling and cutting the branches and preparing the timber for rafting to Moulmein occupied the Pioneers about a day and a half, but it is explained that the work was several times interrupted or retarded by showers of rain, and that the process of cutting and sawing was rendered unusually tedious, owing to the wet

state of the wood. Dr. Wallich was satisfied, however, that the work of the Pioneers was better and less expensive than that of hired laborers, as the Birmans "will not work for less than 12 annas a day, be it as wood-cutters, boatmen, or common laborers, and besides, they would perform only one half of the quantum of work which the Pioneers would get through in the same given time." The other Teak trees, of which there were four in this forest, were *girdled* or *ringed*, an operation that was performed "by removing six inches of the bark and sap all round the trunk near the ground."

35. The results of Dr. Wallich's researches were acknowledged* by the Government of India to have been "highly satisfactory, as well with regard to the resources to be drawn from our new territories, as to the additions which have been made to botanical science," and, in accordance

* Letter dated 6th July 1827.

with his suggestions, instructions† were issued to Mr. Maingy, who had meanwhile been appointed Civil Commissioner of the Tenasserim Provinces, to hold the forests as Government property, and to protect them from depredation or injury by individuals. In reply to

† Letter dated 6th July 1827.

this letter, Mr. Maingy solicited‡ for his guidance more particular instructions as to the management and working of the forests, and he remarked, with reference to Dr. Wallich's reports, that from inquiries which he had made, and from personal observation, he was of opinion that the forests were by no means so extensive as to be considered inexhaustible, that the plan of extending them would be difficult in a country overrun with elephants, and that instead of incurring the expense of establishments for preserving them for the sole use of Government, the most advisable course would be "to issue licences to private individuals to cut timber on condition of paying to Government a duty of 10 or 15 per cent. upon the value of the timber when brought down for exportation; the value to be fixed by arbitration; and it being always optional with Government to take any portion of the timber at such valuation." Mr. Maingy also thought "a general and equal duty of a certain sum upon each tree cut would be a good mode of preventing the smaller and less valuable trees from being cut down"; and that "a regulation also confiscating all timber cut under specified dimensions would tend to preserve the young trees." Nothing was done on the

‡ Letter dated 14th December 1827.

* Letter dated 28th December 1827.

subject of this letter, though Mr. Maingy was informed* by Government that the matter would be considered on the receipt of further information. In the mean while, the forests were being worked as a monopoly entirely by the Government, and large supplies of timber had been prepared for meeting an indent from the Military Department at Calcutta and for other public purposes, when it was proposed to ship some of the timber as an experiment to the Calcutta market. Accordingly, in May 1828, a cargo of 511 logs of Teak, valued at Rupees 6,000 nearly, was conveyed in the Hon'ble Company's ship "Ernaad" from Tavoy to Calcutta, where shortly after its arrival it was sold by public auction at a loss of Rupees 250 nearly. This unfavorable result put a stop to further shipments of timber for the market.

36. In April 1829 Mr. Maingy again suggested to Government that the trade in timber should be thrown open, and private individuals allowed to proceed into the forests and fell trees of any description under the following rules:—

" **RULES OF 1829.**—1st. All persons applying to fell timber are directed to point out where they intend employing themselves for that purpose, together with the number of men in their service.

" 2nd.—No timber shall be removed from the banks of any river without the sanction of the Commissioner, his Deputy or Assistant, having been previously obtained.

" 3rd.—All timber shall be subjected to a duty of 15 per cent., to be levied in kind or in money, at the option of the Commissioner, his Deputy or Assistant. The timber to be valued by two arbitrators, the one to be selected by the Commissioner, his Deputy or Assistant, the other to be chosen by the owner of the timber; in the event of a difference of opinion between the arbitrators, the Commissioner, his Deputy or Assistant shall be at liberty to appoint a third.

" 4th.—It shall be at the option of the Commissioner, his Deputy or Assistant, to select for the use of Government any portion of the Teak timber felled in this Province, the value of such timber to be settled by two arbitrators as above stated.

" 5th.—No Teak trees shall be felled the girth of which shall not exceed four feet, and all such trees felled within that girth will be confiscated by the Commissioner, his Deputy or Assistant."

37. The failure of the experiment of cutting and exporting timber for the Calcutta market induced the Government* to adopt Mr. Maingy's repeated suggestions to throw open the forests to private individuals, on the terms of the rules quoted above, or with such

* Letter dated 1st May 1829, p. 14.

modifications of them as he might deem it expedient to make. Accordingly the measure was carried out, and several speculators, both European and Native, seem to have taken out *leh mats*, or licences, to cut timber in particular localities in the forests. From this time (May 1829) nothing material appears on the records of Government till August 1831, when Mr. Maingy, who had carefully observed the Teak timber of Tenasserim, being convinced that not only timber of a much larger size, but of a superior quality to that generally imported into Calcutta from Rangoon, could be obtained from Moulmein and delivered in Calcutta at a lower cost, submitted a tabular statement in support of his views. The statement was referred to the Marine and Military Boards, but whether those authorities availed themselves or not of the Commissioner's recommendation in favor of the Tenasserim Teak, does not appear from the records.

38. In 1831, while in England on furlough, Dr. Wallich was questioned by the Navy Board regarding the production of timber in the newly-acquired Burmese Provinces. In reply he submitted a copy of his journals (which have been already noticed), with a letter, from which the following extracts are taken :—

“The province of Martaban abounds more than any part of India I have ever visited in a luxuriant profusion of the noblest vegetable productions; the number and variety of fine timber trees produced there is, I believe, quite unparalleled. But in regard to the Teak, such is the quality of it, such the beauty of the climate where it grows, such the numerous advantages which present themselves there, of proximity to the main British possessions, &c., that I venture to offer it as my firm conviction, that the Province might and ought to be made to furnish the British Navy with a permanent supply of the very best timber in the world. To this end I would suggest that plantations of Teak should be established on an adequately extensive scale, which, it requires very little foresight to predict, would within a comparatively very moderate lapse of years become productive of almost incalculable benefit.

* * * * *

“The next to which I shall advert is the Thengan, the most gigantic timber tree in India, reckoned by the Burmese as little inferior to Teak in quality, and far exceeding it in point of dimensions. It grows in vast abundance near the sea-shore, where it constitutes one of the principal features of the forests. It is used chiefly in the construction of canoes, the largest of which are often formed of one single excavated trunk. There are several other trees of the identical class with the Thengan, which attain a great size and afford valuable timber. They all abound more or less in a beautiful and clear resin, which is easily extracted, and is superior in quality to the dammer or resin obtained from the Saul of Hindustan.

“It may perhaps not be deemed improper to mention in this place two substances which are produced in vast quantities in the Burmese territories, and which in my

humble opinion deserve being brought into extensive use for marine purposes. One of these substances is the wood-roil, derived from an immense forest tree of the same tribe with those just mentioned, and found everywhere on the Tenasserim coast; the other is the Petroleum, or earth-oil of the banks of the Irrawaddi. The former is an excellent and cheap substitute for linseed oil, possessing moreover superior preservative properties; the latter I know to be an infallible remedy against the attack of insects, especially the white ant, and I believe it would effectually resist the dry-rot."

39. A copy of this letter to the Navy Board was sent by Government to Mr. Maingy, with a request for information relative to the qualities of the timbers grown on the coasts of Martaban and Tenasserim. Mr. Maingy's successor, Mr. Blundell, met this requisition by forwarding for Dr. Wallich's examination a specimen of each kind of timber, stating the extent to which it was procurable, and the uses to which it was applied by the natives. It does not appear from the records whether Dr. Wallich made any report on these specimens.

40. In July 1833, Mr. Maingy was authorized by Government to entertain a small native establishment, consisting of one head-man and eight or ten coolies, for the purpose of planting and rearing Teak seedlings, and to see that the wood-cutters who were employed in the forests by the holders of *leh mats* or licences felled the Teak trees fairly, and did no damage to the forests. This appears to have been the first step towards the conservation of the forests. Mr. Maingy next addressed Government on the operation of the rules of 1829, and stated that the throwing open the forests to the public under those rules had encouraged speculators to explore the country, and by that means its value and resources were being developed daily. He added, "During the last three years no less than 7,309 tons of converted Teak timber have been exported, and three square-rigged vessels have been constructed,—and four more, two of them ships of 300 tons burthen, are now on the stocks. The Teak forests are found to be very extensive, not only along the upper part of the Attaran river, but on the eastern side of the Salween, and I see no chance of their becoming soon exhausted. Our wood-cutters would be much encouraged if an import duty were charged at Calcutta as at Madras on Teak, the produce of the kingdom of Ava, and perhaps the *ad valorem* duty of 15 per cent. might be beneficially remitted for a few years on all timber used for ship-building." In reply to this the Government promised to take the subject into consideration, but nothing was done. In July 1834, Mr. Blundell, who had meanwhile succeeded Mr. Maingy

as Commissioner, called the attention of Government to Mr. Maingy's recommendation for the remission of the *ad valorem* duty on Teak timber, when used for ship-building, and on the ground that a remission in such cases would be attended with considerable difficulty, and the mode of estimating it would prove harassing to the ship-builders, he proposed as a better measure that the duty generally should be reduced to 10 per cent. on all timber. Upon this letter the Governor General in Council recorded the following Resolution in the Customs Department:—

Resolution dated 5th January 1835.—"The Governor General in Council having considered the question referred from the Political Department in respect to the duties to be levied at Moulmein upon Teak timber cut in that Province, and having referred to the tariff of custom duties levied at this Presidency in their bearing on this article, remarks as follows:—Saul timber the produce of the Bengal Presidency is subject to a transit duty of 10 per cent., Sissoo to a duty of 7½, but Teak timber produced in Bengal, or imported, and whencesoever brought, pays no duty. The motive of this difference was a desire to encourage by all means the production or importation of Teak timber as a valuable article for ship-building. The tariff continued at these rates since its enactment in 1810, and when it was adopted, the great import of Teak was from the Burmese Empire, there being no forests of this timber in Bengal."

"The Tenasserim Provinces were acquired in 1825, and since they have been in the possession of the British nation, the importation of Teak has been extensive, so much so as to produce a fall in the price of the article at Calcutta to nearly an equality with Saul. The importation from Rangoon has continued, but the article from thence has been undersold by the Teak timber of Moulmein."

"It appears that, since 1829, the forests of Moulmein have been thrown open to the public, free licence having been given to any one to cut the timber under the condition of paying 15 per cent. on its value upon arrival at Moulmein. In the year 1833, the Commissioner appears to have held out to the establishments engaged in ship-building at that station the hope of obtaining a remission of the 15 per cent. duty on such of the timber as might be used in that way at the place. The present Commissioner, finding difficulty in ascertaining the proportion of timber so used at the different building-yards, proposes, in lieu of the remission suggested by his predecessor on the timber used, to reduce generally the duty levied to 10 per cent. It was further suggested, that the timber of Moulmein should be favored in the Calcutta market by the imposition of a duty, as at Madras, on the Teak timber of Rangoon."

"Upon these propositions the Governor General in Council observes, *first*, that the 15 per cent. duty levied at Moulmein is in the nature of a rent, which the facility with which the timber is procured and brought to market at Moulmein, as compared with Rangoon, presents the means of realizing. The thriving condition of the trade under that impost was the best evidence that the rent was not too high, and until the forests should become exhausted, or from the necessity of going further off to find the timber, the duty should be felt as a burthensome addition to the expense of bringing down the article, His Lordship in Council would not be disposed to reduce the rent. Its main-

tenance at rather a higher rate is essential to preserve the forests from waste, and there was no particular reason why the ship-building establishments of Moulmein should be favored by an exemption from this rent, seeing that the vicinity to the place of production is itself a great encouragement, and this, added to the security to property, must give sufficient advantages to protect them from the result of any competition that could be offered by similar establishments at Rangoon. If, however, the Government should have been actually pledged to grant exemption from duty on the timber used at Moulmein, His Lordship in Council concurs with the present Commissioner in thinking that a general reduction of the rent duty to 10 per cent. will be better than any attempt at inquisition to ascertain and register what is applied to ship-building at the place.

“ On the *second* point, *viz.*, the proposition to protect the timber of the Tenasserim Provinces by a direct duty to be levied at Calcutta on the timber of Rangoon, the Governor General in Council cannot believe this to be necessary in the present condition of the trade, and with the fact before him of the fall of price that had resulted since the timber of Tenasserim came into the market of Calcutta. If it should be found hereafter that the Burmese authorities, by reducing their rent duty or by granting other facilities, aim to compete with our own Provinces for the command of the Bengal market, it may then be necessary for the protection of the revenue of those Provinces to impose a duty on timber imported from Rangoon, but not until then.”

41. In March 1837, Mr. Blundell recommended the levy of a custom duty at Moulmein on Teak timber imported there from Rangoon and other places within the Burmese territory, in order to protect the timber trade of the Tenasserim Provinces, as otherwise the foreign timber, being imported free of duty, would undersell that cut in the Provinces, which was subject to a duty of 15 per cent. Lord Auckland however, as Governor of Bengal, declined to authorize the measure, until more particular information was afforded of the places within the Burmese territory whence the Teak timber was brought, and the manner of its importation, and Mr. Blundell was reminded that the duty of 15 per cent. which was levied on the Teak of the Tenasserim Provinces was “in the nature of a rent for the free privilege of cutting timber thereon, and that at the time of the duty being so fixed, it was assumed that this rate was the equivalent of similar duties levied on timber cut in forests belonging to the Burmese.” It was also again intimated, that “if the facilities for cutting timber had been increased, or the consideration levied reduced in the Burmese territory,” that would be a reason for revising the system adopted at Moulmein; but the Government was opposed to the establishment of anything in the nature of custom duties in the Tenasserim Provinces merely for the sake of protecting the timber of Moulmein against competition with the produce of the Burmese territories.

42. In April following, 1837, a correspondence passed between Government and Mr. Blundell on the subject of the conservation of the Teak forests, and the means by which it could be best effected. Mr. Blundell pointed out that, under the rules of 1829, parties who desired to cut timber were allowed "permits" or licences to do so in certain localities, to the exclusion of all other cutters from those particular localities; care being taken to make it known to them that the permit was revocable at pleasure, and though the transfer of these permits had been allowed, yet they had never been recognized as conveying aught but permission to cut timber in certain situations. So long as the timber was procured near the banks of the river, and while the market for it was in its infancy, this system answered very well; but as competition and the number of cutters increased, it created great confusion regarding boundaries, as no survey was made when licences were granted, and it was impossible to have defined correctly any other boundary than the banks of the river. As parties went further inland, they trenched on each other's imaginary boundaries; this caused disputes, and led eventually to suits in the courts, which Mr. Blundell stated "we have not the means of deciding with any satisfaction either to ourselves or to the litigant parties." He added, "the distance of the forests from the town, their great extent, and the want of an efficient conservator invested with adequate powers to notice and decide on the spot all infringement of the rules framed, both for insuring proper timber being cut and the preservation of the young trees, must lead, I fear, ere long both to bring the Moulmein timber into bad repute and to exhaust the forests, without providing for their renewal in after years." To remedy these evils, Mr. Blundell suggested "the appointment of some individual well acquainted with the state of the timber market in India and England, as at least a temporary conservator of the forests, with full powers to decide on the spot all cases of infringement of rules and all suits relative to boundaries. This person should also be directed to draw up a report on the state of the forests, and above all, on the eligibility of resuming the permits to cut, and re-constituting a monopoly." These measures, he thought, would ensure the cutting of only proper sized timber of good quality, the preservation of the young trees, and the planting of others, and would also enable Government to send supplies of timber to Her Majesty's building-yards in England; but at the same time Mr. Blundell very fairly stated

that one of the proposed measures involved "the interference with apparent private rights accompanying the original permits to cut timber sanctioned by eight years' adherence to the present system, and would lead to expense, which in justice must be incurred in compensating the holders of the original permits for their outlay towards facilitating their operations in the forests." He added that if the monopoly of the forests was to be resumed, the port might be thrown open to foreign timber, either free of duty altogether, or with a much less duty attached to it than he had before recommended for Teak timber imported from Rangoon and other places; and if it was resolved not to resume the monopoly, it would still be absolutely necessary to have a survey of the forests in order to define boundaries, and to continue a conservator to preserve the forests and provide for their renewal. Accordingly, Mr. Blundell recommended the following establishment for the sanction of Government :—

One Conservator of Forests,	Rs. 500
One Native Assistant, (the present man,)	40
Six Peons, (to act also as boatmen,) at Rs. 10 each,	60
	600
Total,	Rs. 600

For the office of conservator Mr. Blundell recommended the appointment of "a gentleman in the Service of the Hon'ble Company, one who is strictly prohibited from engaging in trade, and who will consequently be above all suspicion of favoring his own interests." He also proposed to employ convict labor in forming nurseries, if these were to be established for renewing the forests.

43. With regard to the interference with ship-building speculations which would attend the resumption of the monopoly, Mr. Blundell remarked that this could be considered by the person who might be appointed to report on the forests; but he was of opinion that so long as Government would not require to send supplies of timber to England, the market might always be adequately supplied by the Government cutters with all materials requisite for ship-building, and that contracts could be made with the conservator by ship-builders for their private supplies, which would in no way be affected by the Government demand.

44. No reply having been made by the Government to this letter, Mr. Blundell again wrote, in March 1838, on the subject of the appoint-

ment of a conservator of forests, representing that the necessity for it had become greater, "inasmuch as every season the forests become more exhausted without adequate measures being adopted to prevent waste and to ensure their renewal in after years"; and he said, "unless such a person be appointed, it would be difficult to frame an applicable set of forest rules, and still more difficult to render them effectual." He moreover recommended an addition of 100 Rupees to the establishment which he had before solicited for the conservation of the forests, in order to enable the conservator and his assistants to defray their travelling expenses; and to meet this additional charge, he proposed to raise the *ad valorem* duty from 15 to 20 per cent., which would not be detrimental to the timber trade, as the duty was levied either in money or in kind, at a valuation below the market rates.

45. This letter and the previous correspondence were submitted in April 1838 by the Government of Bengal to the Governor General, Lord Auckland, with the remark of the Deputy Governor, Mr. Ross, that he "very much doubts whether the present great extent of the Teak forests would admit of the property in the timber being guarded and preserved, without arrangements calculated to be very vexatious, or without establishments of a very expensive kind, which the duty levied on the wood-cutters would scarcely repay." Lord Auckland, not having had sufficient materials before him, was unable to decide on the question of the appointment of a conservator of forests; he therefore, with a view to gain further information, recommended that reports should be called for from Madras on the two great Teak districts on the western coast of that Presidency, one of which had been managed by a conservator, while the other was without such minute superintendence. At the same time he desired that the Commissioner of the Tenasserim Provinces should be directed to furnish information upon the extent of the forests to be preserved in Tenasserim, the mode in which the clearances had been commenced, and in which the plantation of young trees would be prosecuted, upon the amount of public income, and the effect on the general prosperity of the State resulting from the trade in timber; upon the mode in which the proposed Agency might be made effectual for its purpose, and upon the powers with which the superintending officers might safely be vested. On this last point, Lord Auckland "was doubtful, whether it would be necessary or proper to give to such officer full and independent magisterial powers for the

conservation of the forests, as was contemplated by Mr. Blundell," and he thought that an uncovenanted officer who had gained character in the Department of Works and Survey, should be appointed to the office of conservator if it were created, but that "in the first instance there should be rather a temporary reporter on the forests, than a conservator of them on any permanent footing, and in this event, the first object would be to obtain a full account of the present state and management of the forests, their progress towards exhaustion, the encroachment of cultivation or of mere grass jungles upon their site, and the measures which such officer would recommend for their preservation and improvement." His Lordship also observed, "that he would on no account add to the present duty on timber, nor is he inclined to resume the cutting of the trees as a monopoly in the hands of the Government."

46. In accordance with these orders, letters were addressed on the 27th June 1838 to the Government of Madras, for information regarding the Teak forests in that Presidency, and to Mr. Blundell, communicating to him the sentiments of the Governor General, and requiring information on the points on which His Lordship desired it to be given. The Madras Government furnished the information which was required, and Mr. Blundell, in reply to the orders which he had received, intimated (in August 1838) his intention of first personally visiting the forests, and then reporting on the several points on which the Governor General wanted information.

47. There is a great hiatus in the records of this period, for from August 1838, the date of Mr. Blundell's letter, to 1840, no papers regarding Teak forests have been traced. In April 1840,—the Court of Directors, in a Despatch dated 26th February 1840, having directed the attention of the Government of India to certain measures that had been proposed for the preservation of the Teak forests of Malabar,—the Government of India called upon the Governments of Madras and Bombay for information respecting those forests. This requisition called forth voluminous papers on the subject of the forests in Madras and Bombay which will be noticed in their turn with other papers and reports that are in the records of this Presidency.

48. It must be stated here that during the year 1837, on a suggestion made by Lord Auckland, in a Minute dated 26th December 1836, the Government of Bengal deputed the late Dr. J. W. Helfer, to inquire into the natural and commercial capabilities of the

Tenasserim Provinces, "in order that the Government and the public may be enabled to judge with what advantages of circumstance, and consequently with what prospect of success commercial speculations and the employment of capital may be directed towards them." The results of Dr. Helfer's researches were submitted by him to Government in three reports, which were printed in 1838-39. The following extracts regarding the Teak have been made from two of those reports:—

DR. HELFER'S REPORT.—"The Teak forests do not occur contiguous throughout the country, seldom also intermixed in the forests with other trees,—generally they occupy almost exclusively the ground where they appear. It is difficult to determine the conditions of the soil on which Teak trees will grow: it is much easier to answer the questions negatively.

"(a) The Teak will not grow on low ground which is exposed to the regular influence of the tides.

"(b) On rich alluvial soil, without a substratum of clay or gravel.

"(c) On places under otherwise favorable circumstances, where already other trees have got the ascendancy.

"(d) On bare limestone hills.

"(e) On poor sandstone ground.

"(f) On black clay slate.

"(g) Upon mountains attaining a considerable height.

"The most frequent localities are moderately elevated sloping plains, (very often near rivers.) The Teak forests in this country are either in the neighbourhood of the Salween, the Thoung-yeen, or the Attaran river.

"I had only opportunity to visit those on the Salween. There a greater number of trees perish by bad management than are used.

"(a) The persons occupied with that part of the labour called killing the trees, destroy a number which they do not find afterwards fit for use.

"(b) This number of killed trees which are suffered to decay generate a host of insects. Though it is pretended that Teak is not attacked by vermin, yet a great deal of these decayed trees are attacked by *Bostrichus*, *Passalus*, and other coleopterous insects, and the consequence is that these animals have attacked other good trees before they were sufficiently seasoned.

"(c) The same negligence of the natives which reigns throughout the country, with regard to wanton destruction of the forests by fire, extends equally to Teak forests; and I saw extensive tracts utterly destroyed, because it was the pleasure of some wild Karean to fix his abode in the vicinity, and for this purpose to clear the jungle by burning all down.

"As Teak is such a valuable article in general, and, it may be safely asserted, hitherto the only one to which Maulmein owes its daily increasing prosperity, the preservation of Teak forests should be the principal care of Government.

"But not only the preservation, equally so the multiplication. It cannot be denied, that even with good management the number of trees must yearly decrease, and that

timber in localities of easy access must soon become rare. Experience has shown that new trees disseminated by nature on places where timber has been hewn, grow only very scantily up.

“ Teak plantations therefore will be of the greatest importance, and this not only on places where Teak already existed before, but also in localities which in regard to chemical composition of the soil and other circumstances are equally well fitted.

“ Government possesses such vast tracts of country in these Provinces, that a choice of land to accomplish this cannot be difficult, and how could the land be better employed than by preserving that source of wealth which has manifested itself already by such striking proofs.

“ But in the method of cultivation, I would deviate from that adopted by the Dutch in Java. It is an old experience that forest trees do not thrive well if they are treated like fruit trees or other more delicate plantations. The system of nature should be imitated. No nursery beds and no transplantations should be employed. After having cleared the jungle in the chosen places, and after having loosened the soil sufficiently to receive the seed and to be able to cover it with a little earth, I would advise the seeds being disseminated without any further care. The plantation must of course be inclosed to prevent the disturbance of any kind of wild animals. After two or three years, the plants, when sprung up too close to each other, ought to be thinned, besides jungle parasites and other impediments carefully removed.

“ This easy operation should be annually repeated in different parts of the country over wide tracts. Localities affording facilities for the transport of timber, such as rivers and nullahs, ought of course to be the first chosen.

“ This would ensure for ever the existence of Teak forests ; the value of the Provinces would annually increase, and in time prove a most important source of revenue to the Government.

“ This cursory exposition of the natural resources shows sufficiently that the country possesses the elements of great wealth and prosperity, and there are certainly many more hitherto unknown, which time and a protracted examination will develop.”
Report on Amherst Town, pages 38 to 40.

“ The Teak forests of the Tenasserim Provinces do not go lower than the 16° of latitude, or they are only to be found in the country through which the Attaran river and its tributaries run. Beyond the range of mountains which divides the Ye river territory from that of the Attaran, not one single Teak tree is to be found, much less so in the Provinces of Tavoy and Mergui. In Province Amherst, which is consequently the only one producing Teak timber, three separate districts must be distinguished, —1st, the Teak district on the Thoung-yeen river ; 2nd, the district of the Salween river ; and 3rd, the Teak district on the Attaran river. Of the Teak forests belonging to the two first divisions, I have already treated in my first report ; it remains therefore only necessary to speak of the last. The Teak forests existing on the Attaran are the most extensive within the British boundaries, and the timber which they produce is considered superior to that which is cut on the Salween and Thoung-yeen rivers. The same system which is used in the two first districts is equally followed in the last. The forests are let out by Government to private individuals, and a tax of one rupee

levied upon each tree brought to Moulmein. This unrestrained liberty accorded to any individual to appropriate to himself any unoccupied forest under such liberal conditions, contributed without doubt in the first instance very much to render Moulmein a prosperous place, but it cannot be denied that a continuation of the same system will lead in a short time to the extermination of all available Teak forests, and deprive Moulmein of this valuable resource, and render Calcutta once more dependent upon foreign importation for Teak timber. It cannot be expected that individuals whose only care it is to render themselves independent in as short a time as possible, should care about the preservation of the forest, and experience has taught that by far more trees are destroyed than used. A particular survey of the Teak forest, well-drawn lines of demarcation, an improved system of regulations, the appointment of a respectable European to enforce the observance of these regulations, and new plantations laid out in all the places where Teak formerly grew, and where it is now almost extirpated, are measures necessary to be introduced to secure an uninterrupted supply of Teak timber for the future. Mr. Blundell, the Commissioner of the Provinces, having particularly addressed the Government upon the subject of adopting these or similar measures, I refrain from entering into further particulars.”—*Report on Ye, Tavoy, and Mergui, pages 64 and 65.*

49. Regarding timber in general in the Tenasserim Provinces, Dr. Helfer wrote as follows :—

“ The Tenasserim Provinces are an almost uninterrupted immense forest from the water’s edge to the most elevated mountain ridge, 6,000 feet in height ; all ground left to nature is without discrimination, without exception, covered with timber. There are no marshes, no sandy plains, no bare rocks, no such thing as an American Savannah, nothing resembling a New Holland pasturage, only the pygmean endeavours of man, rescuing the soil for his own purposes with the assistance of fire, have divested a small fraction of the area from the primitive forest.

“ The area being 30,000 square miles, it may be assumed that one-fifteenth part of it is cultivated ; leaving one other fifteenth for rivers and two other fifteenths for country which has been burnt down, and where only local vegetation has taken possession of the ground, there remains yet 22,000 square miles occupied by forests. Supposing that trees (measuring at least seven inches in diameter) stand 30 feet apart from each other on an average in a forest, then each tree occupies 900 square feet or 100 square yards.

4,840 yards = one acre,

600 acres = one mile,

100)290,4000 yards in one mile,

29,040 trees in one square mile,—multiplied by 22,000 miles, there are 638,880,000 timber trees in the Provinces.

“ Each tree counted on an average at two annas intrinsic value on the spot, there is at present a dead capital of 79,860,000 rupees in the timber alone, which wants to be called forth into activity to prove useful.

“ Though one-half of it is so situated that centuries will elapse before it will be turned to any use, yet the other half is so placed that it is available. The whole of the

country, on an average not more than 50 miles broad, has a sea-coast, accessible in all parts, of 6 degrees or 414 miles in length ; the land is intersected in all directions by numerous rivers ; the tide ascends in some parts 120 miles up the country ; the timber of the islands is close to the edge of the sea,—and with all these facilities the timber is hitherto entirely neglected. I have now already gathered a catalogue of 377 different species of trees, each of which attains at least a diameter of 7 inches, and amongst these are species fit for every imaginable purpose.

“ The trees in general can be divided in,—

“ 1st.—Precious trees—that is, such where the wood is sold according to weight, such as sandal-wood, camphor-wood, the fine-grained ebony, the iron-wood used by the Chinese instead of nails, the sapan-wood, and other woods yielding dyes.

“ 2nd.—Woods fit for objects of ornament, such as the chessman tree, excellent for turnery, fit for furniture, such as the mahogany of the Provinces.

“ 3rd.—Timber for ship-building—besides the Teak, such as the anam, the anjin, the kananthi, the pynmah, and twenty others, some of which are by the natives preferred to Teak, such as the Thengan (*Hopea odorata*), for that part of the vessel which remains under water.

“ 4th.—Such as are fit for military store-house building and utensils, of which there is a great variety. The number of heavy woods not floating in the water is comparatively very great.

“ 5th.—Such as yield spars for vessels.

“ 6th.—Such as are peculiarly fitted for planks.

“ 7th.—Such as yield good charcoal.

“ 8th.—Fire-wood.

“ The greatest number of trees have the peculiarity to rise straight up, to elevate their branches above the lower vegetation of the forest, many having a bare trunk of from 40 to 100 feet in height without one single branch, and these form generally a small crown compared with the size of the tree. Another peculiarity of these majestic productions is, that the circumference of the tree is not in the same proportion to the height as we are accustomed to see in Europe, that is, the height is in perfection far greater than the circumference—which is to be considered as an advantage, as in most cases the length of the tree is of greater value than the thickness.

“ The firmness and elasticity of the greatest part of the woods is another characteristic, and this again is the natural consequence of their great height. If nature had not given them this property, they could not stand the impetuosity of the storm, but would have been broken down in numbers. This is, however, very seldom to be seen, and in no way proportionate to the damages which forests, chiefly of fir and pine, suffer in Europe.”—*Report on Ye, Tavoy, and Mergui, pages 65 to 67.*

50. In 1840 Captain E. P. Halsted, of H. M. S. “ Childers,” then cruising off the east coast of the Bay of Bengal, greatly interested himself in the resources of the Tenasserim Provinces. His inquiries related chiefly to the facilities afforded by Moulmein, with its plentiful supply of timber, for the construction of ships, and he formed

the opinion that its advantages in that respect "were not surpassed, if equalled, by any spot in India," but "were not so well known as they should be for general usefulness." Captain Halsted submitted to Lord Auckland, in August 1840, all the information on the subject which he had collected, in a paper which is appended to this Summary, there being much valuable and interesting matter in it.

51. In November following, Captain Halsted again addressed Lord Auckland, and submitted a report on the comparative strength of some Tenasserim Pine which he had obtained from Moulmein, and some Riga Pine supplied from the "Childers." His anxiety to introduce the Tenasserim Pine to notice arose from his having been aware that the Admiralty had for some time been extending their researches for that wood to distant parts; that the supply of it for spars of men-of-war in India was sent out at considerable expense from England; and that for purposes connected with the Ordnance Commissariat at Calcutta, it had to be procured from England or America. The following Statement exhibits the results of the experiment to test the strength of four pieces of Tenasserim Pine and two pieces of Riga Pine.

Report of Experiments on the Strength of four pieces of Tenasserim Pine, and two pieces of Riga Pine.

Date.	Number of Specimens.	Nature of Wood.	Length.		Dimensions Square.	Specimen's Weight.			Bent with			Broke with (including the weight of Scale lbs. 141-15 oz.)	REMARKS.		
			Feet.	Inches.		Lbs.	Ozs.	Dr.	$\frac{1}{2}$ Cwt.	$\frac{1}{2}$ Cwt.	$\frac{1}{2}$ Cwt.				
1840.	1	Moulmein or Tenasserim Pine.	5	3	2 $\frac{3}{4}$	11	2	0	32 0-30	40 0-40	62 0-50	3566 12	Cwt. gra. lbs. Broke in 3 $\frac{1}{2}$ minutes with 31 3 1	Each piece had a knot in the very centre.	
2nd November,	2		5	3	2 $\frac{3}{4}$	10	13	0	40 0-30	48 0-40	62 1 1-10th	3793 0			Broke in 5 minutes with 33 3 13
"	3		5	3	2 $\frac{3}{4}$	11	2	0	28 0-40	56 0-45	62 1 1-10th	3798 0			Broke in 1 minute with 33 3 13
"	4		5	3	2 $\frac{3}{4}$	11	5	8	48 0-35	66 0-53	77 1 1-10th	4354 0			Broke in $\frac{1}{2}$ a minute with 38 3 14
4th November,	5	Riga Pine.	5	3	2 $\frac{3}{4}$	8	9	0	27 0-25	40 0-60	44 1-10	2605 12	ozs. Broke in 1 minute with 23 1 1 12	These pieces are free from knot in the centre.	
"	6		5	3	2 $\frac{3}{4}$	8	12	0	37 0-30	40 0-50	46 1-25	2717 12			Broke in $\frac{1}{4}$ minute with 24 1 1 12

REMARKS.—“The tree from which these Moulmein specimens were taken, and the only one then sent down, was felled at hazard by a native in clearing his ground, and lay nearly three years exposed to the weather on the river bank. Its appearance on arrival at Moulmein, in July last, tended to confirm this account of it given to me by its owner, Captain Warwick.

“Before cut up into specimens tried, it lay as a planed spar on the “Childers” deck two months, exposed to sun and rain without cover or paint.

“Each specimen had in its weakest point, and where the weights were applied, a knot of considerable size.

“All were taken from but one, the only tree. While these combined reasons forbid this trial from being held conclusive of the quality of Moulmein Pine, they hold out the stronger hope that under trial on an average of favorable circumstances, it will be found a very valuable timber.”

52. The reports of Dr. Helfer and Captain Halsted, to the effect that the unrestrained working of the Teak forests in the Tenasserim Provinces was fast leading to their extermination, convinced Government of the necessity for an efficient system of conservancy, though the evil at that time did not seem to justify the resumption of the “permits,” or a re-constitution of the former monopoly as had been recommended by Mr. Blundell. With this view it was determined, in November 1840, to appoint to the Department of Public Works in the Tenasserim Provinces an executive officer, who in addition to the duties of that Department, instead of a separate conservator, should have the charge of the Government Teak forests. A moderate establishment was to be allowed him for their preservation, and for regulating the cutting of timbers in those forests where the Government could, without injustice, interfere with the grantees, and he was also to act as Agent for providing timber for Government shipping purposes at Moulmein, or for consignment to the Presidencies. Captain Tremenheere, of the Bengal Engineers, was selected for this appointment, and the Military Board were desired to instruct him, to complete a survey of the existing Teak forests and of places suitable for fresh plantations, and to report on the condition of the several forests, their capabilities under proper management, and the means of increasing and perpetuating the resources of the Province by the appropriation and plantation of new tracts. The Military Board were desired also to request Captain Tremenheere to submit a scheme for the supervision of the forests, consistently with the rights of the grantees, to define and note the boundaries of each existing grant, and as far as possible, to discourage the practice of cutting up valuable timbers into pieces.

53. In March 1841, about the time of Captain Tremeneere's appointment, Mr. Blundell was required in concert with Mr. J. M. Seppings, Surveyor of Shipping, and Captain Johnston, Controller of Government Steamers, both of whom were then at Moulmein, to report on the means in the Tenasserim Provinces for building Teak men-of-war for the Royal Navy, and to furnish information on the following points :—

“ The facility of procuring timber, and the quality of it ? ”

“ Whether a sufficiency of good timber can be commanded ? ”

“ What may be the fitness of the locality and of the river for undertaking the building of large vessels ? ”

“ To what tonnage and draught of water can vessels be built at Moulmein ? ”

54. Mr. Blundell was also requested to give an estimate of the prices by which the expense of building ships was regulated at Moulmein, and to say if the proposition to build men-of-war for the Navy could be recommended for adoption ?

55. It will be observed that all the information sought had been supplied by Captain Halsted in his report, which is appended to this Summary, but that paper was not before Government when the preceding instructions were issued.

56. In reply to the inquiries of Government, Mr. Blundell submitted a memorandum drawn up by himself, another by Mr. Seppings, and remarks by Captain Johnston. The information given in these papers merely confirms the statements of Captain Halsted that Moulmein possessed great facilities for building ships, that good timbers were spoiled and wasted by being cut up into small pieces, and that the forests were mismanaged. They show further that labour in Moulmein was abundant, but expensive ; that Burmans were employed for the heavy and coarse work, and Chinese for work which required nicety ; and that ships were put together generally by contract, different parties contracting for different portions of the work. Mr. Seppings in his memorandum suggested the formation of a Timber Department at Moulmein, and recommended the purchase for that purpose of Natmoo, the building and timber yard of Cockerell and Co., as it was well adapted for a Government yard. Mr. Blundell stated that Natmoo was selected originally by a Captain Warwick, who was the first European who felled timber and brought it down to Moulmein from forests which he had leased under

the rules of 1829. He became involved in pecuniary difficulties, and his yard and right of cutting in the forests were transferred to Cockerell and Co. Captain Johnston surveyed the passage from Amherst to Moulmein in 1826-27, and he was of opinion that there was sufficient depth of water for launching and floating the largest class ship, and that as the soil was of a hard and stiff nature, little preparation would be required "for laying blocks and ways for the heaviest ship."

57. On the receipt of these papers, Mr. Seppings was directed* to proceed again to Moulmein (he had returned to Calcutta), and there institute minute inquiries "as to the feasibility or otherwise of building ships of war at that port."

* Letter dated 24th March 1841.

58. In the mean while Mr. Blundell had deputed Captain O'Brien of H. M.'s 63rd Regiment, to survey and report on the forests of the Attaran. It is not stated under what authority or instructions Mr. Blundell made this arrangement, but it is presumed he acted on the suggestion of Lord Auckland (already noticed), to have in the first instance "rather a temporary reporter on the forests, than a conservator of them."

59. The instructions which Mr. Blundell gave to Captain O'Brien were, to draw up a report on and a map of the Teak forests of the Attaran river; to mark off the localities held by individuals, showing their extent and boundaries; to point out the position and direction of hills and streams; to observe the difference in the appearance of trees, and in the quality of timber between those on the banks of the rivers and those further removed from it, and to endeavour to assign a cause. To state the distance through which the timber will have to be dragged before it can be floated or rafted; the approximate number of trees, how many killed, how many felled; the probable number of young trees growing in those spots whence trees have been removed, and if planted or of spontaneous growth; the best site for planting, the facilities for so doing, the impediments in the shape of wild beasts, fires, &c., and how these can be obviated. To examine forests which had not been explored; to note all instances of wanton cutting of timber; to suggest the best means of supplying the waste of the forests, and to state the extent of establishment which might be required for converting timber on the spot. To submit information regarding the manner in which trees are killed, felled, dragged to the water and sent down; in fact, the

process of bringing a tree standing in the jungle, to town, the time taken in such process, and the proper seasons for the several stages of the process; the quantity of water in the main and subordinate streams, and their capability for floating down timber; and calculating the consumption of Teak during the last ten years, to say what time it will take to exhaust the existing supply.

60. Captain O'Brien was engaged in examining and reporting on the forests on the Attaran river; his report does not give all the information which Mr. Blundell called for, but it shows that several forests had been entirely neglected by those who held *leh mats*, or licences, to cut in them; that some forests had been completely worked out without any authority whatever; and that other forests had been abandoned apparently from the difficulty of transporting timber from them. Mr. Blundell in submitting this journal to Government, requested instructions as to whether these forests should not therefore be resumed, "and if resumed, whether together with forests that may be hereafter discovered, they should be given to private individuals, or remain to be worked by Government for the Royal Navy." Two questions were raised upon this,—first, what should constitute neglect, or in other words, failure to work a forest grant; and second, what remuneration should be made to grantees for trees killed or felled by them, but not removed from the resumed grants. Mr. Blundell was of opinion, on the first question, that if the grantees had not visited their grants and had not brought away any timber from thence for two years, that should be held to constitute neglect. On the second question, he considered the grantees were fairly entitled to the value which the trees bore on the spot, and where expense had been incurred by them in forming roads or clearing channels in the nullahs, some compensation ought to be made, but that no compensation whatever should be given for the resumption of the mere right of cutting. He believed, however, that very few of the grantees had invested any capital in their grants, and under all these circumstances, he suggested that new rules should be framed to meet the few cases of the kind. This suggestion was approved by Government, and Mr. Blundell was requested to prepare rules that would define the first point raised, "leaving the second to be determined with reference to the particular circumstances of each case," provide for the survey and definition of boundaries, impose restrictions in the working of all new or lapsed or resumed grants, and secure to

Government the right of resumption on failure of the conditions of the grants, "due notice being first given in the manner that should be most conformable to local circumstances and to the nature of the engagements."

61. In reply to the foregoing instructions, Mr. Blundell, on the 23rd April 1841, submitted the draft of a set of rules. He also forwarded a journal from Captain O'Brien and a report from Captain Tremeneere, who had accompanied the former officer during a few days in the end of March 1841. The following are the rules:—

"NOTICE is hereby given, that from and after the 1st proximo, the permits under which individuals are now allowed to fell Teak trees within certain localities will be cancelled and resumed, and such localities will be leased or farmed out to the same individual for a period of twenty years under the following rules:—

RULES DATED THE 12TH APRIL 1841. "1st.—That the farmer keep up such an establishment for the preservation and working of the forest as may be considered necessary by the Government superintending officer, in order that the trees be felled without injury to those surrounding them, by having proper ropes, &c., for lowering them; and that the requisite assistance of men, elephants, trucks, carts, &c., be provided for removing them when felled.

2nd.—That no trees shall be killed or felled of a less girth or circumference than 6 feet, measured round the bark 10 feet from the ground.

3rd.—That every tree shall be killed by a broad rim of the bark, say 1 foot, being taken off round the trunk of the tree near the root, at a height not exceeding 2 feet from the ground, and further by cutting to the spine or through the hard wood, to prevent the least portion of sap from rising. This process is only to be done during the months of January, February and March, before the sap commences to rise, and at no other period of the year.

4th.—That no tree shall be felled till the expiration of at least two years from the period it has been killed, in the manner pointed out in rule 3rd.

5th.—That every tree felled be removed from the forest with the least possible delay.

6th.—That for every tree felled and removed, five young trees of a proper size shall be planted by the farmer, or by the Government at the expense of the farmer.

7th.—That no tree shall be on any account cut up into short lengths (called loozars), but that every tree shall be removed as felled, and be brought in that state (after removing the branches), either down the river to the town, or to saw-pits established in the forest.

On proof of breach of any of the above rules, the locality wherein such breach may have been effected will be at once resumed by Government.

The transfer of a lease of any forest from one party to another, must be registered in the office from which the leases are issued, and no transfer will be valid without such registry.

The duty on timber will continue to be levied as usual.

62. Mr. Blundell was of opinion, however, that these rules would be ineffectual without the appointment of a conservator, and that Captain Tremenheere's other duties would preclude his devoting that attention to the forests which they required. He accordingly proposed the appointment of an officer as conservator alone, on 750 Rupees per month, with an adequate establishment, which expenses he asserted would be repaid by the timber that would be sent down on account of Government; and he suggested that the commissariat elephants, then unemployed, should be made over to the conservator for the conveyance of the timber. Mr. Blundell then proposed to appoint Captain O'Brien to the office of conservator, and in fact, in anticipation of the sanction of Government, he made the arrangements he suggested.

63. Before these measures were taken into consideration, Mr. Blundell again addressed* Government, and forwarded a paper from Mr. Seppings, furnishing all the information, to obtain which it will be remembered he was deputed to Moulmein. Mr. Blundell recommended that Mr. Seppings should be directed to fix his headquarters at Moulmein, to superintend and regulate the operations he had advised in his paper.

JOURNALS AND REPORTS.—64. Before noticing the orders of the Government on these two communications from Mr. Blundell, it will be as well to supply an abstract of the reports and journal which were enclosed in them. The first are the report and journal from Captain O'Brien; the second is the report from Captain Tremenheere; and the last is Mr. Seppings's "Observations."

CAPTAIN O'BRIEN'S REPORT AND JOURNAL.—65. The Teak trees on the tributary streams of the great rivers appear to be of the best quality, being of immense girth, tall and straight, and the grain of the wood particularly fine and clear. The trees farthest from the bank become crooked and rough, those growing in the Weinyo and Zimmè are particularly good, but no reason is given for this difference. Teak is not fairly found within the influence of the tide, hence a long distance must be traversed ere it is met with.

No mention is made of the distance of the furthest boundary of a forest from the bank of a river, though in one place Captain O'Brien states that he never saw Teak growing at a greater distance than 150 yards from a stream or rill, which sometimes is not cal-

culated to float down timber; and he instances the Teak on the Weinbraw river requiring to be dragged eight miles before it could be floated; this however was the maximum distance any timber would have to be transported overland.

Some forests in the lower part of the Weinyo river, which had been granted to natives, were totally exhausted.

The first forest of any consequence had been granted to Mr. Wales; the greater portion of it had been felled, but about 500 trees and a very few young plants still remained. Beyond Mr. Wales' boundary a native had killed 500 trees without any grant whatever. Farther up the Weinyo were two unexplored forests, but Captain O'Brien appears not to have had time to examine them minutely, and consequently he gives no details. One of these forests is on the Thengan-nyee-Nyoung; it had the best trees which he had seen.

On the Megwa river there were about 8,000 trees, with many young plants. On the Upper and Lower Tyghee, where Cockerell and Co. had grants, there were about 1,500 trees standing. On the Kyoon Geown, another of Cockerell and Co.'s grants, there were upwards of 10,000 large trees, and as many young plants. About a mile from the Kyoon Geown, Darwood and Co. had a forest almost entirely exhausted, and higher up another forest with about 300 trees.

The Parkat forest, below the Mezelee river, produces excellent timber, but it had been much worked, and had not 1,000 trees standing.

On the Goonjee and Nat-choung tributaries the grants were held by Messrs. Agar and Richardson, but the Teak is somewhat inferior.

On the Mittigate there is a fine forest, which had been granted to Captain Biden and a native of Calcutta, named Annund Chunder Mittre; the upper part contained about 4,000 trees, the lower part had been much worked. There are two forests on the Mittigate Coodoogway which are particularly mentioned as containing several thousands of the finest possible young trees intermixed with a sufficient number of full-grown trees, which would amply repay the expense of forming a road to convey them to the stream; many trees had been killed by natives without any grant whatever. Captain O'Brien advised Government working these forests.

The Lhang-boa forests were recommended to the notice of Government as containing principally young trees and producing excellent timber from the matured trees.

Captain O'Brien does not state the number of young trees he saw, nor whether he believed those which he did see to have grown spontaneously, or to have been planted; he regretted the absence of nurseries, which he considered to be the only method by which the waste of the forests could be repaired. Sites near rills and streams well suited for this purpose were numerous. It would merely be necessary to guard against fires, by the removal of the long grass which in the dry season becomes very inflammable. No animal or insect attacks the plant.

On one of the grants of Cockerell and Co., Captain O'Brien found several instances of trees having been cut while they were in a green state, and unfitted for any useful purpose, without even an attempt at killing them previously. The natives also destroyed some of the most magnificent timber, that would have served for the lower masts of frigates, by cutting it up, either from not having possessed the means, or from unwillingness to incur the greater expense of removing large pieces to the bank of the river. Many fine trees were also shattered in their fall, no precautions having been used in lowering them.

When the working season (the beginning of December) arrives, cutters, who are also sawyers, are hired; they proceed to the spot, establish saw-pits, fell the trees, and convert them into crooks.

Bend Planks, 20 cubits 12 × 6 in.
 Square Timbers, 20 ditto ditto.
 Long round ditto, 20 ditto ditto.
 Loozars, 20 ditto ditto.

In one season a forest that produced 310 crooks, 179 pieces of bend planks, 61 square timbers, 12 long round timbers, and 11 loozars, had employed—

15 Men for crooks.
 40 Ditto bend planks.
 20 Ditto square timbers.
 20 Ditto round loozars.
 —
 95 Men in all.

After being thus cut up, the timber is rafted in the month of April, and floated down to Moulmein. The best crooks were obtained from the grants of Messrs. Cockerell and Co., on the Upper and Lower Tyghee, but they were not numerous.

A tree should be girdled or killed a year at least previously to felling, in order that when cut down it may be perfectly dead. The process is to cut a circle through the bark, at two or three feet from the ground, one inch deep and three inches wide, which causes the death of the tree. It should then be felled, and (to be properly seasoned for ship-building), should be stripped of the bark, and left to dry for another year, after which it may be dragged by elephants to the bank of the river, or converted in the saw-pits, made into rafts and floated down the river. February is the season for killing and felling, and April is the best time for constructing rafts and floating the timber.

The main streams appear always to have abundance of water to float down the timber; the subordinate streams also have a sufficient quantity generally; in the monsoon a rise of 7 or 8 feet takes place.

Captain O'Brien seems not to have inquired into the extent of the supply, calculated on the preceding 10 years' demand and consumption, though in one place he mentions that "with care" a forest might last 25 or 30 years, but he does not say what extent of forest it must be to last that time, nor how much wood can be cut from it.

Captain O'Brien, at the conclusion of his report, observed that the value of timber standing without claimants, and of that killed without grants, together with the newly discovered forests, would amply repay any outlay in making roads and in planting nurseries, by which a most valuable supply of timber would be secured.

CAPTAIN TREMENHEERE'S REPORT.—66. Captain Tremenheere started from Moulmein on the 26th February 1841, to join Captain O'Brien, and fell in with that officer on the Zimmè river, above its junction with the Weinyo, in that portion of the forests where the grants were held principally by natives. Captain Tremenheere inspected the grants of two natives, and found every tree that was worth cutting had been felled in a green state, and many young trees had been cut down: on the opposite bank there appeared the same mismanagment; he suspended the licence of one man, and desired the others to discontinue cutting or removing any timber till further instructions. He recommended the suspension of all these grants for a time.

Mr. Agar's forest on the course of the Nat-choung river had fine young trees, but was not worked in consequence of an insufficiency of full-sized trees. On Captain Richardson's grant on the Goonjee, 80 trees were girdled, and 15 saws were at work converting the timber into planks, which, owing to the winding course

of the Goonjee, was the only form in which it could be conveyed easily to Moulmein. Farther up the river there were many trees that had been girdled by a native about five years previously.

The upper part of the river Ghyne, called the Houndrow, is a clear deep stream about 100 yards broad, but the smoothness of its course is disturbed by a bed of limestone rock. Captain Tremenheere followed this stream as far as its junction with its tributary the Authan, and found well-grown Teak, but in patches which he remarked grew on the left bank of the river only, while there was none on the right bank, although the soil and circumstances of both banks were apparently the same. He therefore recommended seeds being sown on those banks, which are opposite to banks on which Teak is found, as he saw no reason why extensive plantations should not be raised on both sides. Owing to the sinuosities of the Authan, land carriage as far as the Houndrow (a distance of three miles) is recommended, the latter river being well adapted for the floating of timber during the monsoon.

Proceeding on the course of the Houndrow, Captain Tremenheere came upon some excellent Teak trees, with straight stems of great dimensions, which he ascribed to the elevation of the locality, 1,100 feet above the sea, where Teak, he thought, flourished better than in the level plains. The climate here was temperate, being 76° on the same day that the thermometer was 82° at Moulmein. This place was only six hours' journey from the Shan territory.

Captain Tremenheere remarks on the extreme slowness by natural means of the spread of Teak. He takes Teak trees growing on the Goonjee and Authan as types of the low country, and those on the Houndrow as the standard of trees growing in elevated situations, and he shows that a return might more easily and speedily be expected from planting in the plains, where also greater facility of carriage exists. The following extract from his report will better explain Captain Tremenheere's opinion :—

“ The following Table, which is designed to show more clearly the distinction between the early growth and the usual age of full-grown trees on the plains, compared with those which occupy valleys elevated considerably above the sea, represents the thickness of wood, or the increase of semi-diameter, measured from the centre, attained by each tree during successive periods, which are so chosen as to show the changes which occurred in the rate of growth, or the differences which were apparent in the average breadth of the annual rings.

No.	Situation of the Tree.		Number of Rings from the Centre.	Total diameter of these Rings collectively.	Total Age of the Tree.	Circumference.
				Inches.			Yrs.	Ft. In.
1.	In the Plains, {	On the bank of the Authan,	The first 20 rings,	10	82	8 0
The next 7 "			3 $\frac{1}{2}$			
The next 10 "			2 $\frac{1}{2}$			
The exterior 45 "			2 $\frac{1}{2}$			
2.	" {	Ditto,	The first 41 rings,	14	88	9 6
The next 19 "			4 $\frac{1}{2}$			
The next 9 "			1 $\frac{1}{2}$			
The exterior 19 "			1 $\frac{1}{2}$			
3.	" {	A Loozar found in the bed of the Authan,	The first 55 rings,	15	137	12 0
The next 19 "			2			
The next 26 "			3 $\frac{1}{2}$			
The exterior 37 "			4 $\frac{1}{2}$			
4.	" {	On the bank of the Goonjee,	The first 7 rings; the exterior 15 were of soft wood,	86	6 6
5.		 Another tree ditto,	In all 80 rings, .....			"	80	7 6
6.	1,100 feet above the sea, {	On the bank of the Houndrow, ... {	The first 91 rings, ...	12	214	10 0
The exterior 123 "			10			
7.	" {	Ditto ditto,	The first 100 rings,	11	263	11 10
The next 100 "			6			
The exterior 63 "			4			
8.	" {	Ditto ditto,	The first 92 rings,	13 $\frac{1}{2}$	212	10 7
The next 74 "			61 $\frac{1}{2}$			
The exterior 46 "			2 $\frac{1}{2}$			
9.	" {	Ditto ditto,	The first 76 rings,	12 $\frac{1}{2}$	216	11 0
The next 90 "			7			
The exterior 50 "			2 $\frac{1}{2}$			
10.	" {	Ditto ditto,	The first 44 rings,	2 $\frac{1}{2}$	221	9 6
The next 67 "			7			
The exterior 110 "			6			
11.	" {	Ditto ditto,	The first 40 rings,	5 $\frac{1}{2}$	233	13 0
The next 30 "			6 $\frac{1}{2}$			
The next 30 "			2 $\frac{1}{2}$			
The next 100 "			7 $\frac{1}{2}$			
The exterior 43 "			2 $\frac{1}{2}$			
12.	" {	Ditto ditto,	The first 88 rings,	16	251	13 3
The next 52 "			5			
The next 30 "			2			
The next 30 "			1			
The exterior 51 "			3 $\frac{1}{2}$			
13.	" {	Ditto ditto,	The first 142 rings,	28	217	12 0
The next 35 "			4			
The exterior 40 "			2			

“ Nos. 1, 2, 4 and 5, from the closeness of the external rings and other characters, had every appearance of mature trees ; the principal increase in these cases took place during the first 40 or 60 years of their growth, and the increase of bulk after that period, or for the next forty years, is extremely small : whereas with those of higher situations on the Houndrow, the difference of rate during succeeding periods was much less distinctly marked, the advance of the tree being throughout accomplished by very slow degrees.

“ The average age of full-grown trees on the Goonjee and Authan was 84 years, and of those on the Houndrow, 228 years. The average breadth of annual rings of the former was a quarter of an inch, sometimes separately exceeding one inch ; the average breadth of those of the Houndrow was one-tenth of an inch only, and seldom amounted separately to one-fifth of an inch.”

Captain Tremenheere remarks on some forests on the Houndrow which were held by natives, where timber had been felled, but had not for the want of means been removed. This timber he advised being purchased by Government, and removed with the aid of Commissariat elephants. He recommended that Government should retain for its own use the unoccupied forests in the Weinyo, visited by Captain O'Brien, as these forests had the finest trees, and were likely to furnish Government with timber on more advantageous terms than those from which supplies were then obtained. He considered also, that independently of economy, the retention of these forests by Government would have a beneficial effect on the grantees, who seeing the possession of them not lightly esteemed, would be more careful than they had been of their culture and propagation, for no seed had been sown by any one possessing grants. The Mittigate forest was particularly recommended to be retained, as the timber, from the river being unfavorable to its transport, would have to be drawn overland six or eight miles to the northward to a better part of the stream, which process would be ruinous to private individuals, but could be easily accomplished by means of Government elephants, the expense of which would not be felt.

The road from the Attaran to the Houndrow was narrow, running through a dense jungle, and winding so much as to prevent anything being seen in advance beyond a few yards ; the difficulties of surveying or making geological researches, owing to local impediments, were great, and almost insurmountable.

The geological character of the range of hills separating the Houndrow and Ghyne from the Attaran and Zimmè, and of that dividing the Shan provinces from the British territory, is described by Captain

Tremenheere: the former hills consist principally of silicious sandstone, possessing also crystalline limestone, quartz, and slate; the latter are composed entirely of granite.

MR. SEPPINGS' OBSERVATIONS.—67. Mr. Seppings thought that the supplies of Teak timber procurable from the Tenasserim Provinces had been greatly overrated, and that the tracts of land where Teak was procured were not forests of that timber, but merely patches of Teak trees which were met with here and there interspersed with other kinds of timber. The whole of the available Teak timber then at Moulmein for sale and shipment was estimated at 2,000 tons of good straight timber. In the preceding nine years, Teak timber to the extent of 5,000 loads had been annually exported, but that quantity could not be exported for ten years longer without exhausting the Teak districts then known. Crooked Teak, of sizes suited to the frames of line-of-battle ships, were procurable, but not in large quantities. A two-decked ship might have been built in five years at Moulmein, but a frigate was recommended to be first built, in order to test the capacity of the Teak districts. There was sufficient timber at Moulmein to build, in two years' time, a 36-gun frigate, with hull entirely copper-fastened, together with masts, yards and fittings, at £24 per ton,—the sails, gunner's and boatswain's stores being supplied by the Crown; whereas the hull only of a similar vessel, if built in one of Her Majesty's dock-yards, would cost £25 per ton.

Artificers were then scarce, but it was believed their numbers could easily be increased. The shipwrights were Burmans or Taliens; the joiners were Chinamen, the blacksmiths and caulkers were from Madras and Calcutta; all were good workmen, if superintended by Europeans. Mr. Seppings pointed to the steamer "Tenasserim," which was built at Moulmein in proof of his statements, and he mentioned that two pilot brigs for the Company were being built of Teak, and entirely copper-fastened, with masts and yards complete, at the rate of Rs. 189 (£18, 18s.) per ton; whereas in 1819, Rs. 278 (or £27, 16s.) per ton was paid to Messrs. Kyd and Co. of Calcutta for two similar vessels, entirely iron-fastened; and at Bombay Rs. 323 (or £32, 6s.) per ton was the price paid for the same description of vessels, only partially copper-fastened.

Mapoon, on the bank of the river three miles below Moulmein, was considered best adapted for ship-building, water for the largest

ships being found there, as the depth at low water was 5 to 6 fathoms. The shore is shelving, and the soil a mixture of clay and iron, which hardens from exposure to the sun, and is well calculated to form a good foundation for a dock.

Vessels which do not draw more than 17 feet could be taken down the Moulmein river without a steamer, and with a steamer, vessels of the largest draught may be taken down.

Mr. Seppings pointed out the importance of securing supplies of Teak timber for the Royal Navy, and with that view suggested that no more *leh mats*, or licences, should be granted, but that Government should retain the right to fell in all the ungranted forests. By this measure he thought 2,000 loads of Teak would at once be available, and could easily be removed by elephants. He recommended also the employment of qualified persons to examine the Teak and Pine forests of the Shan territory, and the appointment at Rangoon of an agent for purchasing timber for Government; and concluded his paper with again advising the establishment of a depôt at Moulmein.

68. It does not appear from these reports and journals that a single seedling had been seen growing even where the Teak tree was found in a wild state. Nature had done nothing apparently for continuing the supply, unless the absence of seedlings be attributed to the frequent burning of the jungle, or to other causes not stated.

69. On the 2nd June 1841, the above-mentioned reports and journals were submitted to the Government of India; and Mr. Blundell was desired to convey the thanks of Government to Captains O'Brien and Tremenheere and Mr. Seppings for the information supplied by them. The only defect that could be remarked was the omission of all notice of other woods than Teak. Mr. Blundell was authorized to secure the site at Mapoon, "for forming a timber depôt, and if it shall be so resolved, for building ships," and to retain the services of Captain O'Brien with the view of exploring the forests in the northern country, and of cultivating the friendly co-operation of the Shan chiefs. He was further desired to do all in his power "to promote the security and facility of communication by land and water." The proposed employment of a paid agent at Rangoon was not approved, but the employment of one or more merchants resident there for the purpose of collecting timber, being remunerated by a commission, was suggested. Mr. Blundell was authorized to collect for Government all the timber he

could get at moderate prices, and to employ the Government elephants in the collection and conveyance. These elephants were attached to the military establishment at Moulmein, in order to enable the troops to move at a short notice; and the expense of maintaining them was said to be considerable. It was expected, therefore, that the proposed mode of turning them to account would prove in every way profitable.

70. The consideration of the proposed rules was postponed, as the subject of forest control and superintendence was one that required much attention and very careful proceedings. Mr. Blundell was informed, however, that Lord Auckland was unfavorable to any propositions which might tend "to an extensive disturbance, even of very unsettled occupations"; that the primary object of the conservator should be "to mark and define the boundaries of existing forest grants, and to lay down conditions of management"; and that if the occupiers consented to abide by them, they should be confirmed in their holdings except in sites particularly required for public objects.

71. On the same date, (2nd June 1841,) the opinion of Dr. Wallich, the Superintendent of the Hon'ble Company's Botanic Garden, was requested as to the best means of perpetuating the supply of Teak, and a * Marine Despatch, No. 13 of 1841. copy of all the papers was forwarded* by Lord Auckland to the Court of Directors. His Lordship requested the sentiments of the Court, both on the measures which had been taken and those which had been proposed for the management of the forests. He pointed out the advantages possessed by Moulmein for building ships for the Navy, and solicited instructions regarding the proposal to form a depôt at Moulmein and collect timber for Her Majesty's dock-yards. On this last proposal the Court's orders were particularly solicited.

72. DR. WALLICH'S SUGGESTIONS, 1841.—On the 21st June (1841) Dr. Wallich submitted his reply. He remarked that the absence of young Teak seedlings in the Tenasserim forests was justly attributed to the destructive burning of the jungle (against which in 1827, in his report on the Attaran river, he had recommended precautionary measures being taken), as that appeared to him to be the only rational explanation of the matter. And as "it is a known fact that Teak-seeds will spring up in quantities wherever the tree is found, either in its wild state or planted by the hand of man, growing in forests or standing singly,—and that the seedlings will continue thriving and become large

trees unless choked by each other or by some dense jungle of other plants, or else destroyed by the firing of the forest,"—it was only necessary for the preservation of these to cut down every other kind of timber, and allow the Teak to spring up naturally. He observed moreover, that "some explorers may have unconsciously overstated the scarcity of seedlings, for the Teak tree was completely deciduous, and it was possible that a casual observer visiting the forests during the dry months of the year would hardly recognize the seedlings in their twiggy and naked condition, and might therefore be easily led to an inference that seedlings were never found in the natural forests." For this reason Dr. Wallich thought it probable that the officers who had visited the forests had in some measure overlooked the seedlings. He had no doubt, nevertheless, that the true cause of their *general absence* was ascribable to fires, "and that by simply removing that cause, a ready mode would be secured of filling up the vacant spaces in the forests." A strict prohibitory order was therefore necessary against foresters or others burning the coppice or underwood, and in order to promote the germination of the seeds "the lands should be freed from jungle, the ground should be loosened a little under the trees about the time the seed is expected to ripen," and above all, the young plants should be protected against injury from the "annual burning of the tall and stout grass which overruns all waste lands in those parts." Further, he considered it would be necessary, either by fencing or some other means, to keep away wild elephants and other animals that might do mischief. The establishment of local nurseries in the immediate neighbourhood of each of the principal forest tracts, and of a general nursery at Moulmein, also appeared to him a desirable measure.

73. These several suggestions were communicated to Captain Tremenheere, (who had taken up the duties relating to forest conservancy,) in order that they might be carried out; but as it had been stated that the soil at Moulmein was not calculated for the growth of Teak, and that place consequently not adapted for the establishment of a general central nursery, Captain Tremenheere was required to report particularly on that point after visiting the forests.

74. On the 8th September following (1841), the rules dated 12th April 1841 were approved by Government, but Mr. Blundell was informed of the wish of Government not to disturb the occupancy of the grantees unless on very strong grounds; he was therefore desired to report

on the practical operation of the rules before he proceeded to enforce the penalty clause, especially with reference to the prohibition against cutting up the timber, which, so far as it was designed to protect the Government duty, it was thought would admit of relaxation if that duty could be previously secured by any other arrangement. This object was eventually effected by calculating the duty on the cubic contents of each log without reference to its size, and levying the *ad valorem* duty of 15 per cent. on a commutation price of 30 Rupees per ton of 50 cubic feet. It was decided at the same time (with reference to the proposed resumption of some land in Mapoon, which was in the occupancy of Annund Chunder Mittre, and was required to form the depôt recommended by Mr. Seppings), that the occupation was one of mere sufferance, and would be withdrawn at the pleasure of the public authorities.

75. In September 1841, Mr. Blundell reported that there had been so great a rise in the market price of timber, that he considered it injudicious to purchase any on account of Government, and that the only step he had adopted towards collecting a stock of timber was levying the duty on it in kind instead of in money,—a measure which had caused dissatisfaction among the traders. Although by the rules it was optional with the Government to levy the timber duty either way, still as the practice had been to collect it in money, and this course had received the sanction of time, and the change had given dissatisfaction, Mr. Blundell was directed not to persevere in the measure, but to levy the duty *ad valorem*, and to make purchases for Government only when necessary, at the market price. The demand for timber having, however, increased, and the price having been still further enhanced, Mr. Blundell was prohibited from making any purchase of wood which had not previously been approved by a competent judge of its quality and value.

76. In January 1842, the Military Board forwarded some papers from Captain Tremenheere, containing a suggestion with reference to clause 6th of the rules, for establishing a few centrally situated nurseries, instead of having a nursery at each forest, as it appeared that the grantees were either unable or unwilling to plant young trees. The correspondence was referred to Mr. Blundell for his opinion.

77. In June 1842, a question was raised as to whether the timber, which was brought from the Shan States down the Salween river into Moulmein, was properly liable to the inland duty of 15 per cent. which

had been levied upon it, as upon timber brought from the forests within British territory. Exemption was claimed by the dealers, on the ground that Moulmein was a free port, and that a duty on the Shan timber had been previously paid to the Shan Government. Mr. Blundell upon this advised the substitution of an export for the import duty, but this alteration was not deemed advisable by the Government of India, who decided that as the Shan timber derived its value only from the circumstance of its being available for the Moulmein market, the inland duty of 15 per cent. *ad valorem* levied on it should be continued. It must be remarked here that this order of the Government of India differs from that of 1837, noticed in para. 41. The Commissioner had no authority for levying a duty on foreign timber previously to this last order of 1842.

78. In September 1842, the Military Board submitted a second report from Captain Tremenheere on the Teak forests, suggesting further modifications of the forest rules of 12th April 1841. The following is an abstract of the report:—

CAPTAIN TREMENEHEERE'S 2ND REPORT.—79. Captain Tremenheere stated, that in the latter end of March 1842 some of the Teak forests on the Attaran river were visited by Mr. Maling, the Assistant Surveyor, and the remainder by himself. The object of Mr. Maling's visit was to ascertain the extent of certain breaches of the forest rules, which had been the subject of a case in the civil court, and to define boundary lines between different forests. His route was through Mr. Richardson's grant and the Mittigate direct to Kyoon Geown, which is the southernmost forest of any extent. The purpose of Captain Tremenheere's visit subsequently, in April, was that of general inspection. He proceeded partly by the same route, but leaving the Mittigate he struck off to the Megwa forests, and to those at the head of the Weinyo. He visited the following grants:—

Goonjee Forest, held by Mr. Richardson.

Mittigate Forest, held by Annund Chunder Mittre, and worked by his agent, Mr. Fox.

Kyoon Geown Forest, held by Cockerell and Co., and worked by their agent, Mr. Sutherland.

Megwa Forest, held by Captain Clerk.

In all these grants the forest rules framed by Mr. Blundell had been entirely disregarded; many under-sized and young trees had been

killed and felled; many trees had been felled before having been killed, or before the expiration of the prescribed interval between killing and felling; many trees had been killed for several years, but had not been felled; and a great many trees had been killed, and felled above the killing mark.

The explanations of these acts given by the grantees, were chiefly that they had been done by the native contractors, or before the promulgation of the forest rules, or from ignorance, or in consequence of the appearance of decay in the tree felled. In one case, (Mr. Richardson's,) that gentleman stated that he had instituted a suit in the Commissioner's Court against some of his native contractors, for damages sustained in his grant by their violating the rules. It was evident, however, that as far as the forests above noticed were concerned the rules had been inoperative, notwithstanding that the grantees themselves had endeavoured to observe them. Captain Tremenheere attributed this to the character and habits of the Burmese timber-cutters, who always followed their own practices in killing and felling, and to the fact that only the extreme penalty of immediate resumption of the grant was provided by the rules in question for any breach of them, as it was generally believed by the natives that the Government could not desire to have all the forests thus thrown on their own hands.

Captain Tremenheere next noticed in detail the practical effects of each of the clauses in the rules framed by Mr. Blundell, with the manner in which each had been disregarded, and then suggested the following rules :—

RULES DATED 11TH JULY 1842.—" Leases will be granted to all persons who now possess the right of cutting in the Teak forests of the Tenasserim Provinces, assigned to them either by written documents, or by the felling and removing of timber carried on therein under the sanction or by permission of the civil authorities or Superintendent of forests at Moulmein. The boundaries wherein the lease-holder is permitted to cut or carry away Teak, or any other timber the locality produces, will be defined in each lease, but it will confer no proprietary right in the soil.

" The period of lease will not be limited, but will continue so long as the lease-holder shall pay the required observance to the following rules, and shall keep up such an establishment for the working of the forests, as may be considered necessary by the superintending officer.

" The transfer of a lease from one party to another must be registered in the office of the Superintendent, and no transfer will be valid without such registry.

" 1st.—Every lease-holder shall appoint a responsible agent, to be resident in the forest during the killing, cutting, and rafting seasons.

“ On the first of December of each year, the lease-holders shall make known to the superintending officer the number of gangs they intend to hire for killing trees during the season, and the number and strength of parties of men and elephants they intend to employ in felling, dragging, and rafting in their respective forests, when Government peons, in sufficient numbers to prevent any unnecessary delay or obstruction to the work, will be deputed with proper instruments to place a mark on each tree to be killed, and on each log to be brought away.

“ The peons shall make a report to the superintending officer of the number of trees or logs marked, which report, in order to prevent collusion, shall be countersigned by the agent of the lease-holder in the forest.

“ 2nd.—The position of the mark will determine the killing and felling point, which may be immediately below, but not above it.

“ Every tree marked shall be killed during the same season, and no tree shall hereafter be killed or felled without first receiving this mark.

“ 3rd.—Every tree marked shall be girdled by cutting through the sap-wood and penetrating the heart-wood, or duramen, to prevent the sap from rising.

“ This is only to be done during the months of January, February, March and April.

“ 4th.—No tree is to be killed of a less girth than 6 feet, measured at 4 feet from the ground.

“ 5th.—No tree shall be felled until the lapse of one rainy season, after being killed in the manner prescribed by Rule 3rd.

“ 6th.—No raft is to enter the Moulmein waters without a pass, bearing the signature of the agent employed to inspect them.

“ 7th.—For every tree felled, or log brought away, three young trees shall be planted out on their timber sites. This will be effected by perons employed by Government, and the expenses are to be defrayed by the lease-holder.

“ The expense of marking the trees and logs, as directed by the first rule, is to be borne by the lease-holder, at the rate of 2 annas for every tree or log marked. Any surplus over the annual outlay on this account will be carried towards defraying the charges for planting provided for by Rule 7th.

“ *Fines and Penalties.*—If any lease-holder should neglect the 1st Rule, no timber shall be allowed to enter the Moulmein waters from his forest during the succeeding year.

“ For every breach of the 2nd, 3rd, 4th, 5th, and 6th Rules, a fine not exceeding 500 Rupees will be levied from the lease-holder.

“ The fines are to be levied at the discretion of and by the decision of the superintending officer.

“ Information by letter will be given by the superintending officer to the Assistant Commissioner's Court, of the amount of fine due to Government by any lease-holder, which letter shall be considered sufficient proof of the validity of the claim, and shall be sufficient warrant for levying the amount of fine by distraint on the property of the lease-holder.”

Captain Tremenheere visited some forests on the Weinyo river at its junction with the Thengan-nyee-Nyoung, and in the Mittigate Codoog-

way, for which grants were never given, but in which many trees had been killed without permission. He confirmed Captain O'Brien's report of the great extent of the latter forests and of the excellence of their timber, and joined in the recommendation that Government should work them.

At the head of the Houndrow, Captain Tremenheere fell in with other "ungranted" forests, in which natives had without permission killed and felled the largest trees, but had not removed them for want of means; in fact, he noted numerous instances of wasteful killing and felling, and he therefore particularly requested the orders of Government regarding the leasing out of these ungranted forests.

The quantity of timber remaining in the southern forests on the Attaran, Weinyo and Houndrow, was estimated at about 20,000 trees fit for felling, and in the northern forests on the Thoung-yeen, Salween and Lhang-booa, at 7,000, exclusive of young trees, which were numerous in that direction. The Teak on the northern boundary of the Thoung-yeen river was said to be more abundant, but the forests there were held by natives, and little attention had been paid to them, the conveyance of the timber being difficult. The following extract from the report will afford some useful information :—

"The quantity of timber which has been brought from the Government forests to Moulmein between the 12th April 1841 and 12th April 1842, is as follows :—

	Long Logs, Av. 35 feet.	Loozars, Av. 17 feet.	Maat pieces.	Squares 30 feet 12 X 12 and over.	Crooks.	Bend Planks 30 feet 12 X 6 and over.
From the Southern forests } Attaran and Weinyo, }	4,798	2,103	35	461	13,563	1,358
The Northern forests Thoung- yeen Lhang-booa, and Sal- ween, }	4,771	1,157	107	3	1,390	130
Total from Government forests,	9,569	3,260	142	464	14,953	1,488

"The amount of duty realized on all timber including that from the Shan States, from 1st May 1841 to 30th April 1842, during the past commercial year is—

" On 8,944½ tons, in cash, Rs. 36,121 5 3

" On 2,062 pieces of all descriptions, in kind, equal to „ 13,019 8 9

" Total of duty received in Company's Rs. this year, (1841-42), Rs. 49,140 14 0

"The exports during this period have amounted to 8,681 tons of Teak, in value 2,60,430 Rupees, at the lowest quoted price, of 30 rupees per ton."

Regarding the nurseries which Captain Tremenheere established, he writes as follows :—

“ **NURSERIES.**—Three trials have been made this year (of growing young Teak from the seed) of nursery beds, which have been commenced at three different spots in the Attaran forests marked in the plan ;—one at the southernmost and most distant forest, at the junction of the Kyoon Geown stream and the Zimmè, near the forests of Messrs. Cockerell and Co., where the timber is best and most abundant : another on the bank of the Mittigate in the forest of that name, where also the Teak is of fine growth : the third is on the Nat-choung stream, which is one of the forests nearest to Moulmein, or about four tides’ journey. The Teak here is not large, but a nursery on this spot has the advantage of being more convenient for inspection, and is also near a village, by the head-man of which it will be in some measure overlooked.

“ At each of the two first places five beds, raised about a foot from the level of the ground, with trenches for drainage between them, have been prepared.

“ The beds average 78 feet long by 12 feet broad, and are thickly sown with seed freshly gathered from the trees in all January, soon after the seed had perfected itself. They were sown in holes about a span apart and 2 or 3 inches deep, three or four seeds being put into each hole. A few were also sown in these beds in March, having been previously soaked three hours in warm water.

“ At the Nat-choung nursery four beds were prepared. The seeds which remained longest on the tree were gathered and sown in April, the end of the dry season. Those of three beds were immersed three days in the stream before they were planted, and the rest were previously allowed to float on the surface of a pool of water exposed to the sun for an equal period,—the intention being, in the two last cases, to imitate in some degree the process of Nature, or the conditions to which the seed, in its natural state, is exposed before it is deposited on a spot favorable to germination. All the beds were watered for a few weeks after the seed was sown, and they were protected from the direct rays of the sun, and from the violence of the first fall of rain, by a slight covering of leaves and grass placed on a frame work of jungle-wood about 6 feet high.

“ The seed of Teak is imbedded in a thick and very hard stone which is surrounded by a spongy rind, a light substance of brown colour of the nature of bark. There are three distinct cells in each pericarp for the reception of the seed, but there is seldom more than one seed perfected.

“ Of about 300 stones freshly gathered, which were opened, only one-eleventh of the whole had any seed at all. All had externally the same appearance, and there is no criterion by which to ascertain whether the stone contains a seed or not. The tree produces them in great abundance, but the seed in by far the greater number appears either not to be perfected, or to wither very soon after it is formed.

“ This fact may be added to the causes I have before assigned for the very scanty increase of the tree by natural means, *viz.*, the absorption by the seed at the commencement of the S. W. monsoon of more moisture than it can assimilate ; its rapid passage from the spot on which it falls to the tidal waters, which, from the heavy rains and slope of the country, must generally occur ; and the small chance that exists of being arrested in its progress and covered with soil or vegetable matter before the seed decays.

“ About 50 seeds, in which sound kernels were found, were placed in the ground separately at the Nat-choung nursery.

“ No manure or dressing for the ground was used in any case. The beds have not been visited since April, so that I am not able to say whether any of the seed has sprung, but from the hard nature of the stone I should not expect this result till at least the termination of the S. W. monsoon.

“ About 22,000 seeds have, I think, been sown. The expense has been trifling, having been done chiefly by the peons of the establishment under the direction of the forest Goung, with three men in addition hired for about a month,—all of which has been charged in the monthly current expense bills.”

Captain Tremenheere closes his report with a very interesting description and a list of other forest trees, the uses to which those trees are applied, and the value of their timber, but nearly the same information will be found in Captain Halsted's report, in the Appendix. The Thetzee or varnish tree, mentioned by Dr. Wallich in his Report on the Salween forests, is particularly noticed by Captain Tremenheere. He says that the varnish obtained from it is extensively used in the lackering of Burmah and Shan boxes; and that it has the peculiarity of drying and hardening in the shade and in damp weather, or in damp situations. He considered it would be a very good material for coating iron-work or guns and gun-carriages.

80. Mr. Blundell appended to the report some remarks in reference to the proposed supersession of the rules of 12th April 1841, but expressed his approval of Captain Tremenheere's suggestions, and his proposed revised rules.

81. With the approval of the Government of India, the proposed revised rules were sanctioned, the only alterations made in them being that *five* young trees, instead of *three* as provided by Captain Tremenheere, should be planted in place of every tree felled, and that the Commissioner should exercise appellate jurisdiction in the cases of fines which the superintendent of forests might impose for breach of the rules. The superintendent of forests was at the same time invested with magisterial powers to enable him to impose fines not exceeding 500 rupees for any breach of the forest rules, and he was authorized to employ some additional establishment, with a view to mark off the trees to be killed and the logs to be removed, as provided by the new rules.

82. The Military Board were of opinion that the forest leases should be limited to a specific period, but this was not practicable

without a breach of faith with those who held licences at the time, though the Government appear to have had it in contemplation, and to have expressed the intention, in the event of granting leases for unoccupied forests, to limit such new leases to twenty years, renewable on the expiration of that time, conditionally on the lessees' strict observance of the rules. The grant of leases for unoccupied forests was in the meanwhile prohibited, pending the receipt of orders from the Court of Directors, on the reference which had been made to them by Lord Auckland.

83. In February 1842 the orders of the Court of Directors were received. The Court reviewed the measures of the Government and the local authorities, for the management of the Teak forests, from the earliest period down to Captain Tremenheere's appointment, and expressed doubts as to whether the rules which had been framed by him would be sufficient to meet all the difficulties which had arisen. The Court were of opinion that a proper survey of the forests was an indispensable preliminary to any new system, but they thought that it was scarcely possible for the conservator, with the aid of any establishment which could be allotted to him, to exercise so minute and searching a superintendence over such extensive forests, as would enable him to prevent the felling of other trees than those selected by himself, or to see that the business of planting was properly attended to. But even if such interference were practicable, the Court considered it would still be undesirable to commit to any individual powers so liable to abuse.

84. In order to insure the preservation of the forests held by private persons, the Court were of opinion that it should be the object of Government to make it the interest of those persons to take care of them, and to remove all temptation to injure them. For this object long leases should be granted on condition of the payment of a certain percentage on all timber felled, and under an obligation not to clear the land for cultivation or to employ it for any other purposes besides plantation. The felling of timber below a certain size should be strictly prohibited; and a modification of the duty might be made to check the wasteful practice of cutting up large timber. The farmer would then have an interest in the improvement of his forests, and would probably be inclined to plant of his own accord. Even if he neglected to do so, the self-sown plants, which he would no longer have any object in destroying, would in most other situations insure to some

extent the perpetuation of the forests. The Court also suggested that it should be made obligatory on the farmer to supply the places of the trees felled by him, by forming new nurseries and carefully rearing the young plants until they attained maturity; that Government should reserve to itself the right of forming nurseries at the farmer's expense, in the event of his failing to do so; and that the conservator should be allowed to exercise such a limited control over private forests as would merely enable him to see that these conditions of the lease were observed. The conservator should also attend to the forests retained for the public service, and Government should reserve to itself a resource independent of the market, by selecting for itself from the ungranted forests such as were conveniently situated, and sufficiently extensive for all purposes, and placing them under proper management, so as to afford a constant supply of timber, both of Teak and of other useful kinds indigenous in the country.

85. With regard to securing supplies of timber for the Royal Navy, or for building vessels of war at Moulmein, the Court stated that Lord Auckland's Despatch of June 1841, representing the advantages possessed by Moulmein for those purposes, had been laid before the Lords Commissioners of the Admiralty, but that their Lordships had declined to recommend the employment of the timber of the Tenasserim Provinces, on the ground that there was reason to think it possessed no desirable qualities. In consequence of this intimation, the Court desired the Government to abandon the idea of forming a building-yard or of collecting a stock of timber at Moulmein, for shipment to Europe, and simply to confine their attention to supplying the demands of the Indian Governments, and to the preservation of the Tenasserim forests in the manner that had been suggested.

86. In accordance with the sentiments and order of the Court, Captain Tremenhære's attention was directed to the preservation of the forests held by private individuals. He was desired to discontinue forming the stock of timber which had been ordered in June 1841, and to retain the unoccupied forests to supply the wants of Government, working them with the aid of Government elephants, when they were available for the purpose, or when the application of their labor might fall short of the assistance required, to have recourse to contracts in preference to any other system. A report was also required of the arrangements to be made for the general management of the forests,

and on the subject of the unfavorable opinion entertained by the Lords of the Admiralty of the qualities of the Tenasserim Teak. On this point the Marine Board were desired "to call upon Mr. Seppings, the surveyor of shipping, to state his opinion of the qualities of the timber of the Tenasserim Provinces, for the construction of ships, as formed from the examination of vessels built with it." Accordingly Mr. Seppings submitted a memorandum, (a copy of which was sent to the Court of Directors,) from which the following extract is made :

MR. SEPPINGS' MEMORANDUM.—"Teak is the most durable, but differs very much in quality. I will first speak of Malabar Teak, of which there are two kinds, the Northern and Southern ; the first is far superior in point of durability, but more difficult to procure, which I believe arises from the land carriage, or from its not being felled near the rivers and streams of the country. The Malabar Teak is classed at Bombay as follows :

"Northern curved timber, which is brought a distance from Bombay, of from 130 to 140 miles.

"Southern Calicut Teak.

"Northern Pattey or straight timber, used for small vessels and boats.

"Bassein curved timber.

"The great length of time several vessels have lasted, from thirty to fifty years, built of Malabar Teak—in some particular instances they have run nearly a century—makes me designate the prime Malabar Northern Teak the most valuable timber in the world for ship-building. It is however, like every kind of wood, liable to early decay if not properly or gradually seasoned by exposure to a moderate current of air after being felled.

"To show how much I desire to see the Malabar Teak used in preference to any other wood, I beg to give the following extract from a letter, dated 25th January last, addressed by me to the Marine Board : 'In conclusion, I beg to state that economy and efficiency point out the use of Malabar Teak in the construction of all vessels having to endure the heat of a tropical climate. So important is the use of this very valuable wood, for so it may be justly termed from its great durability, that I addressed the late Commander-in-Chief, Sir E. Owen, suggesting its more general introduction in the construction of ships for His Majesty's Navy, particularly in such men-of-war as may be destined for hot climates.'

"I have unfortunately mislaid my letter to Sir Edward, but I think I stated that if Teak was only partially used, it would be an immense saving to the State, *viz.*, the whole of the outside and inside plank and thick stuff, from ten strokes below the upper edge of wales [upwards] together with the beams, waterways, shelf-pieces, &c., of the decks, to be converted from good Teak-wood ; all of which should be connected together, or fastened by bolts and nails, excluding all treenails, which never last in a hot climate when exposed to the rays of a tropical sun, which causes them to shrink ; water then oozes in, and rot ensues ; one of the first Calcutta-built ships called the *Nonsuch*, I was informed by Mr. White, (late a merchant builder at Chittagong,) was

completely ruined by being treenail-fastened ; he observes—‘ I examined her when fourteen years’ old, and found the timbers completely rotten all round the treenails.’ Again, I have seen so many instances of decayed or perished treenails above water, in Europe-built ships visiting this port, that I have no hesitation in giving it as my decided opinion that they are the cause of early decay in many Europe-built vessels in India.

“ India-built vessels, with the exception of the *Nonsuch* and one or two others, have their hulls entirely fastened with iron, or iron and copper ; the latter of course is by far the most preferable, on account of the corroding nature of iron, particularly under water. Malabar Teak is so seldom imported into Calcutta, from the expense of bringing it round Ceylon or on account of the distance, that it may be said never to be used in the building of any Calcutta vessel, large or small.

“ Pegue and Moulmein Teak is extensively used by the ship-builders of the Hooghly, and is the only description of Teak imported in any quantity into the Calcutta market ; it is brought in a half wrought state, the logs or planks being squared. The usual size and dimensions of them are given in the annexed statement :

Description of Teak Timber imported from Rangoon, Moulmein, and the Tenasserim Coast into Calcutta.

Description as imported or brought into the Market.	Prices including original cost of the Timber, removal from the Market, with all charges of Coolies for bringing to the pit all losses by unsoundness.			Length averaging.	Moulded or Breadth averaging.		Sided or Thickness averaging.	
	Rupess.	Annas.	Pic.		Each.	Feet.	Inches.	Feet.	Inches.
Teak, Crooked Large, at	40	0	0	each	18 to 20	1 6 to 1 4	1 1 to 1 3	
Ditto ditto Middling ditto, at.....	25	0	0	”	15 ” 20	1 3 ” 1 2	0 10 ” 1 0	
Ditto ditto 3rd sort, ...	15	0	0	”	14 ” 20	1 2 ” 1 1	0 7 ” 0 9	
Ditto, Boat Timber Large to side from 6 to 4 1/2 Inches, at	6	0	0	”	... ..	... ..	... ..
Ditto ditto to side from 4 to 3 Inches, at	3	0	0	”	... ..	... ..	... ..
Ditto, Duggies Large, at	45	0	0	”	28 ” 32	1 6 to 1 9	0 11 to 1 1	
Ditto ditto Small, at	32	0	0	”	25 ” 27	1 0 ” 1 5	0 9 ” 0 10 1/2	
Ditto Keelpiece Large, at	50	0	0	”	50 ” 60	1 8 ” 2 0		Square.
Ditto ditto Small at	45	0	0	”	45 ” 50	1 4 ” 1 6		Ditto
Ditto Artes Long, at ...	20	0	0	”	24 ” 24	1 0 ” 0 0	0 8 to 0 0	
Ditto ditto Short, at ...	16	0	0	”	14 ” 20	0 10 ” 0 0	0 5 ” 0 0	
Ditto Loosars, Large, ...	30	0	0	”	16 ” 0	1 8 ” 0 0		Diameter.
Ditto ditto Small,	24	0	0	”	14 ” 0	1 3 ” 1 0		Ditto
Ditto Mastpiece Large, at	10	0	0	per foot.	65 ” 80	1 10 ” 1 6		Ditto
Ditto ditto ditto Mid- dling, at	6	0	0	”	60 ” 70	1 5 ” 1 2		Ditto
Ditto Mast, Small, or Spars, at	70	0	0	each	40 ” 50	0 9 ” 1 1		Ditto
Ditto Gun Carriage piece at	20	0	0	”	16 ” 0	1 6 ” 2 0	0 6 to 0 8	
Ditto Bend piece, at ...	100	0	0	”	55 ” 65	1 6 ” 1 2	0 6 ” 0 8	
Ditto Sheathing Board, Long, at	80	0	0	percent.	20 ” 0	0 10 ” 0 0	0 0 1/2 ” 0 0	
Ditto ditto ditto Short, at	60	0	0	”	12 ” 0	0 8 ” 0 0	0 0 1/2 ” 0 0	
Ditto prime Shinbeen, at	16	0	0	each	25 ” 27	1 3 ” 0 9	0 3 ” 0 4	
Ditto Indifferent, at ...	10	0	0	”	25 ” 0	0 11 ” 1 4	0 2 ” 0 2 1/2	

“The Pegue and Moulmein Teak is a coarse, porous, open-grained wood *when compared with Malabar Teak*; its weight, when moderately seasoned or dry, may on an average be stated to be 42 lbs. per cubic foot, whereas the latter, Malabar Teak, is from 45 to 52 lbs. per cubic foot, on an average.

“The forests of Tongnyo and Sarrawaddi supply the whole of the Pegue Teak. The first grows the best quality, the country being high and not flooded during the rainy season, whereas the latter is always in a swampy state, and part of the year covered with so much water as to allow the trees to be floated from where they are felled. The Burmans are in the habit of tapping the Teak tree,* particularly those which are straight grown, to extract varnish or oil from the capillary tubes, which is highly prized by them, and used chiefly for protecting their pagodas, or temples of worship, from the weather, which it effectually does for twelve months. These sacred edifices are built entirely of Teak, the principal parts being sunk in the ground, and although so fixed remain perfectly sound, notwithstanding many of them have stood nearly a century; they are all built of untapt Teak, as the Burmans consider the Teak much injured both in strength and durability, by being deprived of its oil.

“The importation of Teak from Moulmein and the Tenasserim coast has only taken place since the Burman War; prior to that period Calcutta was supplied almost exclusively from Rangoon, but only with straight Teak: the Moulmein market first imported crooked Teak timbers, which sold at such prices as to induce the Rangoon merchants to send crooked timber from thence: the quantity, however, is so very limited, that the greatest difficulty is experienced at present upon the Hooghly in completing, without great delays, vessels of from 100 to 400 tons, entirely of Teak: the only vessels that have been so constructed are as follows:

Sylph.—Opium Clipper, 300 tons, built in 1831.

Lady William Bentinck.—Pilot Brig, 200 tons, built in 1834.

Cowasjee Family.—Opium Clipper, of 430 tons, built in December 1835.

Hope.—Floating Light, 180 tons, built in 1834.

Rob Roy.—Opium Clipper, 333 tons, built in 1837.

“The short period of time these vessels have been launched, prevents any comparison being drawn as to the respective durability of Pegue and Moulmein Teak with Malabar Teak. My long experience in my profession in India, however, enables me to say that the Pegue Teak is not to be relied upon, particularly that of a pale brown, which I have seen go rapidly to decay. Pegue and Moulmein Teak is generally of a very mixed quality, and the importation so limited that it is almost impossible to select from the various cargoes brought to Calcutta a sufficient quantity of what may be termed *prime timber* (dark, close-grained Teak) to build a vessel of 200 tons. Inferior as it is in quality when compared with the Bombay Teak, I prefer it to the Saul or Sissoo brought to Calcutta within the last fifteen years. The accounts I have heard of the forests of Pegue and Tenasserim are, that they are inexhaustible: and if encouraged and properly worked, would supply timber of the largest size and in sufficient quantity to meet the whole supply required for the royal yards of England. I have particularly

* This statement is probably quite erroneous, the tapping being practised on another kind of tree, wholly distinct from Teak.—*Vide ante*, “Report,” p. 14, para. 35.

noticed in the batches of Teak brought from the Tenasserim coast, a species of dark-coloured Teak (approaching to black) which appears to be of a superior description; it is very tough, and the grain close and irregular. I am informed it is brought down from the forests mixed with the common or brown Teak. The following useful information I obtained from Captain Touzar, who was engaged in the Moulmein timber trade, October 1832.

“The head Burman carpenter mistry offered to supply and trim Teak timbers all round at 4 Rupees each (for a ship of 400 tons), or to execute the whole of the work as it regards the supply of carpenters for Sicca Rupees 10,000, including joiners' work for hull, masts, yards, &c.

Price of Teak crooks at Moulmein :

1st sort, large to side, about, 12 to 15 inches, each 7 Rupees.
2nd ditto, middling ditto, 11 „ 8 „ „ 3 to 5 „

Cashmere Merchant's Cargo (imported into Calcutta) cost at Moulmein in 1832 :

From 15 to 18 feet in length, $\left\{ \begin{array}{l} \text{1st sort, large, each 9 Rupees.} \\ \text{2nd ditto, middling, . . . „ 6 „} \\ \text{3rd ditto, small, „ 4 „} \end{array} \right.$

“Boat timbers to side from 3 to 6 inches, from 4 to 7 feet long, 20 to 25 Rupees per hundred.

“The other kind of Teak used in India for ship-building is the Java, of which, during the time the English governed that island, considerable quantities were imported into Calcutta. Of late years scarcely any has been imported deserving of notice. From what I have seen of the Java Teak, it is of a superior quality; and judging from the vessels I have examined, built of that wood, I should say it is nearly equal to Malabar Teak.

“All descriptions of Teak, if sound and free from defects, such as sap-wood, partial decay, and such like unsoundness, are proof against the white ants; whereas all other descriptions of timber are liable to the attacks of these destructive vermin, which in India are frequently the cause of most serious injury to vessels; completely destroying the component parts of the hull, wherever they make a lodgment. No conception can be formed, except by those who have witnessed it, of the devastation, if I may so express myself, the white ants occasion; I have an instance now under my hands, the Hon'ble Company's Steamer the *Ganges*, particulars of which I will relate, as it deserves to be recorded. The Commander of this vessel reported to me that the rudder would not go over. On examining it, I found the head had cast or was out of a centre, which occasioned the rudder to take the counter plank. I desired it to be unhung and the hole to be enlarged. On cutting away the timbers, or chocks, which formed the sides of the hole, they proved rather soft, which made me search further. On doing so, the white ants made their appearance. I then took some of the inside planks off, when several nests presented themselves, swarming with millions of these insects: so extremely defective were several of the timbers, that prior to removing the parts badly eaten I called a special survey and the attention of several scientific gentlemen to witness and report the havoc that had been done. Several of the heads of timbers abaft under the wing transom quite destroyed, and the stern-post so much injured as to

require to be scarfed more than half way down. After opening out the hull in other places, I found several other traces of these destructive vermin, making it absolutely necessary either to sell the vessel out of the public Service, or go into a heavy repair, (which has been duly reported upon, and is now before Government.) From what has been stated, it will be evident that the principal lodgment of the ants had been made abaft, under and above the wing transom ; now this very part about four years ago had been opened out, and was found to be perfectly free from white ants, and the timbers quite sound. The *Ganges*, previous to this opening out had been steamed to a very great extent for nearly two days ; the hull, previously to being steamed, was made perfectly air tight ; to such a degree was it carried that the very dammer was melted out of the seams of the deck, and where the caulking was bad, the steam issued out from the top sides. I mention this fact, because it has been positively asserted that steam will exterminate the white ants ; so far from this being the case, I could, if necessary, give other instances where it had failed equally as much as in the *Ganges* ; besides, the steaming of vessels, I am convinced, is prejudicial to durability : the operation is so searching, (if properly done by a steamer alongside) that it insinuates itself into parts where there is scarcely any circulation of air ; the consequence is, condensation takes place, the water so left is decomposed and rots the timbers and planks. To show that Teak (if sound is proof against the white ants, the Teak planks covering the *Saul* and *Sissoo* timbers (of the *Ganges* so infected with white ants) are perfectly sound and untouched, except the surface of three slightly eaten, which evidently has been occasioned by the inner surface of the planks being soft. If the white ants are closely watched, it will be observed they emit from their mouths a viscous kind of matter which, in my opinion, has the effect of softening and decomposing the wood they attack.

87. In August 1843, there was a correspondence on the subject of the duty on timber. Major Broadfoot, who had succeeded Mr. Blundell as Commissioner, finding that while the Tenasserim and Shan timber was subject to an impost at Moulmein,—the former under the Rules of 1829, and the latter under the Order of 1842 (see para. 77)—the timber taken to that place from Martaban was free from all duty, and that this exemption gave rise to many evils, thought it necessary to impose a duty of 15 per cent. on Martaban timber likewise, and requested authority from Government to levy the same amount of duty on *all foreign timber*. The Bengal Government, however, adverting to the inconsiderable income derived from the impost on foreign timber, to the serious hindrance which it offered to trade, and to the injurious effects it must have on the prosperity of Moulmein and the Tenasserim Provinces, referred to the Government of India, and with the approval of that Government directed (on the 18th March 1844) the entire abolition of the duty which Major Broadfoot had levied on the Shan and Martaban timber, and declined to sanction any impost on foreign

timber imported into Moulmein. This step was entirely approved by the Court of Directors in para. 5 of their Despatch No. 6 of 1845, in the Separate Revenue Department. With regard to the Government forests, instructions were given to continue levying rent from the lessees for the privilege of felling trees under the Rules of 1841. Major Broadfoot, however, delayed carrying out this Order in as far as it related to foreign timber, considering that it would cause a needless sacrifice of revenue ; but in order to meet the wishes of Government in some measure, he reduced the rate of assessment, although he was of opinion that the former rate "did not prevent a great increase of the timber trade," which was then in a thriving state. Subsequently Major Broadfoot's successor, Major Durand, represented these facts to Government, and showed that after the changes which had been made in the mode of measuring and valuing the timber, the duty amounted to only 5 per cent. *ad valorem*, which he thought was a very moderate and unobjectionable tax. Under these circumstances the Government of India, on the 4th October 1845, sanctioned "the levy of a duty of 15 per cent. calculated on a valuation at the rate of Co.'s Rs. 14 per ton on all timber imported into Moulmein, whether the growth of the Tenasserim Provinces or of any foreign territory."

88. Major Broadfoot, in the same letter, reported the measures he had adopted for levying salvage on timber which had drifted from its depôt, and had been recovered from being carried out to sea and lost. The quantity of timber carried away by the floods was stated to be "enormous," and in the endeavours which were made to secure it, "the whole course of the river became a scene of violence," and often the timber was detained by the salvor and appropriated to his own uses. Major Broadfoot therefore issued a "Circular Order" which provided for the protection of this timber, and for the payment of salvage on its recovery. The Native timber owners were satisfied with this Circular Order, but the Europeans objected to it on the ground that in America salvage was not allowed under similar circumstances. As the precise nature of these objections was not stated, Major Broadfoot was desired to communicate with the European merchants, and report their sentiments on the subject. No report however appears to have been furnished, nor has the subject been traced again on the records.

89. In September 1844, a Despatch was received from the Court of Directors, dated the 26th June, in which the Court noticed Capt. Tre-

menheere's revised Rules of 1842, quoted in paragraph 78 of this Summary, and approved generally of them ; but they objected to those clauses which required lease-holders to report at the beginning of each season the number of men and animals each proposed to employ in his forests, and placed restrictions in regard to the felling of trees. " These regulations," the Court remarked, " must often prove exceedingly vexatious, and they can only be enforced by means of a number of petty officers invested with powers which ought not to be placed in such hands"; they therefore repeated their suggestion for giving long leases, on such conditions as would make it the interest of the lease-holders to preserve the forests and maintain a succession of timber trees on their lands. The Court at the same time expressed their approval of the intention of Government to retain the ungranted forests in the Tenasserim Provinces for the supply of the wants of the public Service.

90. On the 2nd October 1844, Captain Durand reported his having directed the partial removal of " the restriction which Major Broadfoot had issued on the 2nd August 1843, for the killing and felling of timber in the Thoung-yeen forests." The order by the latter officer is stated to have been given with a view " to check the system of oppression under which the Karen inhabitants of the Thoung-yeen districts had long suffered." It has not been traced in this office, and therefore neither the particular circumstances which called for it, nor its precise terms can be ascertained; it appears however, from the correspondence, that timber cutters had proceeded to the Thoung-yeen forests, in which the Karens seem to possess the forest rights, and without authority had cut timber, employing the Karens themselves for the purpose of killing and felling the trees, and either not remunerating them for their labor or maltreating them. Major Broadfoot's prohibition put a stop to these proceedings so suddenly, that the timber-cutters could not even remove the trees which they had felled and killed. On a representation of this circumstance by some of the parties interested, Captain Durand permitted them to proceed to the Thoung-yeen forests to bring away this timber, and deputed a native officer, or Goung-gyounk, to accompany them and arrange all disputes which might arise between the claimants to the timber. Captain Durand was anxious also to conciliate the Karens, and to induce them to settle along the Thoung-yeen Valley, as the ill treatment they had received at the hands of Talayens, Burmese, and other classes for a long series of years, had driven them to employ

fire and other means of diminishing the value of their forests, and thus of obtaining freedom from oppression by discouraging the visits of strangers. Captain Durand, however, hoped by protecting them to make them "the best conservators of forests which the British Government could employ" on the Thoung-yeen. He accordingly issued some instructions with the object of securing to them the common rights of British subjects, and of making them value those rights. No orders were issued on this matter.

91. About the middle of 1844 Captain Tremenheere deputed his assistant, Mr. Maling, to survey and report on the Thoung-yeen Teak forests, (which had not before been surveyed,) preparatory to adopting proper measures for protecting those engaged in the timber trade, and more particularly the oppressed Karens who inhabited those forests. The report of Mr. Maling was submitted by Captain Tremenheere with his own remarks. These papers will now be noted along with that officer's observations on the Rules required for the management of the Thoung-yeen forests.

92. It may be stated here that a recommendation had been made to Government for increasing Mr. Maling's salary to that drawn by a Senior Sub-assistant in the Survey Department. This was sanctioned on the 7th November, on its being ascertained that the receipts on account of the Teak Forests Department were in a favorable proportion to the charges, as will be seen from the following statement :

Receipts and Charges on account of Teak Forests in the Tenasserim Provinces for the Years 1841-42 to 1843-44 inclusive.

PROVINCES.	1841-42.		1842-43.		1843-44.		Total three Years.		REMARKS.
	Receipts.	Charges.	Receipts.	Charges.	Receipts.	Charges.	Receipts.	Charges.	
Amherst, ...	50,634	1,003*	53,024	0	29,464	100	1,33,022	2,003	* This item includes Captain O'Brien's salary and expenses. † The proportion of the charges to the receipts is only 1½ per cent.
Mergui, ...	95	0	0	0	0	0	95	0	
Tavoy, ...	364	0	0	0	0	0	364	0	
Grand Total, ...	.....	.....	.....	.....	.....	.....	1,33,481†	2,003†	

MR. MALING'S REPORT.—"The river Thoung-yeen takes its rise in the mountains called Kyokhet, about 120 miles from Moulmein in a S.S.-Easterly direction, and

continues its course nearly N.-W. to Lat. 17° 50' 46" N., emptying itself into the Salween river at the northernmost point of the British territory, about 80 miles from Moulmein. Its average breadth is about 80 feet, and its waters during the N.-E. monsoon are perfectly clear, with a sandy and rocky bottom. The country towards its junction with the Salween is mountainous to its very banks, but here not a single Teak tree is to be seen. Above the point at which the main road from Zimmè crosses the Thoung-yeen, the country is comparatively level near the river, but gradually rises towards the ranges of the mountains on either side of it.

"The Tav-oke Choung is the highest forest visited by me. The Thoung-yeen here is shallow and rapid, and timber is never brought from above this point, nor does the road for elephants or men extend beyond it. It contains several hundred trees, of the largest size and of very straight growth, increasing in number towards the tops of the hills. A few hundred trees have been girdled in this forest by a Karen named Tha-dok, late Thoochee of the village of Koklaik, but as yet no trees have been removed, on account of the great difficulty that would occur in dragging them to the main stream, as the Tav-oke Choung is too rocky and narrow to allow of timber to be floated down it, and even when dragged into the main stream it would require many elephants to push it along, the water being very shallow. Teak is said to be more abundant on the Shan side, opposite the mouth of this stream.

"The next forest below Tav-oke is on the Megualar stream, which is equal in breadth to the Thoung-yeen. This forest extends for several miles on either side of the Megualar, and has been partially worked by the Karens of that district. Teak is the prevailing tree in this forest, and grows larger than any I have seen; one measured by me was 14 feet in the girth. Young trees are growing up annually, but a great many of them are destroyed by wild elephants, as well as by those used by persons employed to drag and bring down timber. The five elephants with my camp were observed to destroy, daily, numbers of young trees amounting often to two or three hundred. Nga Bean has worked in this to the extent of seven or eight hundred trees, but as yet about three hundred only have been removed. Teak occurs in occasional patches of from fifty to a hundred trees between the Tav-oke and Megualar Choungs, but is to be found of much finer growth towards the hills.

"About four miles to the eastward of the mouth of the Megualar stream is a Fir forest, extending several miles in a N.-Westerly direction. The soil on which this tree is seen to grow is of a red gravelly nature, and the country here is never flooded. The Fir does not grow to a very large size, and the bark is very thick; I doubt whether a spar of three feet circumference, after taking off the bark, could be procured. The Karens annually destroy a great many by making a large incision near the root of the tree for the purpose of extracting the turpentine, which they use in great quantities for making torches. Few trees of other kinds are intermixed with the Fir, and young trees are growing up annually.

"Following the downward course of the Thoung-yeen, Teak occurs in occasional patches near its banks; it is more plentiful near the hills called Kyokhet, where the banks of the river are upwards of 300 feet high. There is a fall of about six feet in the bed of the river, which is caused by the projection of two rocks, between

which there is not a water-way of more than six feet during the dry season ; this makes it very difficult for the foresters to bring down the timber from the forests above this. The usual mode of passing the hill grain down this river, adopted by the Karens, is by raft, which they form by lashing together 10 or 12 bamboos : this raft they do not hesitate to guide down the falls, but several accidents have occurred, sometimes attended with loss of life. There are several villages inland between Megualar and Kyokhet Hill. One of the Karens of Kyokhet brought a piece of wood to me, which he stated as being the most durable wood used by this race of people for making spears, dar-handles, &c., and that this was the only place from whence it could be procured. The tree itself grows to a large size, and will not float even when seasoned. The wood is not known to Burmans in Moulmein.

“Twenty-two miles to the Westward of Kyokhet is the old town of Meerawaddi, situated in a bend of the river. It is surrounded by a brick wall 10 feet high and 8 feet thick, in the form of a square, and has two entrances, N. and S. Nothing now remains but the ruins of several pagodas in the midst of jungle ; fruit trees of different kinds, but principally the mangoe and jack, are plentiful, on either side of the river. On the right bank or Shan side of the stream, young Teak trees are very numerous, while scarcely an old tree is to be seen.

“There are extensive plains commencing about five miles East of Meerawaddi, which were formerly used by the inhabitants for cultivating grain. The Fir forest before mentioned extends as far as the old town, but is not seen to pass the Meplai stream. This stream is about fifty feet broad, and takes its rise from a hill of the same name ; it is well calculated for bringing down timber of any size, and abounds in Teak of very fine growth.

“The Mekenai and Laumat Choungs are tributaries to this stream, and on their banks young trees are very numerous, but large timber is not as abundant as on the Meplai. These forests have been worked by the Karens of Mekenai village, but no killed trees have as yet been felled ; the fallen or dead trees only have been removed. The Teak is of very straight growth on Meplai Hill, rising without branches to the height of upwards of 100 feet ; they could only be brought away by an efficient force of men and elephants.

“The Thengan tree, which is used by the Burmese for making their boats, is very plentiful on Meplai Hill. On the flat country between the range of hills and the stream, the soil is rich and of a black sandy nature, and the underwood so thick as to prevent persons penetrating it on either side of a small road or pathway, made by the Karens in travelling from one village to another.

“Teak is not to be seen for more than two miles inland till you arrive at Kamokla, where it grows very large. The Karens of the village of Kamokla have killed a great many trees ; there are three rapids at Kamokla, over which it is very difficult to float timber except during the months of December and January. The banks of the river are perpendicular, and very high.

“The Padouk tree is very plentiful on this hill. Below Kamokla is the Mieraway Choung, which is the highest point worked to any extent by the natives from

Moulmein. Teak is very plentiful on this stream, as well as on the smaller ones tributary to it.

“Tegahore is the next stream, and one of considerable breadth, abounding in Teak of the largest dimensions. The country below Kamokla is more hilly than above it, and the river is broader, with sand-banks sometimes a mile in length.

“Terrapensike, so called on account of the mangoe tree growing there, contains very fine Teak.

“Tannoo and Winsaw are the two streams which have been mostly worked, but the whole country between the Kamokla Hills and Maithee Choung is covered with Teak, and on many of the intervening streams Teak is the prevailing tree. Very few of the Teak trees that have been brought to Moulmein from the Thoung-yeen forests appear to have been seasoned timber, for the wood of this district will never float till the lapse of four years after girdling. The quality of the timber cannot therefore be said to have had a fair trial, for that which might have been partly seasoned has been brought down intermixed with dead timber, without which it could not have been floated.

“All the tributary streams, as well as the main river, are full of sunken timber cut down before the tree has been properly seasoned. On each of these streams Karen villages occur at intervals of 10 or 12 miles. These Karens stated to me that they had only commenced killing timber four years ago, and that before that time all the timber brought away from the Thoung-yeen by Burmans was “Nat-that,” or trees that have perished from natural causes.

“The Karens annually destroy a great number of young trees in clearing away the jungle for their cultivation; they prefer spots where young Teak abounds to any other, the soil being generally richer and well elevated. The young tree shows itself in all the Thoung-yeen forests of all sizes, and bears a proportion of 10 to 1 to the old trees; in some parts, as near Meerawaddi, the young Teak is seen to spread for miles, and often unmixed with other young trees.

“Lance-wood may be procured from the hills near Maithee stream, but I could not ascertain if it was procurable in any large quantity, having only met with three or four trees. It grows very straight, to the height of about forty feet, and is from three to four feet in girth. It is used by the Karens for making bows.

“The next stream below Maithee of any size is the Weenwee, issuing from a smaller range of mountains connected with the Toung Ghee by small hills. Teak is very scarce about here, for only a few patches of trees were seen by me between Maithee Choung and the main road from Zimmè to Moulmein. Below this road, about half way to the mouth of the river, only one small clump of from 20 to 30 trees was seen on a small creek, but the timber was very small and of very inferior quality.

“The march here is also very tedious, as along the bed of the stream is the only way practicable, crossing and recrossing it from one sand-bank to another without any shelter from the sun; several elephants have died of fatigue in performing this journey.

“The road from Moulmein to the higher forests on the Thoung-yeen is called the Koklaik-lau, as it passes through a village of that name, commencing at Megalon on

the Houndrow river. It is of considerable breadth, and practicable to horses and elephants; where it crosses the range of mountains there are three ridges, but these are neither steep nor very high. It falls on the Thoung-yeen about 3½ miles north of Meerawaddi, which may be reached by this road in 9 days, marching about 8 hours a day.

“The next road below this is the Nubboo Lau, which verges on the left bank of the Nubboo stream, a tributary to the Lhang-booa river, and takes its rise in the Toung Ghee Mountains. This road is not much used at the present time; the passage over the mountains is practicable to elephants, but not to horses or other cattle. It reaches the Thoung-yeen river opposite the village of Melamar, at the mouth of the Melamar stream, and occupies from 10 to 12 days from Moulmein.

“There is another road which is generally used by the wood-cutters, being the shortest way to the forests worked by natives of Moulmein, but this is far more tedious than the other two, and very difficult to ascend. By this road the passage from Moulmein to the Thoung-yeen occupies only 7 days. Last year two elephants were killed descending Daunat Toung. This road commences from Daghyne, and crosses the Thoung-yeen between the Tunnoo and Winsaw streams.

“The lowest and most frequented is the main road from Zimmè, and by which the greater part of the Shan cattle is brought to Moulmein. It leads through a gorge in the Weenwee Hills, a branch of the Toung Ghee, and might be made practicable for carts or caravans between the Thoung-yeen and Moulmein.

“The total number of trees said to be killed on the Thoung-yeen, and which are claimed, is as follows :—

By Burmese,	} (<i>Not stated in original.</i>)
„ Karens,	
The higher forests, that is, from Megualar upwards, are estimated to contain,	10,000
Mepelai stream,	1,000
And the streams between Kamokla and Maithee Choung, upwards of 3,000 each,	39,000

—Being in all, including felled trees and those fit for felling,—(*Not stated in original.*)

“These numbers are given from information derived from the Karen inhabitants of the district.”

CAPTAIN TREMENEERE’S REMARKS.—93. On the question of conservancy, Captain Tremeneere was of opinion that the Karens of the Thoung-yeen forests should have an actual and not merely nominal property in the timber of their native forests, precautions being taken at the same time to prevent monopolies. With respect to the working of these forests, he thought it would be sufficient to assign a specific girth within which no tree should be felled or brought down, except under the penalty of three times the ordinary duty, and of a quadruple duty for every tree brought down before it is properly seasoned. This

rule could be enforced without any direct supervision of the forests, as any infringement of it would be easily detected by the collector of timber duties on the timber-rafts arriving at Moulmein, and as no provision was necessary for the perpetuation of the Thoung-yeen forests, which renovate themselves.

94. The consideration of these suggestions was postponed by Government, because the Commissioner was desirous that no rules for the Thoung-yeen forests should be introduced until he should have ascertained the state of the Karen population there.

* 5th February 1845.

A copy of Mr. Maling's report was forwarded* to the Agricultural and Horticultural Society, and has been published in part 1, volume IV. of their Journal.

95. In February 1845, instructions were issued for levying the duty on timber in money, instead of in kind, and for the abolition of the Government timber dépôt at Moulmein,—it being intended that Government should enter the market when timber was required for public purposes, in the same manner as other purchasers. In April following Mr. J. H. Miller, who was employed by a party in Calcutta to superintend the building at Moulmein of a vessel of 500 tons' burthen, proposed the remission of the timber duty upon all vessels built at Moulmein, with the view to encourage ship-building at that place. It will be seen from paragraph 40 of this Summary, that when a like proposal was made in 1833, it was negatived by Government; Mr. Miller's proposal was similarly rejected,—Captain Durand, who strongly supported it, being informed that there appeared no reason for adopting it.

96. In April 1846, the Military Board submitted to Government a correspondence on the conservancy of the forests, which they had had with Captain Guthrie, successor of Captain Tremenheere as Executive Engineer and Superintendent of forests in the Tenasserim Provinces. This and other voluminous correspondence regarding the proceedings of Captain Guthrie in the forests department, down to September 1846, will be found in a paper entitled "*Copies of all Reports which have been made to the India or Home Government respecting Teak forests in the Tenasserim Provinces,*" which was printed by an order of the House of Commons dated 15th August 1848. This paper will be briefly noticed, and some extracts made from it in order to preserve the thread of the narrative in this Summary.

97. Soon after Captain Guthrie assumed charge of his appointment, he determined on ascertaining the extent and condition of the Teak forests of the Province; with this view he personally inspected the forests on the Thoung-yeen, as being the most important, and those on the Houndrow as being the least known. Captain Guthrie deputed Mr. Salmond, whose services he had been authorized to engage for the purpose, to visit and report on the Attaran forests, and employed Burman subordinates to examine the forests on the Salween. The results of these investigations were submitted to Government by Captain Guthrie, in a long report dated the 20th June 1845. The following extracts from the report will show the extent and condition of the forests on the Thoung-yeen.

“ 8. The Thoung-yeen forests being the most important, and the least known, I determined on examining them myself; their state is well depicted in Captain Tremenheere's letter No. 25, of the 2nd March, when he states, ‘Major Broadfoot recommends that all permission to work in the Thoung-yeen forests should be withdrawn in consequence of the lawless state of those districts, and the oppression which the Karens have suffered from the timber-cutters frequenting them.’—Mr. De la Condamine, Senior Assistant to the Commissioner, by whom all permits were signed, has more than once assured me that he has never granted lehmat for these forests. The following is an extract from a demi-official note from that officer on the subject :

“ I have invariably refused grants on the Thoung-yeen to Talayens and Burmese; my reasons for refusing grants were, that I was ignorant of the localities; that when I visited that frontier I found numerous Karens who had killed many trees, had their villages and gardens there, and were paying a regular annual tax, besides being subject to incursions from the Shans, who levied taxes upon them. I thought they had the first right to the produce of their own forests as a means of paying the demand on them, and they immediately set to killing; and to all applicants for grants I replied, go and buy from the Karens; this accordingly has been the practice for 10 years. There exists no such thing as a grant on the Thoung-yeen.’

“ 9. I may here observe that no written or other right was given to the Karens; they were merely allowed to work while others were prohibited; the practical result was, that all classes who felt disposed worked the Thoung-yeen forests, until at last it was found necessary, on the 2nd August 1843, to cancel by public notice all claims to cut timber in the Thoung-yeen. A subsequent public notice, of 10th October 1844, allowed persons who had any claims, even though they never had any permit, to remove trees; to the end of the dry season 1845-46 was allowed for this; and as it was necessary to make arrangements for the management of these forests to gain the required information, I left Moulmein on the 30th December, intending to proceed to the head of the Thoung-yeen, and march down to its mouth.

"I proceeded by the route shown in the annexed sketch, and returned on the 5th February. Major Broadfoot, the late Commissioner, and the present Commissioner Captain Durand, were in favor of the Karens being considered as having a right to these forests; with this I agreed; it would tend to fix and increase the Karen population, induce them to preserve the Teak, and I believe it could be purchased from them at as low a rate as it could be worked by hired labour. During my tour in Thoung-yeen, I invariably told the Karens of the disposition in their favour, avoiding at the same time any pledge; they were always told that they must notwithstanding get passes to cut or kill, and must attend to forest rules.

* * * * *

" 13. The upper division of the Thoung-yeen, or from Meerawaddi upwards, I did not visit, but got much information from the former assistant forest surveyor, Mr. Maling, who was the first person to work it; he worked it this season, but from the obstacles to floating, he succeeded in getting only 240 logs down out of 580 felled and dragged; he represents the timber to be of particularly fine growth, straight, clean, thin bark, and of rather large size. The rocky beds and small size of the stream renders it difficult to work. One great obstacle is a barrier of rocks, having a water-way of six feet only, through which timber must be passed singly, and led by conducting booms, so as to hit the opening, end on. I have inquired much about this obstacle, and from all I learn, a barrel of gunpowder and blasting would remove it. The total number of trees, given after careful consideration, is 13,200 trees, of which 11,200 are full sized; this estimate does not include trees below two feet in girth.

" 14. Meerawaddi to Meplai.—From what I saw, and from such information as I could procure, I estimate the number of Teak trees at 5,200, exclusive of saplings, which abound, viz. above six feet, 1,200, below six feet, 4,000. The Teak here was not of fine growth, and appeared to suffer more from large parasitical creepers than any other tree.

" Meplai Creek I did not visit, but have received information from Mr. Maling, who worked it last season, and from others. The estimated number of trees is 6,400,—2,400 being full sized. This locality is described as being easily worked, and the trees of fair straight growth. Young trees are in abundance. There are about 2,100 trees fit for felling, most of which I think are undersized.

" Meplai mouth, to Kamokla.—Teak seen in considerable plenty on both sides of the river; landing repeatedly, I was disappointed in the appearance of the Teak, very probably from all the fine trees being felled near the river. On reaching Kamokla I ascended the hill, and saw many first-class trees, and have little doubt that much fine timber will be procurable from this locality; I estimate the contents of these forests at 13,000 full size, and 16,000 under size, exclusive of saplings, which are in considerable numbers.

" Kamokla to Winsaw.—From the former place to as far as Theekabaugh stream, containing a number of very fine young trees, the finest forest I had seen. I find in my note-book, "this locality should be reserved for any Government purposes." There is some difficulty in drag-

ging the timber, on account of many small hills and water-courses. Below Theeka-baugh to Winsaw the trees run small; the total estimated number of trees, 23,070,—5,070 being full sized; the very young Teak is not so plentiful as above Kamokla.

“ Winsaw to Eklaiik.—This locality I have not visited, there being no timber of size to fell; I have, however, heard that there are between 2,500 and 3,000 very small trees ready for removal. The number of trees from two to five feet in girth I estimate at 7,000.

“ 15. Of the Thoug-yeen Teak I may remark, that I have seen it growing and thriving in every variety of locality; it has generally the advantage of carrying its girth well to a great height, not tapering quickly; it appears somewhat liable to small cells, isolated, but which appear in sawing up, (this may be caused by the trees being killed when full of sap); notwithstanding this, it is good and strong as any Teak that comes to the market.

“ 16. Further experience, and the employment of subordinate agents to count and examine the trees in each forest, will enable me to give a correct detail regarding the Thoug-yeen forests. In the mean time I have acquired much useful information that will enable me to check proceedings in the localities visited. I may add, that by the measurement of Thoug-yeen timber brought to market this year, that one-third is under size.

“ 17. From the Winsaw I marched towards the Lhang-booa forests, crossing the hills by a very steep and high pass over the Daunat Hill. I was desirous of inspecting one of the experimental nurseries established near the village of Klay, on the Lhang-booa river, by Captain Tremenheere, in the year 1843, when seeds were sown, and seedlings came up; of this not a vestige remains. The seeds are represented as having grown well, but the plants were burnt up in the annual fires; many recovered and flourished on the rains setting in, but were subsequently destroyed by a heavy inundation. I regret to have to report the same of the other three nurseries at Nat-choung, Keon-choung, and Mittigate; with the exception of a single tree at Nat-choung, no trace remains,—a natural consequence of not maintaining an establishment for keeping them up.

“ 18. My march was directed so as to pass the forest of Melon, represented to me as the best in the Lhang-booa, and to pass through a part of the country that had not been traversed before; the information obtained is embodied in the statement and the accompanying plan and references. Buffaloes are much used in dragging the Teak of these localities; there is some straight fine timber, but its general character very crooked, peculiarly hard, sound and close grained, well adapted for ships' crooks; it is generally thought to be of a stunted growth, and not to attain a great height and size; this excuse is urged for cutting it before it has reached the prescribed girth of six feet. I however am inclined to think that, if permitted, it would reach a large size, an opinion confirmed by there being two trees at the village of Wenkiang, having all the distinctive marks of the Teak, irregularly crooked form and short stem, and 15 feet in girth. Where these forests have been worked I saw many under-sized stumps and killed trees.”

98. On the Houndrow Captain Guthrie discovered "more Teak trees than had been before known," but nevertheless his "expectations, both as to the extent of the Teak forests and the fine growth of the timber, were disappointed." He estimated the number of the Teak trees on this river at 2,000. The larger number of these was in the upper part of it, where the trees were comparatively preserved from the axe in consequence of the difficulty of transporting the timber thence to Moulmein. Regarding the general state of the forests on the Attaran, Houndrow, and the Lhang-booa, Captain Guthrie says :

" 28. I may report on the general state of the forests, that the inadequate government establishment could not enforce the judicious rules made for their working and maintenance; they are worked to produce the greatest and easiest sure profit. Many of the forests on the Zimmè and Weinyo (which join and form the Attaran) are worked out, others are getting gradually cleared of full-sized trees; at the end of five years there will not be 2,000 full-sized trees in the forests worked by private persons, and there are but few trees that by their growth will soon attain full size, in consequence of the prevalent practice of felling all trees that approach the full size. There is one very satisfactory point ascertained this season in these forests, viz. the fact of there being very many young trees; both Captains O'Brien and Tremenheere reported that a young tree was not to be seen. Mr. Salmond saw several; all the most accessible trees have been worked off.

" 29. On the Houndrow the forest may be considered unworked. In three localities, on the Weinloug, Authan, and Methan, I found trees that have been abandoned, having been killed 10 years ago. In the Minnunda there were some fine trees being worked this year, said to have been killed 12 years ago. The present supply of Teak procurable is too small to be of importance; the size, however, of many of the trees, and the breadth of the annual ring showing rapid growth, point to this locality as a favourable one for extending the forests by artificial means.

" 30. The Lhang-booa and Salween, from their approximation to Moulmein, and the readiness with which the trees can be brought to market, and from the practice of dragging timbers with buffaloes, are more liable to waste and destruction than other forests. There are a great number of workers of these forests; and from reports received, it appears that fully one-third of the full-sized trees in these forests at present are either killed or felled."

99. The total number of Teak trees in the Province Captain Guthrie estimated at 1,94,000, as shown in the following statement, and he considered that number capable of yielding annually, without injury to the forests, 5,000 tons of timber in the unoccupied forests, and 3,050 tons in those occupied by private individuals.

Abstract Statement of Teak Trees contained in the Tenasserim Provinces.

Name of Main River by which Timber can be floated down.	FOREST.	NUMBER OF TEAK TREES.						REMARKS.	
		Below 6 Feet.			Above 6 Feet.				
		Growing.	Killed and Felled.	Total.	Growing.	Killed and Felled.	Total.		
Zimane River,...	Forest in the possession of Europeans, and also forests worked and occupied by natives,..... Unoccupied forests, Mitigata Codoogway, and Kyouk-Yags, ...	35,868 7,088 42,956	3,518 3,518	39,411 7,088 46,499	12,718 1,821 14,539	5,689 299 5,988	18,387 2,120 20,507	57,798 9,288 67,086	
Weiyo River,	Forests occupied by Europeans and others, Unoccupied forests Allantra, Thengun-nyee Nong, Maue, and Tagoondine,	14,485 5,825 20,310	269 269	14,854 5,825 20,679	2,202 3,979 6,181	292 292	2,494 3,979 6,473	17,348 9,104 26,452	Almost all of the forest-holders here have, I believe, written authority for their working, and hence at present they cannot be considered certainly available for Government.
Salween and Lhang-boos,	Forests on the Lhang-boos and Salween, all of which have been worked, or are in possession of some one,	10,000	1,120	11,120	2,000	640	2,640	14,860	The trees are generally peculiarly hard and sound, but not straight, and well adapted to produce crooked timber.
Houndrow,.....	In different places, and have been worked at one time and another by natives,	1,121	160	1,281	473	270	743	2,014	
Thoung-yeen River, ...	Thoung-yeen forests now free, and available for Government: Upper Thoung-yeen,..... Middle ditto,,..... Lower ditto,,.....	2,000 24,000 25,000 51,000	..... ..... ..... .....	2,000 24,000 25,000 51,000	11,000 14,000 4,000 30,000	200 2,700 1,070 3,970	11,200 16,700 5,070 20,970	18,200 40,700 80,070 89,970	No authority held by any one, and well available for Government; none of this Teak has ever been brought to Moumtain; the fibre close and firm, some trees large, but irregularly of form would prevent its cutting up well.

100. Captain Guthrie, in noticing the Rules of 1841, says, "though the rules may be amended in some particulars, they are good rules, and well adapted for the preservation and maintenance of the forests," but have proved inoperative chiefly through the non-enforcement of the penal clause. He accordingly proposed to resume all the forests in which the rules had not been strictly observed, and the introduction of the following new regulations which seem to have been framed originally by Captain Tremenheere in 1843 :—

“ Conditions.

“ 1st,—The forest to be worked by a proper establishment of elephants, &c.

“ 2nd,—Payment of 15 per cent. on all timber brought to Moulmein, excepting such as may be hereafter specified.

“ On all logs of more than 8 feet girth in the centre, and 60 feet long and upwards, a modified duty of 10 per cent. will be levied.

“ In addition to this duty a payment of ——— annas on each log, or on its equivalent of converted timber, to cover the expenses of planting three young trees on their timber sites for every tree removed.

“ The present payment is fixed at three annas per log, subject to alterations according to the outlay that by experience may be found necessary to effect the object in view.

“ 3rd,—The forest land not to be cleared for cultivation, nor to be employed in any other way besides plantations.

“ 4th,—If these conditions be not fulfilled, or the forest not worked for three consecutive years, the lease will be resumed by Government.

“ Rules.

“ 1st,—Trees to be killed during the months of December, January, February, March, and April, and at no other period.

“ 2nd,—No trees to be killed or felled measuring less than six feet, or four cubits, immediately above the killing mark, or at the butt end of the log.

“ 3rd,—No trees to be felled till the lapse of one rainy season after having been killed.

“ 4th,—No raft to enter Moulmein river till arrangements of the duty have been made by the appointed persons.

“ The superintendent of forests is vested by the Government of Bengal with magisterial powers to impose fines, not exceeding Company's rupees five hundred, for any breach of these rules.

“ There is power of appeal to the Commissioner's court, by which, or in the court of his Assistants, the fines are recoverable on the decision of the superintendent being upheld by the Commissioner.”

“ 101. The following extract from Captain Guthrie's report will show why he proposed that all forest grants in which the rules had not been observed, should be resumed and worked on account of Government.

“ 37. Mr. Blundell, in his letter to Government of 28th April 1837, advocating the resumption of the forests, fairly states the argument against the measure, *viz.*, the apparent interference with private rights accompanying the original permits to cut timber, sanctioned by eight years' adherence to that system, and the expense which in justice must be incurred for their outlay towards facilitating their operations in the forests; this argument is now strengthened by nine years' additional adherence. During all this period persons receiving permission to cut were continually informed that the permissions were resumable at pleasure; this notice was useless, as it could be enforced without any breach of faith. That outlay has been incurred towards facilitating the operations in the forests, is undoubted; it has however been solely for the profit of the workers, and not in any way to meet the favourable consideration of Government; they have neither prevented the destruction of under-sized trees, nor the felling of green timber; they have not attended to the past rules ordered by Government; have, from neglect, annually allowed hundreds of trees to be destroyed by fire, thus depriving the State of revenue and the public of valuable timber.

“ 38. The practical result of allowing private individuals to work forests, has been shown in their present condition and the reckless system of working them. I see no prospect of justice being done by continuing them in the hands of private persons, who argue that the present rules cannot be carried out, being impracticable; that it is impossible to do justice to the forests, and they are therefore to be held excusable for past breaches of forest rules, and wish to carry them on under authority for the future. I advocate their general resumption, and the best mode of doing so for the interests of Government and consideration of the individual may be considered. The question is much simplified from none of the holders having done anything for the prospective benefit of the forests.

“ *1st.*—The nature of the tenures being at will, allows of their immediate resumption; there might be apparent hardship, though without reason, as I think has been shown.

“ *2nd.*—They might almost all be resumed for breach of forest rules, the penalty prescribed by the last clause; but some localities however would escape from not having been broken in all the worked forests is, I believe, undoubted; in some, however, proof cannot be brought forward, from being unworked; in others, breaches that could be proved would be so numerically trifling, that there would be an apparent hardship in enforcing the penalty.

“ *3rd.*—The holders might be induced to give up their possessions by payment of money.

“ 39. Any system of resumption providing for a variety of cases, would, I think, be complicated and liable to objection. I would suggest a notice to the following effect; it might be either a simple Government order or an explanatory one, thus:

“ *1st.*—The State requires that its forests should be worked to the best advantage.

“ *2nd.*—Experience has proved that in the forests entrusted to private individuals many under-sized and green trees are felled and killed, and at prohibited seasons of the year, when the trees are full of sap; and further, that a number of seasoned trees of the full size are annually left on the ground to be destroyed and injured by the

periodical fires ; this being a prevalent reckless and wasteful system, and in opposition to the Government rules of 1841, enacted for their preservation and maintenance, the right of resuming the forests at will having been reserved by Government ; and further, that resumption being the prescribed penalty for any breach of the forest rules, notice is now given that Government resume these forests.

“ 3rd,—The occupiers of Government forests have done nothing for the benefit of the forests they hold ; yet when capital has been expended in killing, felling, and dragging the timber, they shall be allowed a certain period for bringing it away, or a fair value given, under such arrangements as the local authorities shall consider suitable. Unlicensed timber, that is, timber cut against rules, to be forfeited and brought down at the expense of the forest-holder.

“ 40. The transgressors against the forest rules should not be allowed to get off with impunity, and an order of the nature contained in the last part of the above notice ensures a punishment in proportion to the extent of the transgression ; but as the probable cost of bringing the logs down the Attaran may be seven rupees each, the punishment may be considered excessive ; a fine therefore on each log might be substituted : the simple forfeiture of the tree is too light a punishment, as the outlay in killing and felling five trees might be recovered by smuggling one under-sized tree into Moulmein, or by sawing into a square an undersized tree in the forest.

“ 41. I confess my inability, from my own ideas, of suggesting any practicable rules for ensuring the keeping up of the trees in forests held by private individuals ; leases would of course be acceptable—the longer, the more acceptable ; but in leases the inevitable result is obvious to me, the working out of the forests and their waiting the renovation by natural means. Private persons here are not likely to incur any outlay in planting for a benefit to be obtained after many years ; they would be very apt to argue that each planted tree before it attained the age of five years would (from destruction of young plants by wild animals and other causes) cost some two rupees, and that it would yield a better profit other ways than waiting 50 years for a Teak tree, which would then perhaps yield a profit of 10 rupees.

“ 42. In December last, with reference to a quoted extract from a Despatch in the Marine Department, No. 19, of 26th June 1844, to the Working for Government. effect that they approved of retaining the forests for the wants of the public Service, I noticed the under-mentioned advantages that would be derived from working the forests on public account, and recommended its being immediately carried out, since the inspections of the forests have shown me that Government had scarcely any alternative but taking them into its own hands, if they are to be preserved from the extermination they are rapidly attaining.

“ 1st,—The advantages enumerated were securing for Government a continued supply of Teak timber of all sizes, from full-grown trees, killed at the proper season of the year and seasoned.

“ 2nd,—Ensuring the supply at a low rate.

“ 3rd,—Raising to its proper standard the character of the Moulmein Teak, now of inferior repute from that exported, being mixed with unseasoned wood, young trees, and that found dead from natural causes. The dead timber of the Thoung-yeen has been

found as light as 16 cwt. to 50 cubic feet, or a ton measurement; some of the finest close-grained Attaran as high as 22 cwt.

" 4th,—Introducing order into the forests, both as regards care of forests, trees and persons; at present the settlement of disputes between private persons regarding timber occupies much of the time of the Moulmein court.

" 5th,—The power of supplying Her Majesty's Government with timber on which they can rely, the revenue that can be derived from the forests to the credit of the expenses of the Provinces, and by the sale of timber not sufficiently perfect, or for other causes not required by Government purposes.

" 6th,—The small outlay and pecuniary risk at which they may be worked.

" 7th,—To these may be added the prevention of deterioration of the forests, and increasing their value by a judicious system of working, and artificial extension by sowing and planting."

102. Captain Guthrie offered the following remarks on the mode in which the forests should be worked, and (in allusion to the measures which were taken by Captain Tremenheere for renovating them,) on the system which should be pursued for continuing the supply of timber:

" 49. Captain Tremenheere gives some interesting information about experimental nurseries he had established, and the seed of the Teak trees; the nursery I have already reported as now being without a trace, excepting a single tree at Nat-choung; he enters into no details of arrangement. Whatever system of artificially extending the forests is adopted, many men will have to be employed, and the peculiarities of the persons available will inevitably entail many mishaps, much uncertainty, annoyance and trouble. The Madras labourers, comparatively industrious and manageable, are unsuited for the forest life; they would be helpless, and suffer from sickness; parties of these people taken to the forests have done more work than Burmans, but soon became ill, and much trouble was required in feeding them. The Burmans, generally indolent, would be with difficulty induced to enter into any engagements to remain in the forests, where their industry could not be depended on, and they would leave whenever they wished for change. The Karen dwelling in the forests is as unsteady as the Burman, but if he can be induced to undertake the artificial extension of the forests, he would prove a valuable instrument; the forests, however, must be extended, and the most made of the means.

" 50. I am opposed to the general adoption of a system of nurseries and transplanting; I have been informed by two old residents of Java that this system had been adopted and abandoned by the Dutch; it appears to me too artificial a system to be suitable to these forests, and likely to be very expensive. The system I would recommend is sowing the seed, planting slips, and when persons employed in extending the forests have fixed dwellings in them, a nursery might be established; this is the basis of the method, the details must depend upon experience. I shall however mention some of my ideas: the working of the forests will require in them the presence of certain Government servants; these will, to a certain extent, be available

for the extension of the forests ; mixing the duties is undoubtedly objectionable, but less so than the expense attendant on different establishments.

“ 51. Equal attention and equal extension is not due to all forests alike ; all should be kept up and extended, but those in favourable localities on a larger scale than others.

“ 1st,—The localities of primary importance appear to be the forest land on the Attaran, Zimmè and Weinyo rivers. The Teak produced in these forests is inferior to none in strength, with a finer grain, and greater elasticity ; it is also the locality from which timbers can be brought with least difficulty, and is the most accessible for supervision.

“ 2nd,—The various forests on the Lhang-booa and Salween, perhaps more accessible than the Attaran, but growing timbers of an inferior description, crooked and hard, but valuable for naval purposes requiring crooked timbers.

“ 3rd,—The Houndrow, below Kozaie-ko-Gyoon, or 99 Islands. These present so great an obstacle to floating timber that the extension should be below them.

“ 4th,—The Thoug-yeen, from its mouth to Kamokla. Above the latter place the obstacles to floating are considerable ; below it there is a comparative immunity from the destruction caused to young Teak from wild elephants. Bringing down timber from the Thoug-yeen is very tedious, consuming much time, and attended with considerable percentage of timber being lost, from various causes. Timber can be brought from all other places in much less time, and with comparatively no risk of loss.

“ 52. In each of the worked forests two Government servants, or peons, must be kept up throughout the year to control the working, even if done by contract : these should be increased according to the scale on which it is intended to artificially increase the forests, and the cost to be charged proportionately to the timber annually brought down, and to the sowing and planting.

“ 53. The Thoug-yeen contains, as far as I have ascertained, 15 divisions or districts : seven above Kamokla, and eight below it, each under an *Tsokay* or Government official. It appears to me that these would be suitable divisions to adopt in working or sowing ; similar divisions should be made in the other forests. The duties of the persons employed would, in the timber-working department, consist in preparing accurate lists of the timber to be killed, and to be taken away annually ; to point out to the inspecting officer the trees suitable for killing, in order that he may make his selection ; to control the contractors in their work ; point out the trees to them ; see that they are properly killed and felled without waste ; to prevent their being cut into pieces ; to see that the branches are not wasted ; to mark, measure, bring together, and number the trees. In the extension department they would be employed, at the proper season, sowing seeds, in planting slips, and where there were nurseries, in transplanting, in clearing away parasites, lopping redundant branches, keeping down vegetation to a certain extent round the young trees, particularly at the season of the periodical fires, when the dry grass should be cleared for some distance round each plant : or in places where the young trees were close and over a considerable space of ground, it might be preserved from fire by clearing a belt all round. There would be ample employment throughout the year for parties of considerable strength ; each party should be of strength sufficient to authorize the employment of a responsible head

man, on a somewhat larger salary; the additional salary need not be large; he should be able to read and write, and to record work done; and without him the exertions of the people without a head, working each as they pleased, could not result in much. Each party should not be less than six; and there should also be five men on a higher salary as overseers, say 30 rupees a month, and 15 rupees travelling allowance; one each for the Thoung-yeen, Zimmè, Weinyo, Houndrow, Lhang-booa, and Salween: they should be always moving through the forests, pointing out what is to be done, and keeping the men to their work."

103. On the subject of the duty on the timber of the Tenasserim Provinces, and on that imported from foreign places, Captain Guthrie wrote—

" 57. The present duty is levied on Teak alone, not as a nominal *ad valorem* duty, but at a commuted value of 14 rupees per ton on the single log, measuring the quarter girth; this system is, I think, liable to the following disadvantages; there are three rates of duty,—that just mentioned; a different rate (4 annas each) on large crooks, some of which contain a ton of timber, and should pay 2 rupees 2 annas; another rate on smaller crooks, (2 annas.)

" 1st,—It does not protect the Government from loss of revenue on squared timber brought to the revenue stations; the revenue on the entire log would be much more than on the square taken of it. This squaring of timber has been practised in the forests for many years, reducing the revenue and wasting much timber in the abandoned sites. The erection of saw-pits above the revenue stations to convert the timber, would seriously affect the timber revenue. The proposition of constructing saw-pits above the revenue stations has been mentioned by several parties who were told that such an evasion of duty was not likely to be allowed. I only remember the names of two, Messrs. Maling and Catchick. The present system of duty provides no remedy.

" 2nd,—There is no duty laid down for other woods than Teak. I would suggest an actual *ad valorem* duty of such rate as may be determined on all kinds of timber, Teak or others; this would provide a remedy for all the above objections. This rule might be made the cause of much annoyance, if carried out against the bamboo posts or small wood used by the people of the country in constructing their houses or domestic purposes. The local authorities would however always prevent this oppressive carrying out of the rule.

" 58. Mr. Bushby, Secretary to the Government of Bengal, in his letter No. 365, of 31st August 1842, (Sep. Department, Customs), in reply to a reference regarding duty being levied on foreign timber, states, 'The Honorable the President in Council has been pleased to direct that as the Shan timber adverted to in your communication is not entitled to exemption, and derives its value only from the circumstance of its being available for the Moulmein market, an inland duty of 15 per cent. *ad valorem* be continued to be levied on it as at present.' It appears to me that the importation of foreign Teak timber of good size should be encouraged, also that it is desirable to prevent injury to even the

foreign forests, and thus endeavour to secure a supply for a somewhat lengthened period: the former might be encouraged by a reduction of the inland duty to 10 per cent even less; the destruction of young trees discouraged by a corresponding increase on small trees within under six feet four inches from the butt; and the wasteful system of felling young and small trees is so very prevalent that if any check is practicable it should be carried out."

104. Regarding the powers to be vested in the Superintendent of forests, Captain Guthrie was of opinion that without authority to punish, that officer could not successfully carry out the conservancy of the forests; and therefore advised the Superintendent being allowed the powers of a Joint Magistrate, in subordination however to the Commissioner, who should also have the power of awarding, when necessary, greater punishments than can be given by a Joint Magistrate. Captain Guthrie concludes his report with a request for the instructions of Government on the following points:

" 1st,—What are the views of Government regarding the disposal of the forests, those unoccupied and those in the hands of private persons; whether to be granted to private persons on long leases, or the continuation of the present system of tenants at will ?

" 2nd,—Regarding the working of the forests,—if to be worked by Government ?

" 3rd,—The periodical expenditure that will be sanctioned towards introducing the useful woods of the province into notice ?

" 4th,—Regarding duties being levied on other wood than Teak, they being now exempt.

" 5th,—Regarding the artificial extension of forests, and the extent to which it should be carried out ?"

105. Before Captain Guthrie submitted to Government his report above noticed, he had summarily resumed several forests under the penalty clause of the rules of April 1841, for alleged breaches of those rules by the felling of under-sized trees, and the failure to propagate others in their places. Against this measure Cockerell and Co. and Mackey and Co., of Calcutta, (as the holders of extensive forest grants, some of which were resumed by Captain Guthrie,) appealed to Government, when instructions were immediately given to the Commissioner, Captain Durand, to restore the sequestered grants to the holders "until the Government are in possession of such information as will enable them to pass final orders" on the subject. But notwithstanding this order, and the intimation of the opinion of Government on the subject, just previously made to Captain Durand, that it was not intended "to monopolize the forests, or to restrain the free trader,

or trench on the rights of grantees or lessees of the forest lands," Captain Guthrie, with the concurrence of Captain Durand, continued to enforce rigidly the penalty clauses of the rules of April 1841. These proceedings elicited from the Merchants of Moulmein, (represented by a Committee formed of Messrs. Creaton, Austin, Paterson, and Maurel,)

a petition* of appeal to the Commissioner. The petitioners complained of—

" 1st,—The resumption of occupied forests under charge of breach of rules, promulgated under date the 12th April 1841.

" 2nd,—The seizure of all wood brought down during the present season under six feet in girth, and the subsequent levying a fine equal in amount to the Government duty on all such wood being released.

" 3rd,—The prohibition to private parties from working timber out of the unoccupied forests, with the avowed intention of working all such forests on Government account.

" 4th,—The recent regulations issued by the Superintendent of forests, in regard to the collection of duty on, and the passing of wood at the Government station of Kadoc."

—Captain Durand, however, upheld the measures of Captain Guthrie, and reported to Government his having done so. Upon this the Government took into consideration the whole subject of forest management, and after briefly reviewing the history of the forests, from the time that they were thrown open to the public by Mr. Maingy in 1829 down to the period of Captain Guthrie's appointment, communicated* the following observations and orders to Captain Durand :

* Letter dated 7th September 1846.

" 21. Captain Guthrie succeeded Captain Tremenheere as Executive Engineer and Superintendent of forests at Moulmein in September 1845, and immediately turned his attention to the forests. He visited in person, or by deputy, as many of them as possible, and he has reported his observations in a letter to the Military Board of great length, dated 20th June last.

" 22. The main purpose of his report is to exhibit, which is done very clearly, the waste and mismanagement of the grantees, and the constant breach of the rules of 1841, especially in the felling of under-sized trees, and the entire omission to propagate new ones. It is shown, too, that all the nurseries which had been attempted on the part of Government had failed.

" 23. The remedial measure advocated by Captain Guthrie is the immediate resumption of all private grants, and the working of the forests by Government agents on account of Government."

" 24. In the mean time, Captain Guthrie has not been slow to exercise the powers which he conceives himself to possess for the punishment of these instances of neglect on the part of the grantees, and he has in several cases summarily resumed important grants under the penalty clause of the Rules of April 1841, for breach of those rules

by felling under-sized trees ; and these proceedings you appear to have approved and affirmed.

“ 25. It will have been observed from the foregoing statement, that no confirmation of the penalty clause can be traced in the records of Government. If therefore any confirmation be forthcoming in the office of the Superintendent of forests, a copy should be transmitted for his Honor's satisfaction. In the mean time it would seem that Captain Guthrie has been acting under a rule of no authority.

“ 26. But even if the rule had ever been confirmed and authorized by Government, it is by no means clear that its purport would have given to the Superintendent of forests any power to enforce so serious a penalty ; he might possibly have reported the facts and made his recommendations, but the infliction of the penalty would have lain with much higher authority.

“ 27. Independently, however, of these considerations, the enforcement of the penalty of forfeiture of grants for breach of rules, which have been avowedly and notoriously a dead letter ever since they were enacted, and which the Government has never shown any intention or given any notice of enforcing, is a measure altogether oppressive and inequitable ; two mercantile houses of this city have, as you are aware, appealed to Government against these proceedings, and Government have been directed to suspend them for the present. One of the houses thus summarily stopped in their works and deprived of their grants of forest locations, is known to be under a heavy contract with Her Majesty's Government for the supply of timber for naval purposes, and the consequences to them must be very serious.

“ 28. With your present letter you have forwarded a copy of a petition from Messrs. Creaton, Austin, Paterson, and Maurel, who sign as a committee on behalf of the merchants at Moulmein interested in the timber trade, and who amongst other matters complain very reasonably and respectfully of the sudden and ruinous measures of Captain Guthrie in confiscating their grants and destroying their trade, and they appeal to you for redress ; but you have signified to the petitioners your approval of all Captain Guthrie's proceedings.

“ 29. Upon the grounds already stated, the Deputy Governor most entirely disapproves them, and he directs me to request that no time may be lost in redressing the injury which has been sustained by ejected parties, and in reinstating them in the rights, of which they ought not in such a summary manner, or on such insufficient grounds, to have been divested.

“ 30. In regard to future management, the Deputy Governor conceives the only sound principle to have been suggested in the few but apt words already quoted from the Despatch of the Honourable Court, dated 30th September 1842 ; viz., that no conservator with the aid of any establishment could maintain a proper degree of check over such extensive tracts ; that even if it were practicable it would be objectionable to commit such powers to one individual, and that the best and cheapest way of effecting the object would be to make it the interest of persons to take care of their grants by giving them long leases.

“ 31. This appears to the Deputy Governor to be a perfectly just view of the subject. Rules full of petty detail, teaching merchants and traders how to carry on the

smallest details of their business, even to ropes, and trucks, and carts, and prescribing small and meddling instructions, to be enforced under heavy penalties, and this too throughout vast, distant, solitary, and scarcely accessible forest tracts, by one conservator or superintendent, with a few native subordinates (for it would not pay to have a large establishment), must, in the nature of things, fail of any good. The rules would not be observed; their infraction could not be checked, and the penalties could not be enforced.

“ 32. On the other hand, the measures taken with the grantees have been such as to ensure waste and improvidence. They have been sent at one time with permits to fell timber on given localities revocable at will; at another, they have received grants of undefined and disputed tracts for no specified term, but dependent on the pleasure of the authorities for the time being. Even the desire of Government to grant leases for 20 years, as expressed in 1843, seems not to have been carried into effect; but on the contrary, Captain Guthrie as Superintendent and yourself as Commissioner have taken pains to impress upon the grantees that their rights may be resumed at any time, and they have indeed been practically taught that resumption may occasionally be very suddenly and summarily put in execution against them.

“ 33. It would be strange indeed if, under such circumstances as these, the grantees were found carefully guarding the Government interests in the forests, or establishing nurseries of young trees, or sparing to cut down whatever might soonest suit their purposes. The grantees have been obliged by their position to make the most they could in the shortest time, out of a very precarious and uncertain tenure, and their conduct has only been what might have been expected from them.

“ 34. The obvious remedy is to do as the Court recommend, *viz.*, make the interest of the grantees correspond, as far as possible, with the interest of Government.

“ 35. The interest of Government is, that as much timber as possible should be brought to market without injuring the forests or destroying their future productiveness. To make the interests of the grantee identical with these, he should have a permanent property in the forests, and no further restrictions should be placed on him than that the grant shall become liable to the payment of land revenue if ever it is denuded of trees and brought under the plough. The property conveyed by the grant should include not Teak only, but all trees and products of the forest. The duty levied at Moulmein should be heavier in proportion, as the logs are below a given size, and all below a certain girth, to be fixed as a minimum, should be confiscated.

“ 36. The Honourable Court have, in the case of the grants at Mergui, claimed by the Countess Noslitz and Baron des Granges, sanctioned leases for a term of 99 years, and the Deputy Governor does not conceive himself authorized, without further reference to the Honourable Court, to grant leases for any longer term. But it is shown in the reports of Captains O'Brien, Tremenheere, and Guthrie, that Teak does not attain to any large size under 80 years, and it is therefore obvious that grants of such forests should be in perpetuity, subject to a land-rent, on the usual terms, for any part of the land at any time brought under cultivation. The Deputy Governor is strongly of opinion that the system should be pursued in regard to these forests which prevails in the Crown colonies, *i. e.*, that the locations should be sold outright, and a complete

title conveyed to the purchaser. A recommendation to this end will be immediately forwarded to the Honourable Court. In the mean time the Deputy Governor directs me to request that you will communicate with the existing grantees and the persons engaged in the timber trade, in order to ascertain their views on this subject; and you may also take early measures for surveying and defining the boundaries of all existing grants, as well as the particular localities which, in your opinion, had better for the present be resumed for Government purposes. On this part of the subject, however, his Honor entertains a strong opinion, and will express it to the Honourable Court, that the Government interests will be best served by attracting private capital and enterprise to work the forests, and trusting for Government supplies to the market.

“ 37. It will be proper that the Superintendent of forests should take every possible means of establishing Teak nurseries in fit situations, not within the boundaries of occupied grants; and it may be expected that grantees, when assured of reaping the fruits of their own exertions, will themselves endeavour to propagate young trees within their localities.

“ 38. The present duties are estimated by you to be about 5 per cent. on the actual value of the timber. Whether this rate may admit of increase is a question that will be considered hereafter, and will in the mean time be submitted with the other parts of the subject for the opinions of the Honourable Court. But the mode of computation now in use might surely be improved and simplified, and on this, as well as on the proper rate to be levied, his Honor would be glad to have your opinion, and you may invite such suggestions regarding them as the merchants of the place may desire to make.

“ 39. It would seem from passages which occur in the course of the correspondence on this subject, that Major Broadfoot sometime in 1843 issued orders regarding the forests of the Thong-yeen districts, which implied a right of ownership in those forests residing in the Karen tribes. Major Broadfoot's report on this subject has probably been mislaid or lost, as none can now be traced in this office. The Deputy Governor's impression would have been that the Thong-yeen, like all other forests in the Tenasserim Provinces, belong to Government, and he is desirous of knowing exactly what has been done by Major Broadfoot in this case, and his reasons for his measures. You are therefore requested to transmit duplicates of any reports that Major Broadfoot may have made regarding the Thong-yeen forests, and also to state your own opinions regarding them, and the right of ownership in them.”

106. On the 21st October 1846, a report of these proceedings was made to the Court of Directors by the Deputy Governor, Sir Herbert Maddock, who requested the Court's attention to the preceding orders as containing an exposition of his views on the subject of forest management. At the same time Sir Herbert, adverting to the opinion expressed by the Court in their Despatch of November 1842, (see paragraph 83 of this Summary,) wrote as follows :

“ I have endeavoured to carry them out, so far as I feel myself authorized to do so, by expressing my readiness to grant leases of forest lands for a term of 99 years,

subject to no conditions except those of payment of revenue at the established rates of the province on all lands brought under cultivation,—payment of a duty, fixed with reference to the size of the logs, on all timber brought down the river to Moulmein, —and confiscation of all timber below a certain size to be hereafter determined.

“7. But entertaining a strong opinion that, with reference especially to the slow growth of the Teak tree, the creation of a permanent interest in favour of the grantees is required for the due preservation of the forests, and that this paramount object cannot be obtained by any other means, I beg earnestly to recommend that your Honourable Court will give the local Government authority to sell the whole of the Teak forest lands in tracts of convenient extent, and to convey to the purchasers a complete title subject only to the conditions expressed in the preceding paragraph.”

107. The Court of Directors replied on the 20th October following, 1847; they approved of the orders of Government for the restoration of the grants which had been resumed by Captain Guthrie, but did not agree with Sir H. Maddock in his opinion on the subject of the term of the leases, and prohibited “any fresh grants to be made until an extent of woodland, conveniently situated, and sufficient to supply the timber required for the public Service, has been selected and placed under the management of Government officers.” On these subjects the Court wrote as follows :—

“6. We are aware that you do not appear to admit the necessity for this precaution, and you observe that ‘the Government interests will be best served by attracting private capital and enterprise to work the forests and trusting for Government supplies to the market,’ but we do not concur in this opinion. It is quite possible that not only leaseholders for 99 years, but even leaseholders in perpetuity may not think it worth while to form plantations which must remain for eighty years without yielding any returns of value, and that after felling the timber on their estates, they may leave them waste or bring them under the plough. The latter course would no doubt be productive of much advantage, both public and private, but it might be pursued too far and in any such case a stipulation should be introduced into the leases providing for the payment of the ordinary assessment on lands brought into cultivation. It is absolutely indispensable that a certain extent of forest land should be preserved for the supply of timber, and that the valuable resources existing in the Tenasserim Provinces should not be exhausted through a repetition of the neglect which has proved so ruinous to those of Malabar. For these reasons ‘Government,’ as we observed in our Despatch of the 30th November 1842, ‘should reserve to itself a resource independent of the public market’; and we must consequently repeat the injunction made in the same Despatch, ‘that before any further grants are made, some forests sufficiently extensive be selected and placed under proper management, so as to afford a constant supply of timber, both of Teak and of other useful kinds indigenous in the country, for the wants of the Bengal Government as well as of the Royal Navy.’”

108. Captain Guthrie was succeeded in the appointment of Superintendent of forests, which was then made a separate and independent office, by Captain T. Latter, who shortly after visited the forests, and in May 1848 made a long report on them. A part of this report was printed by order of Mr. J. R. Colvin, the successor of Captain Durand as Commissioner. The object in printing a part of Captain Latter's report was "for the purpose of eliciting remarks from persons acquainted with the subject; more especially in reference to the views advanced on the mode of the self-propagation of the Teak plant." The following extracts from the report will afford valuable information on the forests, and show Captain Latter's views :—

"6. The region occupied by the Thoung-yeen forests consists of an elevated valley, (about 800 feet higher than the Moulmain plains,) having the Daunat range on the West, and the range called the Toungnyo on the East. These two ranges, slightly trending towards one another, meet, and form a sort of 'cul de sac,' at the bottom of which rises, and through the whole length of which, in a North-Westerly direction flows, the Thoung-yeen river. It runs parallel to the Daunat range, which sinks gradually into the plains to admit of its junction with the Salween river. The Toungnyo range, as far as I could learn, runs due N., proceeding into regions unreach- ed by our geography. I should estimate the whole length of this valley to be about 250 miles; its width, an average of 25 to 30. The Thoung-yeen, keeping somewhat closer to the Daunat range than to the Toungnyo, divides the valley into two long strips. The one on the left or Western bank, being held as British, may average about 12 miles in width; the other, or Shan, about 15 or 18.

"7. This valley is happily and conveniently divided into three parts by two mountain spurs, the Southernmost being called the *Kyokhet* or 'Rocks of Difficulty,' the northernmost *Kamokla*, or 'The Ruler's Rock,' from a Talayen prince and his suite having been wrecked and drowned there. Thus the valley may be considered as consisting of three portions. The highest and Southernmost, from the sources of the Thoung-yeen to the *Kyokhet* spur, may be called the Upper Thoung-yeen. The next, and largest portion between *Kyokhet* and *Kamokla*, may be called the Central Thoung-yeen, and from *Kamokla* downwards, the Lower Thoung-yeen.

"8. Both the bounding ranges of Daunat and Toungnyo, together with their spurs, consist of mountain limestone, presenting all the grey and grotesque appearances and cavernous issues of sudden waters (many at a high temperature) so characteristic of that rock. Their highest portions again are of granite, but of a composition in which the feldspar greatly predominates, the quartz and mica being in very subordinate quantities. It is for this reason the weathered peaks get very rapidly disintegrated, the feldspar rapidly decomposing into Kaolin clay; the fracture of such points presents the dead even appearance of a clay rock, rather than the sharp and angular edges of true granite.

" 9. It is from the disintegrated feldspar of these weathered peaks that were probably, in a great measure, once supplied the deposits of stiff clay, which we find playing so important a part in the economy of the Thoung-yeen forests. These ranges are also said to be metalliferous.

" 10. Though the two narrow strips into which the valley of the Thoung-yeen is divided by the river, belong to the same region of land, yet in their minor features they present a curious difference of physical aspect. The first thing that drew my attention was the circumstance that in proceeding down the Thoung-yeen, whilst the British bank presented an innumerable succession of small streams and rivulets, most of them dry in the cold weather, the Shan side showed few or none of such, the mouths of large streams only presenting themselves, and in most cases these were dry; whereas the only large stream of equal size on the British side (the Meplai) was full of water. This is caused by the fact that whilst the central portion of the British forest strip consists of a considerably raised plateau or ridge, the corresponding portion of the Shan side is depressed; thus all the water on that side is shed inwards into the depressed central portion, and when the level of this water gets above the mouth of the evacuating streams, the water flows into the Thoung-yeen, when however it is lower, this central region forms marshy rice land; whereas on the British side, the central portion being raised, (as is well shown by an inspection of the map of the Central Thoung-yeen,) there is one mass of water shed directly into the Thoung-yeen, another towards the Daunat range, which, with the drainage of those hills, forms the Mekenai Kyoung, the Laumat Kyoung, the Meplai Kyoung, running north and south, till they meet and proceed in one channel eastward into the Thoung-yeen, under the common name of Meplai River.

" 11. This difference in the physical geography of the two tracts affects their respective forests in a remarkable manner; for as on the Shan side the forests only occupy the more elevated banks of the river and the region along the base of the Toungnyo hills, there is left the low central portion for rice land, by which (though unadapted for Teak) a considerable population may be supported without trenching on the forests; and there exists consequently a great deal of *lay*, 'wet' or permanent cultivation, there. Whereas an opposite state of things existing on the British side, and there being no large central tract adapted for permanent cultivation, (but only a raised plateau on which Teak will not grow,) the small number of inhabitants it can support are obliged to clear tracts of forest for the purpose of raising their crops of grain. Their cultivation, though on a plain, is therefore called *toungya*, 'hill, or shifting cultivation.* It will be shown that these continued and continuous clearances of forest-ground have a very disturbing effect on the forest vegetation.

* "Before the occupation of these Provinces by the Burmese, the valley of the Thoung-yeen was divided into four counties or jurisdictions, extending from the Daunat to the Toungnyo range, and supported a considerable Talayen population. The chief cities, the ruins of which may still be traced, were *Meerawaddi*, *Dongmney* (now Winsaw,) *Donggyeen* (now Eklaik,) and *Dong-Thoung-yeen*. These were all situated on the now British bank of the Thoung-yeen, whilst their rice cultivation lay on the other side of the river, now possessed by the Shan, subject to Siam."

" 12. A thorough appreciation of these forests cannot be given without a few remarks on their geological structure. The features of these are simple, but striking.

" 13. The great underlying rock is most probably the mountain limestone, of which the Daunat and Toungyo hills are composed ; but in the valley itself this nowhere obtrudes itself to view. We find there the lowermost rock to be a compact sandstone, the upper portion consisting of a concrete of small rolled pebbles imbedded in a siliceous matrix. On this reposes a deposit of large rolled pebbles, the depth of the bed varying from 8 to 14 feet. On this again, and of about the same thickness, is a bed of stiff pure clay, supporting a layer of *humus*, or soil proper, of from a few inches to a foot in thickness.

(Figure 1 on the Map.)

" These strata are generally quite horizontal, except in the upper Thoung-yeen, where the sandstone has a dip of about 35 degrees.

" 14. It will be observed that the newest deposit of the above is the stiff clay. It is this rock that the Teak tree affects most particularly, and in proportion to its presence and thickness is the abundant growth of the tree.* The superficial deposit of *humus*, or soil proper, composed of the decay of vegetable matter, is not favorable to forest vegetation. It is evident, therefore, that whatever local causes affect the presence or distribution of these two beds, have a corresponding effect upon the nature of the vegetation that clothes them. One great disturbing cause is the washings or removals of surface caused by the heavy tropical rains. In a long sweep of country such as the Thoung-yeen forests there are undulations and depressions of surface : into the lowest of these the superficial soil is washed, is retained, and accumulates ; and we find one sort of vegetation ; in places of an intermediate depression, where the influence of the soil predominates, but is yet mixed with a large quantity of clay, we find a second kind of vegetation ; till coming to the pure unmitigated clay itself, we find the forest reigning in all its grandeur.

" 15. We find these three stages of vegetation peculiarly marked. First comes the real forest, free from underwood, with its stately avenues and unbrageous tree shading its dank and unripened bosom from the genial influences of the sun. Next and intermediate are found growths of smaller, and as it were, more orchard-looking trees, such as the papaya, the wild sloe, and many wild fruit trees, as also the coarse tall

* " This is the general rule ; there may be occasional exceptions which however will be found due to local peculiarities :—A stunted Teak, for instance, is sometimes found on the very summit of perpendicular cliffs many hundred feet in height, as also on the precipitous sides of a hill ; but then these are always composed of limestone, which, from its tendency to abound with cavities and irregular shelvings, enables clay and moisture to lodge. Again Teak is very often found abundant on low hills, but these hills will be found composed almost entirely of clay, as may be shown by the circumstance of elephants sinking deeply into the ground in mounting over them during the rains, as also from the excessive slipperiness of the soil.—All these mark a Teak soil. Whereas the portions occupied by Fir and Engben are not at all softened by the heaviest rains, and receive no impression from the weightiest tread. " T. L."

tiger-grass, the scrub bamboo, &c. &c. The soil here, more accessible to the ripening effects of the atmosphere, has progressed a stage towards maturity. Last we find occasional sweeps of soft Savannah grass, the presence of which is a sure sign that the soil has fulfilled the full circle of its obligations towards the production of a cereal crop. Where such tracts sufficiently abound they are used for *laydax*, the 'wet' or permanent forest cultivation. It will be perceived that the forests depositing an endless succession of decaying vegetable matter, (which accumulates and forms *humus*, or soil proper,) would, as it were, ultimately cause itself gradually to disappear, were it not that the disturbing and removing causes above alluded to put off this catastrophe to an almost indefinite period. I consider these remarks of importance, as they should be borne in mind in the selection of localities for artificial nurseries. It also explains the reason why teak is found to be the most abundant in the vicinity of streams. It is a very great mistake to infer from that circumstance that the Teak tree affects a damp soil; it is, on the contrary, a peculiarly dry and arid looking plant. Any attempt at planting it along the low banks of plashy streams would meet with failure.

" 16. Although the process which I have described above is that of nature, yet it can be hastened by the hand of man. By far the greatest cause of the destruction and disappearance of the Teak tree is the cutting down and clearing the forest for the purpose of cultivation, or *toungyas*. Although all the individual Teak trees may be left standing, (as they generally are,) yet the soil having been once exposed to the influences of the sun and atmosphere, the vegetation that re-appears is never of the original or forest kind, but of the intermediate or second stage. All the forests in the Lower Thoung-yeen, from the Northern flank of the Kamokla spur downwards, are gradually disappearing on this account. I have passed for days through these deserted *toungyas*, deserted long before the memory of man, and have never seen them reverting to their original type; not but what in the lapse of ages, the words of the Latin poet might not be applied to them,—

'Magnus ab integro sæclorum nascitur ordo.'

" 17. In illustration of the above, I will here submit for your inspection a section of the forest, from the Thoung-yeen river to the Daunat range.

(Figure 2 on the Map.)

" The section is that of the tract, about 3 miles south of the Meplai, running due East and West, and at right angles to the course of the Thoung-yeen river, where the characteristics which I have endeavored to insist upon are the most marked. This section shows very prominently the raised central sandstone plateau alluded to in para. 10 as inimical to the presence of Teak, simply because the clay has been washed off of it to the lower and more level land near the rivers. It is on this spot that are found the Fir and Engben trees. This last is a tall straight tree, something like Teak, with a white, light, stiff wood, and from what was said by a nautical person who was for a short time in company with me, appears well adapted for spars and masts. In the districts immediately above and below the Meplai district, to which the above section refers, this central plateau is conformably represented by a range of minor but preci-

pitous hills, running more or less parallel to the Thoung-yeen river and the Daunat mountains.

“ 18. But if instead of taking a vertical section of the forests in their breadth, as above, we take one in their length we find the identically same peculiarities, though on a smaller scale. For instance, the one below is a section running N. and S. parallel to the course of the Thoung-yeen river, of the tract of country called Thiepau’s, south of the Kamokla spur, and north of the Meplai. I have chosen it, because it abounds in a greater number of little streams.

(Figure 3 on the Map.)

“ A,—Raised plateau of sandstone, without Teak, also not elevated enough for Fir, but covered with Engben.

“ B,—Clay (resting on the bed of rolled pebbles), washed to the vicinity of the streams, and covered with Teak.

1,	Maupoothoo	Kyoung,	(stream.)
2,	Thiekara	ditto	ditto.
3,	Thengan	ditto	ditto.
4,	Engyeen	ditto	ditto.

“ It is thus evident that if a person were walking over such an extent of country, he would find himself in a forest of Engben trees, then he would fall in with Teak, and would know from its presence that he was in the vicinity of a stream, crossing which he would again find Teak; then he would get among Engben trees again, and so on.

“ 19. A superficial observer, therefore, thinks that this connexion between Teak and streams is on account of the presence of water, and that the plant affects a damp soil; whereas such is not the case,—the reason being, that in those localities the stiff clay has been washed down and is enabled to lodge.

“ 20. Having thus, at some length, given a description of the physical aspect and geological structure of the Thoung-yeen forests, before proceeding to the next portion of my subject, I will make one remark, to which I shall have to refer hereafter, and that is, that when the clay, the presence of which is so necessary to the existence of Teak, is largely mixed with lime, the compound thus formed being the most favorable for the development of vegetation, we find in those districts through which the limestone spurs of Kamokla and Kyokhet have obtruded themselves, (the disruption of strata so created having caused their lime to mix with the clay), that the Teak, although perhaps not quite so numerous, is yet individually of a far more magnificent and universally vigorous growth, some being full 18 cubits in girth. There are also very few, if any, trees of imperfect development.

“ 21. Having thus mentioned the kind of soil on which Teak grows, I will proceed to make a few remarks on the nature of its growth and the mode of its propagation. Teak is never found in a forest entirely composed of individuals of its own kind, but in company with numerous other forest trees, all requiring the same contingencies of soil and circumstance, and having the same peculiarities of growth. Sometimes a patch of 30 or 40 young Teak trees may be seen without almost any intermixture of other trees; but this is only in particular cases, round some tree which is shedding its

seed. Teak may be said to be very numerous, when it averages one in eight of the trees of the forest. It is thus evident that all the Teak in a tract may be cleared away without in any way altering the forest aspect of the remaining vegetation.* The individuals of other families that remain still enable the ground to keep up its original type. Therefore if young Teak were planted on such spots, all the contingencies would exist necessary for their progress to maturity; whereas if the ground had been thoroughly cleared, as in the case of *toungyas*, the soil, having become altered, could only afford the requisites for a totally different species of vegetation.

"22. The grand mode by which Teak propagates itself is by seed. I have never seen a single case of a sapling shooting from the root; and in the Thoung-yeen only in a few cases where the soil was adapted for a vigorous vegetation, have I seen the stump that had been left of a felled trunk sending up shoots. The first spot on which I saw young Teak in any abundance was half a day's march beyond the Meplai village; and after a careful examination of the locality, I found that they were evidently from the seeds of some partially decayed trees which had been left standing; and in every other case in which I met with young Teak, I found that their presence could only be attributed to a similar cause. This is a very singular fact, but it is almost more singular how it explains many points, which appeared so difficult of solution, in reference to the self-propagation of Teak. It is a remarkable circumstance that whenever I found a great number of fine vigorous and sound full-grown Teak trees, I never saw any seedlings near them. But where these fine sound trees had been cleared away, and here and there some old or deformed trees, or trees decaying from being covered by creepers, or with the large holes in them, &c. &c., existed, I found them accompanied by vast numbers of seedlings. It would thus appear that with the mature trees injured in their growth, or trees progressing to palpable decrepitude, the vegetative force of nature not being called away to the formation of woody structure, or to the support of a large mass of substance, is directed to the effectual development of the seed. So striking is this fact, that one might almost think the plant gifted with volition, and that, conscious of decay, it hastened ere it disappeared to shed its representatives around it. I do not mean by this to say that a Teak tree in its prime does not produce seeds; on the contrary, it does so in abundance, but they never come to anything until the individual shall have reached the decadence of such prime.

"23. This is the reason why that in tracts where Teak abounds, you always find it very nearly of the same size and age, either all full-grown or half-grown, or seedlings; still they are always palpably of the same generation. Not as with mankind, where

* "This observation is worthy of remark, as it shows that if young Teak do not reappear in the same localities from which wood-cutters have worked out the original Teak, it is not because the ground or soil is altered: in such spots, *viz.*, forests where the Teak tree only has been cleared away and all the other forest trees left, the place of the removed Teak is, after some time, supplied by forest trees of the same kind as those that were allowed to remain. The second stage of vegetation described in para. 15, and which may be styled forest jungle, in contradistinction to forest *trees*, only makes its appearance (except were growing naturally) on spots where wholesale clearances have been made of *all* the trees of the forests. "T. L."

we find in every society a due admixture of old age, youth, and childhood.* Except that in the case of very young seedlings, there *may* be a few rapidly disappearing individuals of a former generation left. If my view then is correct, and we take a forest of fine trees, the process would be this. Nature would first rear a forest of trees; they would grow up side by side, all nearly of the same size and age; when they had fulfilled the obligations of their growth, and were nearly all about the same time hastening to decay, they would simultaneously, before they disappeared, scatter their young around them. A new forest would thus rise, with individuals of nearly all the same size, to go through the same process. If, however, such a forest in its full prime were worked, the forester would hasten to kill every tree at once, and thus most effectually prevent the Teak re-appearing.† If, however, there happened providentially

* "It is not to be doubted that there may be found occasional exceptions; but these, if anything, would rather tend to confirm the rule. The first years of the existence of the Teak plant appear to be occupied in attaining height. Thus a very few years' difference in the age of two seedlings, offsprings of the same tree, makes an extraordinary difference in their appearance; and the elder, of some 15 years of age, would appear not of the same generation as the younger, of but a month's date. In the lapse of years, however, this disparity disappears, and the full-grown Teak tree, of 185 years of age, would equal in size and appearance one of 200 years. An illustration of this is shown in the case of a patch of very numerous young Teak, about half an hour's march from the bank of the river in the march from *Khyouk-pouk Tsahan* to the Thoungyeen. Here some half-dozen older trees have been shedding their seed for the last 15 years or so, and they are surrounded by seedlings varying in height from 1 foot to 20 and more. These last have almost the appearance of young Teak, in contradistinction to seedlings, and an instance at first sight appears of an admixture of 'old age, youth, and childhood,' in reference to Teak. But on examination it will be shown that none of these apparently *young Teak* have the marks of seed capsules, whereas the old ones are covered with them; thus showing that the seedlings could not have been the produce of the young Teak raised with them. Again, at times very young seedlings may be found without any old tree near them: in such cases the parent tree has fallen down, and got destroyed or otherwise disappeared, letting alone the many ways in which seeds may be conveyed by storms of wind, by birds, and even in the rough fur of animals, &c. It is probable that the remarks in the text with reference to Teak are just as applicable to *all* forests in a state of nature. Any one who has seen either the forests in the North of France, or Southern Germany, or even forest-plantations in England and Scotland, must be aware that when standing in the middle of a given space which the eye can contain, all the trees are nearly of the same size, and thus he can see a considerable distance between the stems of the trees; whereas if these trees were accompanied by swarms of seedlings of varying height, the line of vision would be perfectly obstructed."

† "As a corroborative illustration of this point, the following extract is appended from an article entitled, 'Teak forests and timber trade of the Tenasserim Provinces,' from the *Muslemic Chronicle* of the 23rd December 1846:—

'It has been remarked that where Teak forests have been worked out by the wood-cutters, that no young trees have risen up in the same forests to fill up and supply the places of the parent tree, but that forest trees of a different description invariably spring up and occupy the ground from which Teak trees have been taken away. This curious fact is well known to the Karens and Burmese wood-cutters, and has no doubt been noticed by many European observers before. The reason that might be given for this is, that the ground has exhausted its strength

to be some imperfect or malformed trees or crooked in shape, or otherwise so injured as not to be worth bringing away, these would remain to form centres of propagation, and the forest would revive. This is the reason why Teak seedlings are so abundant in the Middle and Upper Thoung-yeen; whereas on the flanks of the Kamokla and Kyokhet spurs, as also on the Attaran, they are not to be found, except in very rare instances. From the great admixture of lime in the soil of these last-mentioned districts, the vegetation is so powerful and vigorous as scarcely to admit of imperfectly grown trees, (in other words, centres of reproduction),—they, being all in their full prime, are being killed, and are rapidly disappearing without leaving any representatives behind them.

“24. In the Middle and Upper Thoung-yeen, the greatest enemy to the Teak tree is a species of parasitical Ficus. It is curious to see the process by which this plant entirely destroys a tree. At first, under the guise of a slender and graceful creeper, scarce the thickness of a finger, it appears only to appeal for support. In its second stage it may be seen spreading out the woody structure of its stem and shooting its light foliage far above the original tree, yet appearing, however, to vegetate with it, as it were, on equal terms. Till last comes the closing scene; the parasite has entirely enveloped the original tree in its deadly folds, and absorbing all the juices of its life, nothing remains but the projected stump of some withered arm to show that any other plant had once been there. Yet, this parasite appears never to attack trees of a perfectly vigorous and healthy growth; and thus it is that I have never seen a single instance of its presence in the forests of the Attaran, or of Kamokla and Kyokhet.

in bringing forth and rearing to maturity the vast forest of trees that cover the face of the country and is not in a state to support and nourish another generation of young trees. Young Teak are, notwithstanding the above remarks, very plentiful, springing up spontaneously in new localities. They are scattered about in many places, the young plants choosing as it were new spots and tracts where no old trees exist. Whenever the soil is congenial to their growth they thrive well, and do not require assistance; unassisted nature alone takes the task of rearing Teak trees for future supplies, and will do so more efficiently than by any artificial nurseries that may be made by man. From the number of young Teak trees found growing scattered in every direction, there is no reason to apprehend a want of Teak for the future, although it is by no means improbable that before the young trees attain a mature age and are fit for cutting, the Teak trees worth falling will be exhausted.’

“With reference to the above extract it is very evident, from its own showing, that the reason why young Teak do not appear in localities ‘where Teak forests have been *worked out* by the wood cutters,’ cannot be because the ground has been exhausted of its capabilities of again rearing a forest type of vegetation, seeing that it is immediately said ‘that *forest trees* of a different description invariably spring up and occupy the ground from which Teak trees have been taken away.’ Again, the circumstance of young Teak being found generally all of the same size, and not mixed up with mature trees, is noticed. But if by their springing up *spontaneously* it is meant that the soil produces them by any creative energy it may have in itself, or in other words, by equivocal generation, and that they are not the produce of the seeds of some parent trees, it is to be feared that modern botany would scarcely concede to ‘*unassisted nature*’ the possession of so strange a power.

“T. L.”

“ 25. I have but a few remarks to make on the Attaran forests. The only tract in that part which I was enabled to visit were the forests on the Zimmè branch of the Attaran,—having been disabled by illness from proceeding to the Weinyo.

“ 26. The forests in the Attaran river are not like those on the Thoung-yeen, situated on an elevated plain,—the whole extent of country being on the same level as the plains of Moulmein. I found, however, the same kind of soil obtaining as on the Thoung-yeen; namely, clay resting on compact sandstone, but the bed of rolled pebbles and concrete was absent. The under-lying sandstone likewise, instead of occupying the prominent part it did in the Thoung-yeen forests, even altering the nature of the superincumbent vegetation, was very subordinate, and would in a great measure escape the notice of a casual observer. The Attaran plains are intersected by several ranges of hills; the most easternmost, being one called the Thoung Wyn, separates the forests on the Zimmè from those called the Upper Mittigate. Between the Zimmè and the Weinyo, again, is another range of hills bearing various detached names; and to the west of the Weinyo is a third range intervening between it and the sea. All these three ranges are composed of limestone; they are somewhat low, but very precipitous, and their peculiarity is that they do not consist of continuous ranges, but of small detached ones, all running N. and S., and occupying different positions in the plain, and at varying distances from the streams. The consequence is, that the original clay has been much mixed with their lime, and the soil is of the same marly nature as the forest tracts on the flanks of the Kamokla and Kyokhet spurs. The vegetation likewise is exceedingly vigorous; the underwood in many places impassable. The Attaran Teak is therefore much more rapid in its growth, attaining a larger size in a shorter time, and is altogether of a far more compact and sound substance. On account of this propitiousness of soil, and consequent vigour of vegetation, it happens that scarcely any imperfect or malformed trees, or trees decaying in their growth, or (as I have before shown) in other words, centres of propagation, are to be met with, and *ergo*, no seedlings. This absence of seedlings is a characteristic mark of the Attaran forests.

“ 27. The only way in which reproduction could take place in the Attaran forests would be by leaving a few trees scattered over an extent of country, to grow old, die away, and produce seedlings during the latter period of their existence; but this is prevented, for any tree that can possibly be a source of gain is cleared away. And from the accessibility of these forests, their short distance from Moulmein, and the navigation of the river offering no obstacles, any crooked or deformed trees which may exist, and would have been left standing in the Thoung-yeen, as not worth the expense of removal (and therefore ultimate sources of germination), are in the Attaran forests cut for the purpose of supplying crooks for ship-building. Thus it is we are thrown back to a former period, when these forests were allowed to go through the processes of nature. The young Teak (in contradistinction to seedlings) which we *do* find on the Attaran, are representatives of seeds that germinated some fifteen, twenty, or thirty years ago, when the plant thrived unvexed by the presence of man. Another peculiarity is, that the force of vegetation being so powerful in the Attaran, stumps of felled trees invariably throw out a number of sprouts, which after attaining to a certain height, become very crooked, and thus afford a continued supply of crooks.

“ 28. The Attaran Teak affects the banks of streams, not on account of any partiality for water, but merely because there, as in all flat countries, the land immediately bounding the stream is the highest. The land extending between two streams is like a saucer, lowest in the centre ; and however adapted for rice cultivation, is invariably shunned by Teak.

“ 29. I have already alluded to two existing causes of injury to teak, *first*, the formation of *toungyas* ; *second*, a parasitical creeping Ficus. I never found one instance of the last in the Attaran forests, as it would appear that this foe never attacks any but plants of a less vigorous growth. The first likewise is very subordinate in the Attaran. The Karen population is very scanty, (although there is going on a steady immigration from the Siamese states.) But in any case the Attaran forest districts could support a numerous population without in any way interfering with the localities affected by the Teak plant. For as the whole extent of country is a plain, intersected by an immense number of streams, and (as I have already remarked) the central portion between two bounding streams is the lowest, there is to be found there an accumulation of moisture and soil adapted for rice.

“ 30. A third supposed cause of interference is the injury done to young plants by allowing a tree when felled to fall of itself and not lowering it with ropes, &c. I think that such causes of injury are so slight and local as not to be worth notice. Timber is expressly and invariably dragged in the wet weather, when the surface is moist and slippery, because it thus requires one tith of the labor necessary in other seasons, when the surface is rough and impeding. For the same reasons foresters, in dragging a tree, go out of the way to get into a track formed by a preceding log, which has smoothed the way before it.”

109. The “ fourth and last supposed source” of destruction to Teak forests, Captain Latter says are the periodical fires which occur in the month of April, when the vegetation is dry and parched up. Captain Latter ascribes these fires generally to the natives, (who burn the vegetation and felled trees for the purpose of clearing the ground for cultivation,) and after describing the appearance and extent of the fires, writes thus :—

“ 33. It should be remembered that though the fire may consume the stem of the young plant, it does not consequently injure the root. It is surprising to what a small depth of soil the heat of a very great conflagration is able to penetrate. Each successive destruction of the stem throws accumulating vigour into the root ; till at last, aided by the ashes of its former self, the plant is enabled, during the interval of visitation, to shoot itself safe beyond the influence of the destroying element. This fact is curiously shown by the circumstance that when a number of seedlings are found at the foot of some parent tree, and the surrounding ground bears the palpable marks of the last fire, the seedlings varying in height from 1 foot to 12, and even 15 feet, will be found free from the slightest marks of fire. It is evident, therefore, that they must have all sprung from the ground at the same time since the last fire ; although, from their varying heights and concentric wood rings, actually seedlings of different years. Another illustration was in the case of two seedling trees in the Attaran, near the

Goonjee creek. They were both within nine feet of one another, near a solitary old tree which was evidently their common parent; they were both nearly the same height of 15 feet. The ground and every object around bore the marks of the last conflagration, and the only difference was, that whilst the thickest and eldest was smirched with smoke, the stem of the other was perfectly clean, showing that it had sprung up after the last fire. Thus the elder had already successfully withstood the effects of the last fire, whilst the younger, having since that date reached the same height, and nearly the same substance, would probably be as victorious over the succeeding ones. It should be remembered, that it is the long dry grass and crackling underwood which supply the devouring element with life. Hurried on by the terrific draft itself creates, the slightest pause would be fatal to its career. A tree full of sap and green vigour requires a regular roasting before it will succumb; with such the fire does little more than flicker up the trunk, licking off the dry moss and unsightly parasite. It destroys only those trees which have been felled and left lying on the ground: the effect of a conflagration on such prone trees is most destructive. In the wide extent of forest I have visited, I have never seen a single instance of a healthy and sound plant permanently injured by the fires. Again, if we take into consideration the fact that every tree brought into the market is killed and allowed thoroughly to dry and season for three years, and is in this state exposed, *standing*, to the attacks of three successive conflagrations, and that few bear the slightest marks of fire; it will be evident that the destructive effects of annual fires have been much over-estimated. I cannot but think therefore, that any money expended in the prevention of the attack of these fires will be thrown away,—the more so, that taking into consideration how rapidly a dense and stifling underwood springs up in this climate, it is probable that so summary an admission of ventilation, just before the setting in of the rains, is highly beneficial to the nobler plants of the forest.

* * * * *

“ 79. I will now refer to the subject of nurseries or artificial sowings of seed. The remarks which I have already hazarded, on the mode of the spontaneous reproduction of the plant, will render this subject much more simple.

“ 80. Self-sown seedlings being so abundant in the Thoug-yeen, there would be no need of nurseries there, except perhaps on the flanks of the Kamokla spur. It is on the Attaran, where the plant is rapidly disappearing, from the causes I have already alluded to, that some artificial measures might be adopted.

“ 81. I have at some considerable length dilated upon the circumstance of the seed of a still growing vigorous Teak tree not germinating. I do not mean to say but what there may not be some rare exceptions; but the broad fact, I feel assured, will only be confirmed by further examination. It may be said, that perhaps the reason of seeds not germinating in the presence of vigorously growing plants, is not so much from want of germinating power in themselves, as from the ground, already taxed to the uttermost for the support of one giant brood, refusing to exhaust itself by attempting to rear another. To this however I cannot agree, as I have seen many instances of vigorous young plants, rarely scattered here and there, from 15 to 20 years old, covered with the empty capsules of fallen seeds, and yet having no seedlings around them. The only modification of my opinion which I could concede, is that in favor-

able circumstances, where the Teak has been pretty well cleared away, those vigorous young plants which are left may produce, by the kindly force of nature, germinating seeds, sooner than they would have done had they been in a crowded company.

“ 82. It is well known that every attempt at artificial sowings have proved a failure. I will endeavour to point out what I consider the reason, *viz.*, that instead of imitating nature, her processes have been strangely violated.

“ 83. One locality was selected for planting seeds, because from the number and magnificence of the Teak trees on it the ground was argued to be peculiarly favorable to the plant. What I have already pointed out, (*viz.* the fact of seedlings not being found in the immediate presence of vigorous trees,) will show that this was just the very reason why it ought to have been shunned. Again, on the next and last occasion, a space of ground was cleared and kept clear, long ridges were thrown up on which seeds were planted in drills and rows, and were expected, like the teeth of the dragon in mythology, to start up in files and platoons. Here again the feelings of nature were violated ; the access of the sun and the impingement of the rain altered the nature of the soil, and robbed it of its capabilities of raising a forest type of vegetation.

“ 84. I would, therefore, recommend that in the case of artificial sowings the process of nature be imitated as much as possible. I would select a locality, in every respect preserving its forest type, on which there was little or no Teak, but which had once been a notoriously favorite locality of the plant. I would then proceed to sow the seed with spargent hand, without any regard to regularity and system or arrangement. And although, perhaps, I would not have sufficient presumption to imitate nature in her higher combinations, and set fire to the seedling in order to see it rise again, as if refreshed with sleep, yet I would leave it entirely to the varying vicissitudes of its fate, and try if by that means I could not see a vigorous healthy brood arise, instead of one single sickly solitary exotic;—for it should not be forgotten, that out of the many hundreds of thousands of seeds planted by Government, one only has come up.

“ 85. With reference to the proper time of killing or girdling the Teak trees, I must mention that the Karens declare that they ought to be killed in September, just as they are getting into full flower. They say that then the tree dies sooner, the bark comes off easier, and it seasons quicker. On this point I can form no opinion, as I think it ought specially to be referred to a scientific botanist “ whether the girdling a tree in full flower is detrimental to the wood.”

* * * * *

110. It may be observed here that many of Captain Latter's opinions have been impugned, and his views of the mode of propagation of the Teak plant have been pronounced to be erroneous.

111. It has been stated in para. 108 that Captain Durand's successor, as Commissioner of the Tenasserim Provinces, was Mr. J. R. Colvin. This gentleman assumed charge of the office of Commissioner on the 29th December 1846, immediately gave his attention to the important subject of forest management, and on the 28th October 1847 submitted to Government an elaborate report “ on the general question of the course

to be followed in regard to the Teak forests." It was sent in reply to the letter, (quoted in para. 102,) which had been addressed by Government to Captain Durand on the 7th September 1846, and contains, together with much valuable information regarding the forests, a complete exposition of Mr. Colvin's views and suggestions on forest administration.

112. The Teak forests of Tenasserim are described in Mr. Colvin's report as being in two great divisions. One extends along the Attaran rivers (the Zimmè and Weinyo) in the South, and the other on the Thoug-yeen river in the North. The superficial area of the former was estimated at about 225 square miles, that of the latter at about 600 square miles; but in either division only about the half of the estimated area is supposed to have Teak growing on it. The timber from the Attaran (or the Zimmè and Weinyo) forests, was superior in grain and durability, and averaged in size a quarter more than that from the Thoug-yeen forests. There were only three unoccupied forests on the Attaran, that is to say, only three forests for which no *leh mats* or licences had been granted to individuals. These were the Upper Mittigate and the Mittigate Codoogway on the Zimmè river, and the Thengan-nyee Nyong, on the Weinyo river. Mr. Colvin proposed (in a separate communication, which will be noticed hereafter) to grant the Mittigate Codoogway forest to Messrs. J. Mackey and Co., who had applied for it, as well as for the Upper Mittigate, and to retain the other two forests for Government, as they were "well suited to be reserved for the purposes of having a large growth of timber at command, when a supply of such timber may be required for the construction of the larger class of ships of war." Of the other forests on the Attaran, which were occupied or held under *leh mats* or licences by private parties, who also worked them, Mr. Colvin proposed to grant long leases to those parties for their respective locations, on such terms as Government might prescribe. But Mr. Colvin strongly recommended the cession in perpetuity to the holders of *leh mats* or licences of all locations which were occupied by them.

113. The general terms on which Mr. Colvin proposed to grant leases for 99 years or in perpetuity were, that—

* * * "At the end of certain terms of years, say of 10 year terms, the grantee should show that he has, within his limits, Teak seedlings growing up, say to the extent of a third or a half of the whole number of trees which have been taken from the forest on an average of the past 10 years. A restricted condition of this kind should leave an ample reserve to the grantee for space occupied by more advanced trees already naturally produced, and rising in the forests, (which would of course deprive

him, *pro tanto*, of space for new plantations,) as well as for partial failures in his attempts to raise new plants. I would not mix up the Government officers in plantations within the boundaries of private tenures. The grantee ought to be distinctly responsible for his own failures, and to be allowed to aim at success in the manner which he may think likely to be the least costly and the most effective.

“19. The grant might include, as suggested in para. 35 of your letter, not only Teak but all trees and products of the forests, with the reservation to Government of the discretion to impose a duty, should it think fit, not exceeding 10 per cent. upon such trees and produce, in like manner as on the produce of mines.

“20. The grantees might either, as recommended in the letter of the Hon'ble Court of Directors of 30th November 1842, be restrained by an express condition from clearing the land from cultivation, or employing it otherwise than for plantations, or if it is thought that the admission of absolute property within the limits above shown, will be of little consequence in this uncleared territory of above 25,000 square miles in extent, the property might be made complete and unconditional, subject, as referred to in your letter, to a land-rent at the usual rate for any part of the land at any time brought under cultivation. The objection to this last mode of procedure is, that the land might lie useless in the hand of the grantee, as he would scarcely find his profit in engaging to pay rent-rates for ordinary produce in those comparatively remote districts. On the other hand, if the grant be made on the terms stated by the Hon'ble Court, I would allow clearance to the extent of a tenth or some such proportion of the area without forfeiture of the grant, so as to allow the grantee to give encouragement to parties to settle near the places where the Teak grows, and to give useful assistance in forest conservancy.”

114. In granting leases or permanent tenures to the occupants of forests on the Attaran, Mr. Colvin thought it would be advisable to exclude “many of the Burmese holders of forest licences, who have not the means or the character from which to look for a useful result, were such a concession made to them.” With this view, Mr. Colvin proposed to “make it a condition of a permanent grant that not less than 200 logs shall have been brought down from the tract within some one of the last three years.” Forest-holders, who may be excluded by this condition from claiming new leases, might be allowed to retain their respective holdings, “but whenever as many as 50 logs shall not have been brought down from the forest within a consecutive term of three years, the tenure might then be absolutely resumed.” Mr. Colvin would leave the holders of the new leases unfettered in their mode of bringing Teak to the market, by any conditions save some relating to the size of the trees. These conditions he would enforce at the duty station under the following rules:—

“1st.—That the minimum girth of logs allowed to be prepared for duty, be reduced from 6 to 5 feet.

“2nd.—That the duty be fixed on the log, and not per ton, at the rate of 3 rupees a log on all wood but that of the Attaran, and 4 rupees per log on the Attaran wood.

“3rd.—That below the standard of 5 feet girth, no timber be allowed to pass beyond an allowance of 5 per cent. for branches of trees and natural dwarf timber, &c., which proportion may be passed at half duty along with any raft of full-sized timber. Under-sized wood in excess of this proportion to a full sized raft should be confiscated.”

115. The duty then existing was at the rate of only 5 per cent. on the actual value of the timber, and referred to a percentage calculated on the timber after adding to it the cost of conversion. But on the rough log the duty ranged at from 10 per cent. upwards, “according to what may be taken as the average value of the rough log,” and this Mr. Colvin considered the principle on which to levy the duty.

116. On the subject of the renovation of the Attaran forests, Mr. Colvin concurred in the opinion of Captain Guthrie, which is quoted at pages 142 and 143. He therefore proposed to select the Thengan-nyee Nyoung forest on the Weinyo river for his first experiments, and with that view applied for the services of a qualified person from the Calcutta Botanical Gardens “to superintend the details of this experiment.”

117. Regarding the management of the Thoug-yeen forests, where there was a thinly scattered population of Karens, who were admitted to possess certain undefined prescriptive claims on the trees, Mr. Colvin wrote as follows :—

“28. My own opinion in favour of leaving matters of this kind to private enterprise is so strong, that notwithstanding even the special considerations applicable to forest property to which I have before referred, I might have been disposed to have recommended a survey, valuation, and sale of convenient divisions of forest on the Thoug-yeen, if it had not been for the existence there of the Karen population, whose recognized connexion with the forests, and rights in them, call for a suitable provision of security, such as I fear cannot be given on any transfer in property to private purchasers. I do not think that it is necessary or reasonable to allow, as of principle, to the Karens, a complete and exclusive property in every tree which they kill and season, but usage and expediency alike concur in assigning to them a beneficial interest in every tree, and an assumed freedom also from molestation in moving about the forest, and hence I see no medium between permitting the Karens to prepare the trees, for an established payment, under Government superintendence, if the cost of such superintendence should not prove incommensurate, and allowing them to dispose of the trees as they may themselves arrange, if the expense of supervision by the Government should be found decidedly beyond any return which can be obtained by the disposal, as on its account, of the trees in the forest.”

118. Captain Latter having been ordered by Mr. Colvin to test the system of working the Thoung-yeen forests under Government control, divided the forest tracts into two portions. The first or lower portion extended from the Eklaik Choung, or creek, in the North, to the Kunnoo Choung in the South, and the second portion began at Kunnoo Choung and extended Southwards to the Meglah or Megualar Choung. The first portion, which was estimated to contain about 4,500 trees ready for removal, was made over to Karens, who resided in that locality, and "who came forward through their agent and offered to bring down the trees for Government, receiving no advances or payment until the arrival of the timber at Moulmein." Mr. Colvin assented to this arrangement, in order not to withhold what he understood was almost a necessary inducement to the Karens to bring timber down the river, but he did not intend again "to treat them otherwise than as purchasers on their own account." The second portion, from Kunnoo Choung to the Meglah, was subdivided into five smaller portions, and these were thrown open separately to public competition under the following notification, which is here appended as an illustration of the measures which were adopted under Mr. Colvin's directions :—

"NOTIFICATION.

"1. Tenders are invited for the purchase and bringing down in this season, of the killed and seasoned and *Nat-that* Timber, in the tracts mentioned in the table annexed, at a rate not less than one rupee for trees killed, seasoned, and standing ; of rupees two and annas eight for trees felled and lopped ; and five rupees for trees dragged to a water-way ; these rates being for full-sized trees ; and at not less than half of these rates respectively for under-sized trees. Tenders for each tract to be separate, though the same person may tender for one or more tracts.—Tenders to specify the rate offered for trees of each class, as above stated.

"2. The killed and seasoned trees in the tracts referred to, according to the returns in the office of the Superintendent of forests, are specified in the annexed table.

"3. Should there be more killed and seasoned trees in any tract than those enumerated in the table, they may be taken on being pointed out by the forest Goung or the peon of his establishment, one of whom will go up with each purchaser. For such additional killed and seasoned trees, a payment will be required of one rupee for every killed tree ; rupees two and annas eight for every tree felled and lopped ; and rupees five for every tree dragged to a water-way, for full-sized trees ; and half payment for under-sized trees, as above. *Nat-that* trees may be brought down without any other specific payment than that included in the general terms of the tender for purchase.

" 4. No tree, whether killed and seasoned or *Nat-ikat*, to be cut unless first pointed out to and marked by the forest Goung or peon, as above, who may accompany the purchaser; and no tree, whether received standing or felled, to be removed from the forest until so marked by the Goung or peon, with a mark to be given to him for that purpose by the Superintendent of forests. For every killed and seasoned tree cut or otherwise received, a receipt to be given to the Karen Tsokay of the division. Any seasoned trees brought down to Kadoe in excess of the receipts so given, will be liable to confiscation.

" 5. Payment of the sum tendered as purchase-money, to be completed by 1st July, 1848; but should any of the timber cut and brought from the tract included in the tender and contract, be brought to Kadoe to be passed for duty before that date, a value for such Timber, (or for so much of it as the Superintendent of forests, with appeal to the Commissioner, may determine,) at a rate of Rs. 15 per ton for sound timber, to be paid on account of the purchase-money, (in addition to the duty,) before the timber can be passed; and the same rule to be continued on the arrival of each raft, till the whole amount of purchase-money has been paid, after which the duty only on the timber will be required.

" 6. Should the amount of purchase-money not be paid in full by 1st July, 1848, all timber belonging to the party tendering, whencesoever brought, to be liable to seizure, at or above Kadoe, and to sale by order of the Superintendent of forests, in satisfaction of the claim of Government on the contract. This not to bar any right of civil action on the contract, or any lawful remedy whatever which the Government may otherwise possess. All sales of timber, brought from the tract comprised in the contract made before the timber has been passed at the Kadoe station, to be invalid unless the purchase-money for working the Tract has been paid up in full, and the Superintendent of forests to have the same right of seizing such timber in that case in the hands of a third party, as in that of the party to the contract.

" 7. Any timber not dragged to the water's edge before 1st January, 1848, to remain in the forest as the property of Government.

" 8. Special security may be demanded from any party tendering, at the discretion of the Superintendent of forests, with an appeal to the Commissioner, and the party to be similarly bound to show that he possesses, or has the means of acquiring, the necessary number of elephants, &c., for working the tract for which he tenders.

" 9. With this reservation, the highest tender to be accepted.

" 10. All timber to be brought down to Kadoe at full lengths as cut. A penalty for bringing down any short lengths, or for any wilful and serious damage, or waste to other trees in cutting or bringing the seasoned timber from the Forest, or for cutting trees otherwise than as above stated, or for removing the marks to be placed on the trees by the Forest Goung or peon, to be included in finally settling the terms of each contract.

" 11. Tenders to be sent in ten days, *i. e.* on or before 5 P. M. of Tuesday, June 22nd, to the Commissioner's Office, sealed.

Statement of the seasoned Teak Trees in the under-mentioned Districts on the Thoung-yeen River.

NAME OF DIVISION.	NAME OF TSOKAY.	No. of Trees ready to be brought down this season.				Total.	
		Felled.		Killed.			
		Under 6 feet Girth.	Above 6 feet Girth.	Under 6 feet Girth.	Above 6 feet Girth.		
Tegabore, and Mieraway, ...	Gnathanyo,.....	.....	.....	.....	1099	1099	Of the 600 felled Trees; 579 are dragged to the Meplai River, about half way down to the Thoung-yeen.
Meplai,	Phaganan,	459	141	518	784	1902	
Kyokhet, or Meplai, to Megualar Choung, ...	Gnathaaba, ...	.....	.....	559	867	1426	
Megualar,	Paupopah,	91	97	14	239	441	
Grand Total, ...						4988	

" N. B.—The Meplai lot of 1,902 trees will be open to tenders in two parts; viz., of 1,302 and of 600 trees each. It is possible that some of the Trees, above mentioned as standing, may be found to have been since felled by the Karens, on purchasers now going up to the forests. In that case, the fact must be noted in the receipt to be given to the Karen Tsokay under article IV. of the Tender.

" The usual double duty will be charged on the under-sized Timber, which is included in the contracts with the view of clearing the forests of all old dead wood."

119. For the five sub-divisions separately, Messrs. Booth and Deas and five Natives contracted under written agreements, framed in accordance with the terms of the preceding notification. Mr. Colvin expected that the returns of this experiment would cover the expenses which were incurred in properly conducting it, but he was doubtful whether it would be profitable if tried on a more extensive scale, and therefore recommended to Government that the question of the Thoung-yeen forest management might " be left to be determined by further experience."

120. On the 24th April 1848, Government replied to the foregoing report. Mr. Colvin was furnished with a copy of the Despatch of the Court of Directors dated 20th October 1847, quoted at paragraph 107 in page 150, and was informed that such of his measures and recommendations as were in accordance with the views expressed by the Court in that Despatch, were approved. The only proposition, therefore, which was negated, was that for ceding forest-holdings in perpetuity

to the existing occupants, who were to be allowed leases instead, while the questions affecting the forests on the Thoung-yeen river were allowed to lie over until experience had satisfied Mr. Colvin of the advantage or otherwise of his experimental measure. A report was in the meanwhile required on those forests, which it was suggested should be reserved for Government in the same manner and for the same purpose as the forests of the Attaran, and Mr. Colvin was desired to communicate with Dr. Falconer, the Superintendent of the Botanical Gardens, as to the sort of person best fitted for the proposed nursery in the Thengan-nyee-Nyoung forest.

121. On the 21st June following, (1848,) Mr. Colvin acknowledged the foregoing order of Government and of the Despatch of the Court of Directors of 20th October 1847 which accompanied it, and again pressed the reconsideration of the question of the tenure to be granted to the holders of forest tracts on the Attaran river in the following remarks:—

“ 2. The Despatch from the Hon'ble the Court of Directors, transmitted to me with that letter, states two important objects as in their contemplation with reference to the management of the Teak forests of these Provinces,—the one, that the tenure conceded to occupants of particular tracts should be such ‘ as might interest them in keeping up a succession of timber trees on their lands;’ and the next, that no fresh grant should be given ‘ until an extent of wood-land conveniently situated, and sufficient to supply the timber required for the public service, has been selected and placed under the management of Government officers.’

“ 3. The orders of the Hon'ble Court, prohibiting any concession of permanent property, may perhaps be held to apply rather to the more extensive proposition* then before them, for selling *the whole* of the forest lands with a full proprietary title, than to the more limited question of the tenure on which it may be best for the public interest to allow the actual holders of portions of the forest lands to continue in possession.

“ 4. I need not repeat that the portions so held by individuals are situated on the streams of the Attaran river only, and that the whole of the forests along the Thoung-yeen river are within the exclusive possession and control of the Government officers, so that the second of the objects above specified, as declared to be necessary by the Hon'ble Court, is already effectually provided for.

“ 5. In respect to the first object, that is, the interesting the present private holders of forest lands in keeping up a succession of timber trees, it seems to be alike obvious and important that such interest can only thoroughly be given by making their tenure avowedly permanent. It is clear that they would have no interest in attending to the rearing or preservation of a succession of timber trees, which would come to maturity only after the expiration of their 99 years' lease, other than such a compulsory one as might be attached to them by the exaction of a penal condition, the fulfilment of which

* See page 150.

they might neglect or evade, and yet hope to save themselves from the stipulated consequences, under the shelter of many excuses which might be partially fair and reasonable, or at the least specious.

"6. I strongly believe that it would be decidedly better for all parties, the Government as well as the present holders of forest tracts, that their tenure should be at once made permanent, instead of being for any term of years.

"7. I feel there is much truth in the remark of the Hon'ble Court, that even holders in perpetuity may not think it worth while to form plantations, or provide for fresh growths of trees, which must remain for 80 years, or even more, without yielding to them any returns of value. But the question here is not whether it is desirable to part with forest lands to private persons, but whether having parted with them it is not better that the transfer to such persons should be on the most secure and acceptable tenure.

"8. I am satisfied that all the general objects which the Hon'ble Court have in view regarding a full independent command of valuable forest resources in this territory, will in no way be effected by the measure proposed of granting to *actual holders* a change from a 99 years' lease to a permanent property.

"9. The question would then remain whether to give over these tracts, to be held as forest property only, upon some special conditions such as are referred to at the close of paragraph 18 of my report of the 28th October last, or to make them absolutely over on no other condition than that of payment of revenue, at the rate of the locality, on all or the greater part of such of the lands as might hereafter be brought under cultivation. Of course, special conditions, such as were before mentioned by me, might be eluded, or a violation of them might be palliated by holders on a permanent title subject to such conditions, as well as by holders for 99 years; but then there would be strong motives of direct personal interest superadded, in order to secure an observance of those conditions. The Government, however, may probably be prepared to adhere, in preference to its original recommendation, that the concession of a permanent tenure in these cases should not be fettered by any such special precautionary arrangements.

"10. I would venture to solicit, if it should appear proper to the Right Hon'ble the Governor, that the point here discussed, referring solely to the present holders of forest tracts in the Provinces, should be particularly submitted, with the explanations offered in this report, for the definitive consideration and orders of the Home Government."

122. On the 10th July following, Mr. Colvin again addressed Government, and submitted for approval a copy of a memorandum prepared under his orders by a Committee consisting of Captains Phayre, Berdmore and Latter, "for the purpose of finally settling the rate of duty per log" to be charged in the Provinces, in lieu of the old duty per ton. Mr. Colvin says "the Committee sat publicly, so as to show to all parties interested the data on which they proceeded, and to receive any suggestions which such parties might desire to offer." The rates of duty which the Committee proposed differ but slightly from

those suggested by Mr. Colvin in his report of the 28th October 1847, and quoted in para. 114, being 4 rupees for each log brought down the Attaran river, and 2 rupees 12 annas, instead of 3 rupees, for each log brought down through the other rivers. It was expected that the levy of a uniform duty on every log below a minimum size would discourage the felling of under-sized trees.

123. On the 7th August 1848, Government authorized the adoption of the proposed scale of duty, and on the 13th September following, a full report on the subjects of Mr. Colvin's report dated the 28th October 1847, of his two subsequent communications of the 21st June and 10th July 1848, and of the orders of Government thereon, was sent to the Court of Directors under instructions from the Earl of Dalhousie, the Governor of Bengal. The favorable consideration of the Court of Directors was solicited to the proposal of Mr. Colvin for converting the leases for 99 years into grants in perpetuity. The Court replied to this report on the 12th September 1849. They disapproved of Mr. Colvin's proposal for granting leases in perpetuity, but sanctioned all the other measures which had been suggested and those which had been introduced, the modified rates of duty included. On the subject of the proposed leases in perpetuity the Court wrote,—

“5. We cannot accede to any recommendation which would alienate from Government in perpetuity the proprietary right in these forests. We attach little importance to the argument urged by the Commissioner, as we are of opinion that, where the prospect of obtaining any remuneration for the labor and expense bestowed on the forests is so distant, as must necessarily be the case in regard to the plantation of young Teak trees, a perpetual tenure would have little, if any, advantage over a 99 years' lease, in inducing the grantees voluntarily to incur that labor and expense, where there exists no express condition to that effect. We consider that a far more effectual plan for securing a renewal of the forests on the tracts occupied by the present holders, would have been to make it a condition of the lease that three seedlings should be planted whenever a tree had been cut down, and that any default in this respect (which might be ascertained by periodical inspections) should render the grant liable to resumption. Such a condition, if faithfully performed, would secure for the future a constant supply of Teak timber, and it might be held out as an inducement to the lessees to exert themselves for the improvement of the forests, that if they were successful in that object, they might look forward to a renewal of the lease at the expiration of the present term.”

124. The Court of Directors further deprecated the recognition of any proprietary right in individuals, whether European or Native, to either the growing timber or the land in the Thoung-yeen forests. They observed, in reference to Mr. Colvin's report on this subject, that

“ in the proceedings of the local officers, there appears to be a tendency to blend the right of property in the timber with the fair reward for labor.” The Court thought the Karen inhabitants might “ reasonably expect a fair remuneration for their labor in felling and preparing the trees, but they must not be allowed to have any right of property in the timber itself or in the land on which it grows.” These orders of the Court of Directors were communicated to the Commissioner of the Tenasserim Provinces on the 14th January 1850.

125. In the meanwhile Mr. Colvin's application for the services of a person from the Calcutta Botanical Gardens to superintend the nursery in the Thengan-nyee-Nyoung forest, resulted eventually in the deputation of Dr. Falconer, the Superintendent of the Botanical Gardens, on a tour of inspection of the forests. Dr. Falconer embarked for Moulmein in January 1849, and after having made a tour of the Teak tracts in prosecution of the objects of his mission, returned to Calcutta in April following, with all the requisite information for suggesting proper measures for the renovation of the forests. Pending the submission of his report on that subject, Mr. Colvin's experimental measures in respect to the Thoug-yeen forests have been continued from year to year, under certain modifications rendered necessary by circumstances; leases also have been granted to certain holders of forest tracts, in accordance with the instructions of the Court of Directors on this subject, and with the further special reservation that these leases are to be considered only as temporary until the settlement by Government of the general questions connected with the forests.

126. Mr. Colvin's proposal to grant one of the three unoccupied forests on the Attaran, the Mittigate Codoogway, to Messrs. Mackey and Co., who had applied for it as well as for the Upper Mittigate, has been mentioned in para. 112. The question of the tenure of these forests led to a voluminous correspondence between Government and Messrs. Mackey and Co., who asserted a claim to the proprietary right in both forests. This claim was subsequently abandoned, and the firm has been allowed to hold only the Mittigate Codoogway under a temporary licence pending the decision of Government on Dr. Falconer's promised report on the subject.

127. Here I might stop in this Summary of the principal papers relating to the Teak forests of the Tenasserim Provinces, there being none others which come within its scope;—but before concluding, it may

not be amiss to add a paper entitled "Suggestions for the better regulation of the timber trade of Moulmein," which was submitted to Government in August 1846, by Mr. O'Reilly, a gentleman of some experience in the timber trade:—

"SUGGESTIONS FOR THE BETTER REGULATION OF THE TIMBER TRADE AT MOULMEIN.

" 1. Previous to the year 1838, the export of Teak timber from the Tenasserim Provinces was confined to the demand for it in the Calcutta, Madras, and Mauritius markets, and subsequent to that period, a demand in the home market has been created which has steadily increased up to the present date, and involves in itself an amount of 20,000 to 25,000 tons per annum, which with efficient regulations for the better security and encouragement of the trade, will progressively increase up to the maximum of the capacity of the Provinces to supply.

" 2. The supplies brought into the Moulmein market are derived not only from the forests within our own boundary, but also very extensively both from the disputed boundary on the right bank of the Thoung-yeen river, and from the Karennee and subadjacent territories, situated in the Burman country, above our boundary on the Salween river.

" 3. To the want of a properly defined boundary line to the eastward of the Salween may be attributed the constant litigation in the local courts affecting the non-performance of contracts with the native dealers; these people being of the lowest scale of principle, induce the cutters, on what may at present be termed the Shan side of the Thoung-yeen, to annul their previous contracts to others, and give them possession of the material they may have ready, which, on its arrival at the Government station, or, as is frequently the case, on its way down the river, is seized by the first purchaser. A case in court ensues, and should no jurisdiction be proved, the matter is referred back to the native authorities from whence it was obtained, and there settled on the principle of the 'longest purse the winner'; the defeated party then re-commences proceedings in the English court, and generally succeeds, by the same vexatious process repeated over and over again, in placing the case almost beyond the power of the local authorities to adjust.

" 4. It has occurred to my notice on several occasions, that cases of the above description have passed through the different courts seven, eight, or even ten different times, with the original cause for a case, altered, however, in some shape to meet the spirit of the litigant.

" 5. The remedy for the evil above stated lies with Government, and can be applied without inflicting injustice in any sense of the word. It is by adjusting the boundary to the same limits as that under the Burman rule previous to our occupation of the country, which extended to the old city of Meerawaddi, situated some distance to the eastward of the Thoung-yeen river.

" 6. I feel convinced that the early settlement of this point would tend greatly to enhance the prosperity of that branch of the trade (timber) of Moulmein, inasmuch as it would place that territory under the surveillance of our own authorities, and deprive the petty chiefs and others, who at present arrogate a right of possession in

that quarter, of the means of annoyance to the local Government, which, since the demand for the Teak of the Thoung-yeen has been created, has been so prevalent.

" 7. Other fertile sources of mismanagement, dispute, and consequent litigation, have their origin in, and a want of a proper system of registry of contracts with the native cutters, a measure I consider absolutely necessary in the absence of a Queen's court of justice, for the reason that, as the trade has increased, so also has the business of the local courts, to a much greater extent than such trade warrants. The cause may be traced to the employment of law agents, who not being professional men, and not over-scrupulous as to the means employed in bringing 'grist to the mill,' have effected a system of chicanery and bad faith on the part of the native dealers, of which the court records afford convincing proof.

" *B.* The carelessness, I might say with truth, the wilfulness of the timber dealers themselves in their indiscriminate transactions with all and every class of natives, who by fair means or otherwise obtain possession of a few logs of timber; the constant depredations by the Burmans of the timber which comes down the falls of the Salween, and without great precaution on the part of the owners floats over to the Burman side of the river, where it is seized, carried to Martaban, and is there disposed of to the agents of timber merchants of Moulmein. On its arrival at the latter place there is always some claimant on the part of the original proprietor ready to institute proceedings for its recovery; suit upon suit ensues, and thus is the time of the local administration completely occupied in the settlement of these and the like cases.

" 7. The remedy I would propose in regard to the foregoing, is as follows:—

" *A.* That a system of registry of all contracts with the natives be instituted, to form part of the duties of the principal assistant, and a charge made of one per cent. as registry fee, to be borne equally by the contracting parties. Such contracts to be made in the native language, with an English translation attached, so that the native dealer may not have the excuse, so frequently made, of not understanding the terms of the contract.

" 8. Such a system would have the effect of restoring a more healthful tone to the trade by placing it out of the power of the law agents to create disputes, as a consequence of the present defective one.

" 9. In regard to *B.*, it must be obvious that by removing the cause that incites the cupidity of the Burmans, an improved state of things would follow as a natural consequence; I would suggest, therefore, that on the boundary including our possession of both banks of the Thoung-yeen being settled, all timber otherwise than from our own forests, *viz.* the stolen timber from Martaban, and that from the Karennee country, be chargeable with a rate of duty to the extent of 20 to 25 per cent. above that paid by the timber of the Provinces.

" 10. The inefficiency of the present existing regulations for the conservancy of the Teak forests is but too apparent; in fact, the application of the terms of those regulations, from their impracticability, has rendered them a dead letter from the date of their enactment, nor is it a difficult matter to assign the mismanagement and confusion which has crept into this branch of the trade of the Provinces to the absence of all tenure bestowing a proprietary right to the parties working the forests. It is not to be expected that regulations of the nature of those now in operation, which gave

no right of property (being merely licences to cut within specified limits,) are adapted to the proper conservancy of the forests, and although the most stringent rules may be made to this effect, the circumstance that Government can at any time resume possession, as was lately exemplified in the proceedings of the Superintendent of forests, will continue to operate against any and every measure that may be enacted on the present system.

" 11. As connected with the future interests of the Provinces, the subject of the preservation of the Teak forests, and propagation of the tree to meet the continued demand which has been created, is of the most vital importance. It must therefore be the wish of Government to adopt such a method as will effect so desirable an object, and place the matter on the most permanent basis for the future, to which end I would suggest,—

" 1st.—That the Teak forests wherein no licences have been granted be classed under a survey, giving to each an equal distance of water frontage, and sold in perpetuity.

" 2nd.—That those forests which have been worked for a period of not less than four years should also be so disposed of, giving the same extent of boundary as they now possess in the *lehmat*s, or cutting licences, &c.

" 3rd.—That all other forests from which no regular supplies of timber have been received, and consequently no large outlay incurred, be resumed by Government, classed, and disposed of as those of No. 1.

" 4th.—That a Government duty of 10 per cent. *ad valorem* be continued on all Teak timber, the produce of the Provinces, and 35 per cent. upon all timber from other quarters.

" 12. The foregoing, applying so immediately to the best interests of the proprietor, would insure a proper attention to the preservation of his forest, with the view of rendering it a valuable transferable property, and besides the Teak, an inducement would thus be created to bring into notice and use the other valuable timber which abounds in the Provinces.

" 13. Upon the extent of the stock of old and new timber, and its proximity to the water, would depend the value of each forest; hence it would be the object of each proprietor to renew the exhausted stock upon his grants, to ensure its enhanced value in the event of sale or transfer.

" 14. In thus disposing of the Teak forests of the Tenasserim Provinces, it would be requisite in the first instance to have a thorough inspection, survey and report, upon which to form a prospectus for the information of capitalists at home, whose attention to this staple of the Tenasserim Provinces has of late been directed; and on the completion of the necessary documents, a sufficient time should be given to allow of intending purchasers making themselves more intimately acquainted with the subject, by reference to the coast, ere the final disposal of the forests be made.

" 15. It would be almost impossible to state the probable amount that would accrue to Government from the sale of the forests, but as the only available ground upon which to form an opinion is that of present value, under the less advantageous circumstances to the proprietor, I may state that a second-rate forest was some time

ago transferred to a party for upwards of 60,000 rupees, and as this purchaser had merely the right of cutting the timber, it is reasonable to suppose that a right of possession in perpetuity would confer a higher rate of valuation.

“16. In conclusion, I would urge on the notice of Government the impolicy of interfering in any way, beyond what has been stated, with so important a part of the commerce of the Provinces; it will be but too apparent, on a retrospective view of the proceedings of the local administration, that to the circumstance of such interference, both directly by the authorities on the spot and also through the Commissariat Department for military purposes at Madras, must in a great measure be attributed the almost inextricable confusion and mal-administration which has prevailed, to the detriment of other more important matters affecting the welfare of the people and the general interests of the Provinces.

“17. Supplies of Teak timber for Government purposes, to any extent and of the best quality, can always be had by tender and contract with the respectable part of the mercantile community, and until a difficulty presents itself in this respect, I conceive that Government would do wisely to adopt the plan of proceeding which entails the least interference in or connexion with the trade of the coast.”

128. There is also another paper by Mr. O'Reilly, dated 15th April 1849, entitled “Observations in connexion with the route across to the head of the Houndrow river,” which contains valuable information about the extent and condition of the Teak forests, as observed by him so recently as 1849, besides some interesting remarks on the subject of the propagation of the Teak tree. This will be found in the Appendix.

W. R. BAILLIE.

Bengal Secretariat, 1851.

SUMMARY OF PAPERS

RELATING TO THE

MADRAS AND BOMBAY FORESTS.

1. THE papers relating to the Teak forests of the Madras and Bombay Presidencies, submitted by the Governments of Madras and Bombay, and mentioned in paras. 46 and 47 of the "Summary of papers relating to the Tenasserim forests," will now be brought under review. It may however be remarked here, that although these papers are very voluminous, the information they contain on the early history of the Madras and Bombay forests is not so complete as that which has been obtained regarding the Tenasserim Teak forests.

2. The principal forest districts are those of Malabar, Canara, Travancore and Goojerat, on the Western coast of the Peninsula of Hindoostan. There are also in the neighborhood of Rajahmundry, on the Eastern side of the Peninsula, extensive forests which stretch inland in a Westerly direction towards the territories of the Nizam. The abundant stores of excellent ship timber which were supposed to exist in the Malabar forests very early attracted the notice of the Bombay Government, to which the Province of Malabar was subject for some years after its acquisition. At first the forests were regarded as private property, but shortly after, there appeared ground for believing that, during the dominion of Tippoo Sahib, the right of felling timber had been, (as it was up to 1840 in the neighbouring countries of Cochin and Travancore,) an exclusively royal privilege. Accordingly, in August 1800, the Court of Directors authorized the Bombay Government to assume this right on behalf of the East India Company. The Province of Malabar having, however, been made subordinate to the Presidency of Fort St. George, the Court's instructions remained some time without effect. In 1805 the Bombay Government, to which the control of the forests had been intermediately restored, appointed Commis-

sioners of survey to ascertain the limits of what might be considered public forests, and to distinguish them from groves and plantations forming part of private estates. In 1806 an officer was appointed Conservator, but it was not till the 25th April 1807 that a proclamation was issued asserting the Company's right of sovereignty over the forests, and forbidding the felling of the timber by private individuals.

3. In the district of Palghaut, Captain Watson, the Conservator, reported that the inhabitants generally resigned their claims to the forests "without a murmur." Some of the forests were claimed as hereditary property, but the claimants afterwards admitted that they held the forests only on a grant from the sovereign Rajah of Palghaut to some of their ancestors, and consented to resign their claims to the Company, and to take charge of the forests as the overseers of Government. Upon this the Conservator, Captain Watson, following up what he conceived to be the spirit of his orders, agreed to grant them a compensation for the loss they might sustain by the resignation of their claims in favor of the Company. In making this compensation, two modes suggested themselves to the Conservator, *viz.*, either to grant the claimants pensions or to allow them a fee or reward for every tree that was felled. To the grant of a pension was opposed the consideration that the Company would be burdened with a permanent and heavy charge without securing the services of the claimants. Captain Watson, therefore, adopted the other alternative. This mode of indemnification was afterwards reported to have proved perfectly agreeable to the wishes of the claimants.

4. The instructions of the Court of Directors, of August 1800, show that their object was to receive a regular supply of timber for public purposes, from unappropriated lands, to which alone the proclamation was intended to apply. It was not designed to invade private property, or to prevent any one from disposing at his pleasure of the timber on his own estate. The Conservator, however, assumed much larger powers than were entrusted to him. The proclamation of 1807, which formed the basis of his authority, contained no definition of the term "sovereignty," nor had those forests been specified over which the sovereignty extended. But the Conservator acting upon his own views on these points, succeeded in a short time in establishing a monopoly of all the timber of the two Provinces of Malabar and Travancore. He cut down and appropriated to the use of the Company,

not only the trees of the private forests, but even those growing on cultivated lands, paying revenue to Government, while the proprietor himself, unless expressly permitted by the Conservator, was prevented from cutting a piece of wood on his own property, or removing the young seedling plants that were injuring his land. It does not clearly appear whether any payment was made to the proprietor for the timber taken by the Conservator from his estate, but he was obliged, nevertheless, to pay duty upon the timber growing upon his own property when he made use of any of it for his own purposes. The trade in timber was almost annihilated, for even if the merchant could obtain the Conservator's permission to purchase private timber not required by Government, he had no longer the same means of disposing of it, its exportation having been prohibited soon after the establishment of the new system. Finally the peasantry were deprived of the privilege of cutting wood for fuel and other ordinary purposes, a privilege which they had enjoyed from time immemorial, and which was stated to be particularly prized in the rainy climate of Malabar, where large buildings are required by the peasants for the protection of themselves and their property.

5. These evils and the consequent discontent having been unheeded for a considerable time, at length attained so great a height that in 1822 the office of Conservator and the whole prohibitive system were abolished, and Government for several years exercised only a very slight control over the forests. The greater number seem to have been abandoned to the neighbouring rajahs and landholders, who had held possession of them on the first occupation of the Province by the Company's Government, and even in those which were considered as Government property, permission to fell and carry away timber was granted to any one on payment of a small duty.

6. It was, however, brought to the notice of the Government of Bombay in 1830, by a representation from the Nelumboor Rajah, that this perfect freedom had given rise to inconveniencies of scarcely less magnitude, though of a different nature from those which existed under the former conservancy system. The forest-holders, or the persons who obtained from them, or from Government, permission to fell timber, looking only to their present interests, began to clear the land completely, cutting down all the trees indiscriminately, and leaving no young plants to succeed them. Some of the more accessible forests seem to

have been destroyed, or materially injured by these means. Timber of the best quality could not be procured, and the inferior kinds only were obtainable at an enhanced price, and this state of things seemed likely, if unchecked, to issue in the entire dissolution of the forests.

7. Under these circumstances, the Government of Bombay, on the 20th April 1830, called upon the Indian Navy Board to submit a report on the Malabar forests, with a view to arrangements being made for their preservation and improvement. The Indian Navy Board replying on the 29th May 1830, strongly advised the appointment of a Conservator, "whose attention should be solely devoted to the preservation of the forests, on the same principle as that part of the duty of the Conservator was formerly exercised." The Government of Madras being next consulted on the subject, transferred the correspondence on the 22nd April 1831 to the Board of Revenue at that Presidency, for "consideration and report."

8. Nothing, however, appears to have been done in the matter until September 1837, when in consequence of the receipt of a report from the Resident of Travancore on the forests of that Province, the subject was revived, and the Government of Madras again called the attention of the Board of Revenue to the letter of 22nd April 1831, and with reference to the report on the Travancore forests, requested the Board's consideration of the general question of adopting measures for the security and improvement of the timber forests. The Board of Revenue replied to this communication on the 26th October following, to the effect that the attention of the authorities on the Malabar coast had been specially directed to the subject, and that on the receipt of information from them, the Board would not fail to submit their sentiments on the measures required for the preservation and improvement of the forests.

9. At the same time, the Board forwarded a report from the Principal Collector of Malabar, Mr. Clementson, dated 3rd April 1834, in which that officer, referring to the Terroopaad Rajah's letter and to the recommendation of the Indian Navy Board, condemned all direct interference by the officers of Government in the cutting of timber in that district, considering that this would be an infringement of the rights of private property; but he suggested the imposition of a heavy duty on all Teak timber which weighed less than three candies. Mr. Clementson wrote as follows:—

“The policy which induced the Government at Fort St. George to recommend the abolition of not only the monopoly of timber, but the office of Conservator of forests, was obviously to afford protection to the inhabitants of Malabar against any encroachment on their private property. That the monopoly which prevailed until 1823 was an encroachment upon private rights and property, has been established beyond a doubt. How far, therefore, the adoption of a measure nearly similar to the one which had been done away, in consequence of its being pregnant with the most baneful consequences, would be expedient and consistent with justice, appears to be extremely doubtful.

“However desirable it may be to prevent the cutting of young Teak trees growing in the vicinity of rivers, I confess I am at a loss how any impediment can be laid without infringing upon private rights, for with the exception of certain forests in the talooks of Palghaut, Temalpooram and Wynaad (from which timber was never cut, though they abound with the finest trees) which belong to the Government, all the rest are private property. The subject does not appear to have escaped the attention of the former Collectors. Both Mr. James Vaughan and Mr. Sheffield repeatedly issued Circular Orders, impressing on the minds of the proprietors of such forests the injury they did to their own interests by cutting half-grown trees. Mr. Sheffield in the 7th para. of his letter to the Board, dated the 25th December 1828, proposed that the cutting down young Teak trees should be altogether prohibited under a heavy penalty. I cannot concur with that gentleman in this opinion, as it will be an illegal interference with private rights, which would be not only inconsistent with the liberal views of Government, but one which would, I fear, excite the greatest discontent; all that can be done to discourage in some degree a practice which is likely to be injurious to our maritime interests, appears to be the imposition of a heavy duty on all Teak timber measuring under three candies.”

Upon this point, the Board of Revenue promised to report more particularly on the receipt of the information they had called for from the local officers.

10. In September 1838 the Board of Revenue again addressed the Government of Madras, and forwarded reports regarding the forests of Malabar, Canara, and Rajahmundry from the Collectors of those Provinces. Before, however, adverting to the sentiments of the Board on the subject of the conservation of the forests, these reports and the report on the Travancore forests will be noted.

TRAVANCORE, 1837.—11. The report regarding the Travancore forests, dated 12th August 1837, was addressed by Mr. Monro, who was the Conservator of the Travancore forests at the time, to the Resident, Colonel Fraser; the Teak in that Province having been considered the property of Government, and a Conservator appearing to have been “always” employed for its preservation and improvement.

12. Mr. Monroe says,—“The Teak tree shoots up for the first seven or eight years remarkably fast, till it attains the height of 12 or 15 feet, after which its growth is uncommonly slow, and it does not attain the rise of the 6th class log even in the most favorable situations till it is about 35 or 40 years' old; a 5th class takes about 50 years, a 4th about 60, a 3rd about 70 or 80, a 2nd about 90, and a 1st class takes about 100 to 120 years.” Mr. Monroe makes this statement with confidence, as he acquired all his information from his “own personal observation and the experience of nearly 20 years in the woods.” He adds that a tree of the 1st class will remain “round and good” for nearly 200 years, and then begin to decay slowly; he had “an enormous tree of the 1st class cut some years ago, which could not have been less than 1,000 years; it was full of earth, almost to the top, and so hollow and decayed, that it was good for nothing.” The Teak which grows on the sides and tops of the mountains is far superior to that which grows in the black heavy soil of the low grounds, and though it takes a longer time to attain the same dimensions as the other, yet in strength and durability it is generally superior. That which grows in the valleys is by no means to be despised, and only yields in quality to the mountain timber.

13. The plan Mr. Monroe adopted for the preservation of the forests, was “for any 10 trees fit to cut, two are to be left for seed, and for every tree actually felled, 10 are to be planted.” His mode of seasoning was, after barking, to allow the tree to stand one or two years, when it is felled and piled up in dry places from whence, in the following, the third year after barking, it was sent to Alleppee for sale. But it is stated that many trees are so full of oil that they will not float for five or six years after they have been felled, and the only way of floating them down the streams was to raft them with lighter wood.

14. Mr. Monroe ascribed the destruction of the Malabar forests to their having been thrown open to all who wished to work them, and to contractors having been employed in getting timber from those forests. He says :

“The system, of throwing open Teak forests to all who wish to cut, or giving them to contractors, is in the highest degree *ruinous*. They cut indiscriminately all that comes in their way; any range of forest, however extensive, would be destroyed if left to their tender mercies. They never think of planting, and all that such speculators calculate on is present profit or loss, without troubling their heads about depriv-

ing future generations of the benefit *they now enjoy*. The Teak forests in Malabar are, I am told, in this predicament, and if the British Government do not oblige them to plant, and also leave some large trees here and there for seed, this valuable tree will be extinct. There are two ranges of hills in our forests that were formerly rented to a Parsee, and if the contract had not been taken from him before it was too late, he would not have left a Teak tree standing. It will take 40 or 50 years before the forests recover the effects of his avarice."

15. Mr. Monro estimated the number of Teak trees in the Travancore forests fit for cutting, in 1837, to be about 1,00,000.

MALABAR, 1837-38.—16. Regarding the Malabar forests, besides the Report of the 24th May 1838, submitted by the Board of Revenue from the Collector of the Province, Mr. Clementson, there is a paper dated 27th July 1837, written by Captain Cortlandt Taylor, who was deputed to the coast with a view to obtain supplies of Teak for the Ordnance Department at Madras. These two papers will be noted together.

17. The Malabar forests are, with few exceptions, the property of private individuals, who appear almost generally to have permitted the felling of the Teak, without discrimination as to the age or size of the tree, in consideration of what was termed the "*kooty kunum*," which was a fee of one rupee paid by the coast timber-dealers for each tree cut down. The only forest owner who pursued a different course was the Nelumboor Rajah, Terroopaad, who, being aware of the value of the timber, acted as a merchant on his own estate, cut and conveyed the timber to the stream, where he disposed of it to the best advantage to the coast merchant, and thus realized a profit of about 100 per cent.

18. The forests of Malabar are at some distance from the coast, but the timber is conveyed to it during the periodical rains at the flux of the internal streams. "At first the trees nearest these streams were felled, but gradually they have disappeared from such neighbourhoods, and are now only to be found at considerable distances from the rivers. As the largest and most valuable trees become more difficult of access (only their stumps and stunted shoots marking the places where they once stood), the younger ones have fallen to the axe." This was one of the supposed causes of the ruinous consequences already described, and with a view to its removal, Captain Taylor remarked, if the felling of trees below a certain girth were prohibited under direct penalty, or by a high additional duty, "it would even now tend much to the future preservation of the forests, and would in due time yield proportional benefits to the proprietors and to the State."

19. The timber merchants who purchase the trees have them felled and conveyed to the adjacent streams, down which they are taken to the market on the coast, where an inland duty of five per cent. is levied. From this depôt the Bombay or foreign merchant exports it, "at an enormous profit to the coast dealer, who then pays an additional three per cent., or in all a duty of eight per cent. per candy, on its leaving the coast." This duty is levied on an assessment of the article, on the average of 9½ rupees the candy, the first class timber being assessed at 12 rupees, the second class at 9 rupees, and the third class at 8 rupees the candy. The revenue derived from this source by the Madras Government, it was stated, (in 1837) was about 27,000 rupees annually on an export of about 35,000 candies.

20. Captain Taylor recommended that the assessment on which the duty was levied should be raised, and that the increased assets should go towards the support of a Conservator and establishment, for protecting and improving the forests.

21. Mr. Clementson in his report first contrasts the condition of the Travancore forests with those of Malabar. He ascribes the healthy condition of the former to their being the property of the Sircar, and observes—"nothing can be easier, therefore, than the adoption of measures calculated to preserve them in an efficient manner." But the forests of Malabar being almost all of them the property of individuals, the Government could adopt no such protective measures without interfering with private rights, on which point Mr. Clementson referred to his letter of 3rd April 1834, noticed above, and he repeated the suggestion he made in that letter, for the imposition of an enhanced duty on under-sized timber, "as the best and only equitable means of checking in some degree the destruction of the young trees." Mr. Clementson fully admitted that a great number of young trees were annually cut, notwithstanding the repeated remonstrances which were addressed to the proprietors upon the injury they did to their own interests, but he stated also that the forests abounded in valuable trees, and that the exportation of timber was progressively increasing, and it was his opinion that the difficulty alleged to have been experienced in providing timber had been greatly exaggerated.

22. With respect to the Government forests in Palghaut, it was reported that no trees had been felled in them since 1828, and that they were very rich in timber.

CANARA, 1838.—23. The report on the Teak forests of Canara is dated 18th August 1838, and was written by the Acting Principal Collector, Mr. H. M. Blair.

24. The Teak forests of the Province of Canara “are considered the property of the State, or at least the Government assumes the sovereignty of the forests,” and no trees can be felled without permission.

“In the Southern talooks of Canara little Teak is to be found. The principal forests are situated in the Mogamias, lately added from Coorg, and are in most instances claimed as private property, but this claim is founded more on presumptive right established by previous enjoyment than on the possession of sunnuds or other documents conferring a proprietary title.

“In the four talooks of Sondah, Soopah, Honore and Ankola, in North Canara, considerable quantities of Teak timber are to be found, both at the foot of and above the ghauts. These forests were formerly considered sufficiently valuable to be placed under the charge of a Conservator, who was stationed at Sedasheghur, and had a large establishment under him to fell the timber and bring it to the coast.”

25. The Conservatorship and establishment were abolished in 1823 in consequence of the Bombay Government not requiring further supplies of wood for the Dock-yards. The forests were then left under the care of the revenue authorities, who took measures to prevent the trees from being injured or felled, but from want of an establishment and experienced servants, were unable “to improve the trees, or to plant young ones when required.”

26. The Teak which grows in the four talooks of Sondah, Soopah, Honore and Ankola, in North Canara, was divided into two classes. “The first is a dwarfish stunted tree, seldom growing 50 feet in height, of which there are extensive forests on the eastern frontier of the Soopah and Sondah talooks. The degenerate size of this tree is attributable to its growing at a distance from the line of ghauts in a tract of country where the soil and air have little humidity, and the same cause would in all probability prevent its improvement.” The wood was not fitted for ship-building purposes, but was thought well suited for gun-carriages, agricultural implements, and small beams and rafters. The forests of this description of Teak were estimated to contain about 1,54,000 trees. Considerable numbers of these trees were felled annually, and conveyed to the Mahratta country for building purposes by private individuals and merchants, who first obtained permission to fell the tree, subject to the payment of a transit duty of

5 per cent. on the value of the wood, estimated at 9 rupees the candy. The collections from this source amounted in the two years 1836 and 1837 to rupees 5,424, and Mr. Blair was of opinion, that the system of allowing these trees to be felled upon application should be continued, as they were generally unfit for public purposes, and it was necessary to put some check on their increasing number.

27. The second class of Teak "is found along the line of the ghauts, and is the description which is valued for naval purposes." There were supposed to be upwards of 40,000 of these trees in the forests, but this number was merely conjectural. Most of the trees were at some distance from streams, and therefore difficulty would be experienced in conveying them to the coast; "all timber which could be easily floated down was removed by the Conservator." The natives divided these trees into five classes, of which the first class included trees varying in age from 60 to 100 years, and yielding logs from 12 to 16 inches square. There was however no regular standard of measurement, and Mr. Blair says "as the Teak, like the Sandal-wood, has been hitherto the exclusive property of the Sircar, few persons have ever engaged in the trade, or are acquainted with the different qualities and value of the wood."

28. Mr. Blair thought that the preservation of these forests was sufficiently secured by the system then in force, by which persons were prevented felling trees without permission, which was not granted in cases where the trees were fit for public purposes, or grew in places of easy access. As little Teak-wood was used within the district, and its clandestine removal was attended with difficulty, the trees were seldom stolen. The greatest injury which appeared to be done to the forests was the "occasional destruction of young trees when the sides of hills are being cleared for the *cumere*, or up-land cultivation," but this evil was easily checked by the revenue authorities. Mr. Blair said the improvement of the forests was a work of some difficulty, as there were no persons in the province acquainted with the best methods of raising young trees and with the soils most suited to their growth. Colonel Gilbert, who was the Conservator for some time, "planted some small experimental gardens, both on the coast and under the ghauts," but they had proved failures, though "with a little experience and care, the measure ought to be successful, as trees are continually springing up in the jungles from self-sown seed." Mr. Blair recommended the deputation of an officer to inspect the forests, in order to obtain

information of their quality and value when compared with the produce of other forests. He also expressed his concurrence with Mr. Monro, in the remarks that gentleman had made on the impolicy of renting out the forests, being of opinion that no trees ought to be cut excepting such as were pointed out by a proper officer. In concluding his report, Mr. Blair said that the Canara forests were deserving of examination by an experienced person for other products besides Teak, as they contained "Poon-spars, Blackwood and other more common timber, which might be found a valuable source of revenue."

RAJAHMUNDRY, 1838.—29. The report regarding the Rajahmundry forests is from the Collector, Mr. G. A. Smith, and is dated 18th August 1838.

30. The forests in which the wood is grown do not appear to be in the Rajahmundry district exactly, but about seventy miles beyond its extreme frontier, "in the territories of the Nizam, in that part called the Cumbham Mettoo Sircar, in the talooks of Dresteo Mahepauldavoo, Chirlah, Madenerow, Palmenchah, Ashwarow, and Rickapillay Soorreddywar." Parties who desire to purchase the timber of these forests send agents or servants to make advances to the hill people, who cut and deliver the timber to them on the banks of the Godavery, "or the Aukhundah Gowtamy, as it is called by the natives at that point, from which it is brought by Palmenchah Badrachillum and Rickapillay to Palavaram, the frontier chowkey" in Rajahmundry, and from thence to Rajahmundry, where the Godavery branches off to Coringa and Narsapore.

31. The timber was divided by the natives into two classes, styled *toondoos* and *cuddies*. The former vary in length from 12 to 18 or 20 feet, and yield a plank of from 12 to 18 inches; the latter run from 24 to 30 feet, and give planks of from 6 to 8 inches. The price of the former on their arrival at Coringa was rated at 8 rupees 4 annas each, and that of the latter at 2 rupees 14 annas each. The cost and expenses being as follows:—

<i>For Toondoos.</i>	Rs.	As.	P.
Hill peoples' charge,	4	0	0
Roosooms,	0	8	0
Nizam's duty,	0	8	0
Soorreddywar at Rickapillay,	0	8	0
Hill Reddies between the Nizam's and Company's Territories, ...	0	4	0

Transport to Palavaram, including all charges and Company's duty,	0	12	0
Transport to Coringa,	0	12	0
	<hr/>		
Total, Rupees	8	4	0

For Cuddies.

	Rs.	As.	P.
Original charge at Rickapillay,	1	0	0
Soorreddywar's Roosoom,	1	0	0
Reddies' ditto,	0	2	0
Hire, duty, &c., to Palavaram,	0	6	0
Ditto, to Coringa,	0	6	0
	<hr/>		
Total, Rupees	2	14	0

“ The time for purchasing the timber is from December to June, the latter being the period when the freshes of the Godavery allow them to be brought easily down that river. In a season, from ten to three thousand may be procured” of the dimensions given above, but to obtain planks of larger size, extraordinary exertions are necessary.* The timber is formed into rafts, fastened by chains, and turned adrift on the river in the height of the freshes, to float down towards the coast.

32. This was all the information which Mr. Smith was able to obtain. He had not himself seen any large timber, and he was inclined to believe the supply to be very limited, because when he first joined the district in 1822, there was an “ immense quantity of timber” at Coringa, for which the forests appear to have been severely taxed, inso-much that “ for several years the ordinary natural supply of the district was stopped to an extent which caused a good deal of complaint.”

33. In submitting the Reports of the Collectors of Malabar and Canara, the Board of Revenue merely observed, with reference to the measures to be adopted for the preservation and conservancy of the Teak forests, that interference, if at all necessary, should be exercised through the channel of the revenue officers, and not through a conservator with distinct and independent authority. That the Collector of Malabar might be “ required to issue local orders requiring all landholders to obtain permission previous to the felling and indiscriminate cutting of timber, as in Canara, and might be authorized to take such

* It appears that on one occasion an European firm obtained some timber from the forests about 50 feet in length, yielding a plank of 22 inches.

steps as seemed necessary to prevent the cutting of small timber and under-sized trees, with a view to the preservation of this valuable product, as well as to secure a future supply by planting and protecting young trees." Regarding the Rajahmundry forests, the Revenue Board said nothing.

34. The question was then referred to the Military Board at Madras for their views regarding the forests, as well with respect to the perpetuation of a supply of the Teak as to the development of their other timber products. The Military Board on the 13th November 1838 deputed Lieutenant Miller, the Deputy Commissary of Ordnance at Canara, for inquiry in that Province, but no officer was available at Rajahmundry for a similar purpose. The instructions given for the guidance of Lieutenant Miller at Canara were, to examine the forests " particularly with reference to their resources in Saul timber, as well as Teak," and on the 14th December 1838, the Resident at Travancore and the Principal Collector of Malabar were also desired to give such information as each possessed or could obtain regarding the resources of the Travancore and Malabar forests in Saul timber.

35. In the mean while, the attention of the Bombay Government had for some time been directed to the capabilities of the Malabar and Canara forests for affording supplies of large timber, and to the best means, whether by contract or agency, of obtaining timber for the public service. The subject of the supply of large timber was brought to notice in May 1838 by the Commissary General at Bombay, who, previously to concluding a contract for the ordinary supply of timber for the naval and military departments of the Government, requested instructions as to whether he should stipulate also for a supply of large timber for frigates and line-of-battle ships in anticipation of such vessels being again built at Bombay for Her Majesty's Service. The Government referred the matter for the opinion of Admiral Sir C. Malcolm, then Superintendent of the Indian Navy, and requested him to consult Captain Harris of the Indian Navy thereon, as that officer in the year 1828-29 was Timber Agent in Malabar, and had some practical local experience in the timber resources of the Malabar forests.

36. Sir C. Malcolm replied to this requisition in June 1838, and submitted a report from Captain Harris. Upon this report he remarked, " From a want of system and the due care necessary to perpetuate the supply in those parts of the forests which border on the rivers,

by preventing the cutting down of trees before they have arrived at their proper growth, that every year the difficulty of procuring timber must increase ; as now, in the absence of all prohibition, the trees which may be at the least distance from water-carriage are cut down without reference to age or size, and thus every successive supply must be obtained from a still greater distance, and at a proportionately higher cost, owing to the greater expense for land carriage to the nearest river or nullah." To remedy this state of things, both Sir C. Malcolm and Captain Harris recommended the appointment of an officer at Malabar as Agent for the supply of timber, and Sir Charles Malcolm further proposed to add to the situation of Agent the office of Conservator of forests, with full powers of management in the cutting down such timber as was required, and of preserving the young trees and saplings sufficiently to renew the stock. But as a preliminary step, he advised the deputation of an intelligent officer to Malabar and Canara, "to examine into the state of the Teak forests, and report upon them."

CAPTAIN HARRIS'S REPORT, 1838.—37. Captain Harris states that the forests of Malabar contained abundance of timber of the first quality, but that it remained unavailable to all but the rajahs, from the remoteness of water-carriage and the inadequate means of the generality of the merchants ; and also, that when he was Agent for the supply of timber in 1828-29, he had been supplied by the Summaree and the Terroopaad Rajahs.

38. Captain Harris gives the following description of the method of preparing the timber: "On the opening of the season the tree is sawed through above the roots and left in that state for a time to absorb the sap, then felled to the ground and trimmed into shape ; here it may be left one or two seasons, or is at once dragged by elephants to the bank of the river, and finally floated down to the sea on the first rise of its waters." The cause of there being no superior quality of timber within a moderate distance of water carriage was stated to be, that "since the abolition of the conservatorship, every tree, instead of being nourished and protected in its growth, has been cut down, the proprietor of the soil disposing of it for the *kooty kanum*, or insignificant sum of one or two rupees, to the coast timber merchants, by them conveyed to the coast, and disposed of at a very considerable profit, unattended with the risk and loss that would follow in the attempt after the superior timber." This practice of felling Teak trees

without discrimination as to age or size, had tended to devastate those parts of the forests which were situated within a few miles of the streams by which the timber is conveyed to the river.

39. As regards the question whether a contract or agency was the better mode of obtaining timber, Captain Harris points out the difficulty a merchant would experience in providing timber of a superior quality, from the want of means of transport,—water-carriage of any kind being in some places leagues off, the natural obstacles to be overcome being very great, and the aid of elephants with experienced men inured to the work of transport being also required. He adds that out of four contractors for the supply of a portion of superior timber, only one fulfilled his agreement; he therefore “firmly believed and should expect that if Government made a contract with any such persons for supplies of this nature, they would be involved in disappointment.”

40. In regard to the best method of procuring timber of superior quality, Captain Harris observes, “the sources whence this quality of timber could be procured have, since the abolition of the conservatorship, been gradually consuming, and have now no doubt become quite absorbed; it will follow that as the distance from the water-carriage has increased so has the value of the article, and consequently it now becomes an object no doubt of serious consideration, in the event of the building of large ships and frigates at Bombay, to obtain a supply fit for such purposes.” Accordingly, Captain Harris recommended that the Summaree and Teroopaad rajahs, and the Emam Khawn should be invited to supply the required timber, as they had the means of bringing it down to the coast, though perhaps at an increased price; that an officer should be stationed at Malabar in communication with the above persons, for the purpose of examining timber, and that he should have the support of the Madras Government and of the civil authorities of the Province; that means should be adopted for the preservation of the young Teak trees and saplings, and that trees under three candies should not be allowed to be felled. On these points, it appears Captain Harris generally agreed in the Teroopaad rajah’s recommendations.

41. On the 19th June 1838, the Commissary General again addressed the Government of Bombay, on the subject of the supplies of timber, and submitted a Report by Lieutenant Threshie, and a letter from Mr. J. Fell, “senior merchant at Calicut,” regarding the resources on the Malabar Coast and the best means for their development. Lieutenant

Threshie was Sub-Assistant Commissary General at Malabar, and appears to have been deputed during April 1838, expressly to obtain information and report on the resources of the Malabar forests, and on the state of the coast timber markets. Mr. Fell belonged to the Bombay Civil Service, and was consulted on account of his knowledge of the subject, he having long resided on the coast and given his attention to the timber trade.

42. The Commissary General advocated the appointment of an officer, who should be located on the coast, for the purpose of securing supplies of timber and of looking after the forests, but he thought that the best way to protect the young trees would be to levy a heavy duty on all timber under three candies, as recommended by the Collector of Malabar, Mr. Clementson.

LIEUT. THRESHIE'S REPORT, 1838.—43. Lieutenant Threshie's report is confined to the forests of Malabar and the state of the local timber marts. He was not able to extend his inquiries to Canara by personally visiting that Province, but as far as he could ascertain, the supply there was very small, and the export "not exceeding 500 or 600 candies per annum, Canara being chiefly noted for its Poon-spars."

44. With regard to the forests of Malabar, Lieutenant Threshie was of opinion that the statements which had been made of the alarming decrease of their resources in Teak timber were groundless, and that there was no reason for apprehending any diminution in the supply, "to meet the demands of the Indian Navy, were they even much greater than they are at present." Lieutenant Threshie admitted that young trees to a "certain extent" had certainly been cut, but he says, "there is, and always will be a rapid succession of young plants, self-sown from the seed of the parent tree, which requires no care, as the strongest plant will always make way for itself."

45. All the Teak-timber and plank which was exported from Malabar was felled and conveyed to the coast from forests, the property of private individuals; but there were also extensive forests belonging to Government in the talooks of Palghaut, Temalpooram and Wynaad, in which the finest Teak-trees were procurable in great abundance. These forests, however, had not "felt the axe for the last 30 years"; owing, as Lieutenant Threshie was of opinion, to their situation with reference to water-carriage not being so favorable as those of private individuals, though he considered the superiority of the Government

forest timber "would in itself compensate for any difference in outlay," so that if the supplies from the private forests failed, the Government still had their own forests to fall back upon.

46. Referring to the destruction of young Teak-trees, and to the daily increasing difficulty which must consequently be experienced in procuring timber, Lieutenant Threshie wrote,—“No doubt, as the work of felling the trees for the supply of the market progresses, the distance it has to be transported to the nearest river will increase from year to year, unless protection is afforded to young trees in the vicinity of the rivers, and thereby add to the expense of the timber, but many years must elapse before this can materially affect the prices,” though it may throw “a number of small traders out of the trade, which is to be wished, owing to their wretched means of transport and want of funds, which merely enables them to deal in small timber.”

47. The disregard by the proprietors of the repeated and pressing remonstrances addressed to them by the Collector against allowing their young trees to be cut down, Lieutenant Threshie attributed to the fact that the timber was of trifling value *in the forests*, one to two rupees the tree, and that “the owners of the forests, seldom looking to futurity, are anything but careful of their state.”—“A merchant or forester purchases a right to fell the number of trees he may consider equal to his means of transport for the next two or three years, procures a permit or order for the same from the owner, and sends the people with whom he may have contracted or merely engaged at a certain rate per tree (about one rupee) to the forest,” when the operation of cutting commences. This operation is described as “cutting round the tree from about the height of a man’s shoulders,” the hatchet being more easily wielded at that height. The girth of the tree, as in the Tenasserim Provinces, determines the depth of the cutting. The trees are then allowed “to remain in this half-cut state for a greater or less period, according as the merchant requires a fresh supply of timber to meet the demands; however, one season is actually necessary, that the sap may be sufficiently absorbed to render it capable of being transported and floated down the river; some trees remain two or three years in the forest, and again on the coast a year or two.” It was stated to be the interest of the merchant to have the timber well-seasoned, as otherwise the expense and trouble of conveying it down the river was greater.

48. Lieutenant Threshie was of opinion that to put an effectual stop to the destruction of young trees, and so also to check the exportation of inferior timber, no way could be better than, as suggested by the Collector of Malabar, by imposing a heavy duty on all Teak timber measuring less than three candies, as two-thirds of the straight timber exported was nothing more "than the shoots or saplings from old trunks, soft and spongy, and soon liable to decay in ship-building." In fact he thought all that was required to check the destruction of young trees was to protect them by rendering their export unprofitable. The duty levied at the time was eight per cent. upon all Teak timber, of which five per cent. was the inland duty and three per cent. the export duty.

49. On the subject of the classification of Malabar Teak timber and plank, Lieutenant Threshie says,—“ All timber is classed simply as *above* or *under* three candies, in which straight and crooked is included; this is the usual method, and it is sold accordingly in the trade, but selections are frequently made, a purchaser inspecting the lot marking such logs as he requires, and making his bargain afterwards with the owner. This is according to the value of the logs selected, more or less expensive, the cheapest way being to take the whole lot without any rejection, allowance being made for defective or unsound timber,” and a further allowance of 10 per cent. being added “to cover all trivial imperfections in the timber.” If the purchasers required planks, the timber was cut up at their expense; there were “various ways of delivery, *viz.*, on board the vessel,—merely giving it over where it lays,—and floating it in the river, forming a raft of it, and making it over to the purchaser.” The last was more generally preferred. All timber was exported on Bombay bottoms, no tonnage being procurable on the Coast excepting what arrived from Bombay. The freight varied in 1838 from one and a half to two rupees per candy, and from four to five rupees per hundred *guz* of plank. The immediate purchasers were brokers. There appeared to be no fixed or paid agents in Malabar, and the brokers purchased for the Bombay merchants for a percentage of from one to two rupees, “and even more according to circumstances,” namely the terms of payment and the credit of the individual ordering the wood; “the broker being considered by the vendor, as the responsible person for the purchase-money.”

50. The price of the timber was, above three candies, 12 rupees per candy ; under three candies, from $8\frac{1}{2}$ to 10 rupees per candy ; plank of any description, without an arrangement being previously made for its supply, was rarely procurable, the merchants having an objection to supply it as there was no market for the refuse.

51. The timber measure in Malabar was,—

16 Moganies to 1 Borel.

24 Borels to 1 Kol,

24 Kols to 1 Candy.

The plank measure of “ one Malabar guz ” was—“ one guz in length, twelve borels in breadth, and one borel in thickness.”

Sawyers’ work was estimated by the guz or candy, which was one guz in length and the same in breadth : the usual charge was one rupee per such candy.

The guz used in all measurements was $28\frac{1}{2}$ inches.

52. The working season in the forests is said by Lieutenant Threshie to be from June till February, during which time elephants are brought into requisition for the transport of the timber. These elephants are kept expressly for that purpose, and are hired out by the owners to the foresters. “ The latest season that timber and plank can be sent from the coast is up to the 15th of May,” but after the 1st May Lieutenant Threshie thought it could not be done with safety.

53. Lieutenant Threshie did not think the system of contracts desirable, as he doubted its ever affording satisfaction, but “ a person on the part of the Commissariat, with a competent person from the dock-yard could always make a satisfactory purchase ” for the ordinary supply of one or two years. For any extraordinary demands, however, an officer ought to be stationed on the coast, “ who would gradually obtain a permanent influence on the market, and might also be useful in procuring other supplies.”

MR. FELL’S LETTER, 1838.—54. Mr. Fell’s letter contains his opinion on the question, “ whether a contract or an agency was the better mode for procuring timber for the public service ” ? He was “ decidedly in favor ” of an agency, as all contracts within his knowledge since 1832 for any large supply had failed or proved unsatisfactory ; and independently of this, he added, “ I am in doubts of there being any person in possession of *kooty kanum*, or right of selling Teak timber, to make a contract, and if there are, whether in the forests to which

that right applies there be trees adequate for naval purposes, for with the exception of one district in the North-Eastern quarter and another to the Southward all the forests of Malabar are exhausted." Mr. Fell also stated that the class of people who were contractors were not such men as could be charged with the responsibility of a contract for supplying the public service, and he moreover mentioned as an important objection to contracts, that the forest proprietors had made it a practice to sell the same timber "to ten different persons," which caused so much litigation in the local courts that it induced the belief that the free trade in Teak timber had proved "a curse rather than a benefit to that country."

55. The Government of Bombay appear not to have acted upon the foregoing Reports, but their substance was communicated to the Court of Directors, and a copy of the whole correspondence was forwarded on the 31st October 1838 to the Government of Madras for "any suggestions or arrangements" which that Government could make, "calculated to assist" in obtaining the required supplies of timber. The Government of Madras thereupon referred the correspondence to the Board of Revenue for report, and the Board replied on the 28th January 1839. They noticed the great diversity of opinions regarding the state of the forests, remarking that Lieutenant Threshie was inclined "with Mr. Clementson to treat the reports of the decrease of their resources as greatly exaggerated if not unfounded, and to consider the forests adequate to meet any demands for the Indian Navy," while Mr. Fell, on the other hand, gave it as his opinion that most of the forests in Malabar are exhausted, and that there are few in which any timber can be found adequate for naval purposes. The Board added, however, that both Mr. Fell and Lieutenant Threshie were agreed in opinion on the "advantages of an agency over the endeavours to procure timber through the medium of contracts," and therefore, if a duly-qualified agent were appointed to inspect personally, and report upon the extent and condition of the timber, they anticipated much benefit from his labors. "For," the Board stated, "if the continuance of the present system is leading to the speedy exhaustion of the forests, and if, as Mr. Fell states, the free trade in timber has been anything but a benefit to the country, no time should be lost in taking steps to reform a system which must ultimately prove so injurious to the interests of the Province in the destruction of one of its most valuable products."

56. During the time that this correspondence was passing at Madras, the Government of Bombay, on the 12th January 1839, was addressed by the Superintendent of the Indian Navy, Sir Robert Oliver, regarding the available means of procuring timber for the construction of certain steam-vessels which it was in contemplation to build at Bombay. Sir Robert's letter to Government was written in consequence of a representation which had been made to him by the Controller of the dock-yard, Lieutenant Williams, that the stock of timber in hand was small, the supply in the market scanty, and the prices increasing, while the quality was daily becoming inferior. Under these circumstances, and as the proportion of timber which was usually contracted for was calculated only for ordinary purposes and exclusive of building new vessels, Sir Robert advised "immediate steps being taken to procure the required supply of timber, both for present and future consumption, of good quality and fair and equitable prices, either by means of an agency on the coast to break the monopoly," or by some other means; "for," he said of contracts, "a continuance of the present system will preclude the possibility of building at all in Bombay, and be the means of forfeiting the high character hitherto maintained in this branch of the service."

57. On the 23rd January 1839, Sir R. Oliver again pressed on the attention of Government the necessity of adopting some steps for the early supply of timber requisite for building the steamers, and advised the deputation of Lieutenant Williams to the forests as Agent, to select and purchase the required quantities.

58. On the 29th January 1839, the Government of Bombay sanctioned the deputation of Lieutenant Williams to the Coast of Malabar, but only as a temporary measure, and on the same date the arrangement was reported to the Government of Madras with a request that that Government should direct the revenue authorities of the coast to render every assistance in their power to the undertaking.

59. The Government of Madras replying, on the 19th February 1839, to the above-mentioned communication of the 29th January 1839, and to that of the 31st October 1838, forwarded for the information of the Government of Bombay the correspondence that had passed among the officers of the former Presidency, with a view to show that the improvement of the forests in Malabar had already engaged their attention, though, they said, "nothing decisive towards that end has

been done, in consequence of the limited nature of the information that has been supplied by the local officers on the coast, as well as of the difficulties which seemed to stand in the way of such improvement." The Government of Madras under these circumstances thought the recommendation which had been made by the Board of Revenue at that Presidency, for the appointment of a qualified person to inspect and report on the forests, was the best that could be adopted, and as Lieut. Williams had been deputed to Malabar, they advised his being also "entrusted with the duty of obtaining more accurate information respecting the state of the forests and their resources"; and, in anticipation of the Government of Bombay approving of this measure, the Government of Madras instructed the revenue officers in Malabar to render every aid to Lieutenant Williams in furtherance of that object, as well as in the execution of the duty with which he had been specially charged.

60. Shortly after the receipt of these papers at Bombay, Mr. Farish, who was then Governor of that Presidency, recorded a minute, dated 4th April 1839, on the several points connected with the supply of timber and forest conservancy. Mr. Farish advocated the location permanently of an Agent on the Malabar Coast for the purchase of timber for both Governments, as he did not agree in the opinion held by Mr. Clementson as to the great abundance of Teak in the forests. In order to distinguish the Government forests from private forests, and so also to secure private rights, Mr. Farish proposed a survey of the forests; and he considered that during the progress of the survey, and as the private claims were admitted, the Government should "endeavour to purchase the royalty or forest right" over such tracts as were well situated for transporting timber to the coast, or which were on other accounts desirable, either on the plan adopted by Captain Watson in 1807-8, or in some other way. By the term "*royalty or forest rights*," Mr. Farish explained that he meant "a right to exercise the conservancy of the forests, and to forbid the felling of timber not of proper size, or not requiring to be removed for the purpose of thinning the forests, or other sufficient reason of which the Conservator would be the judge."

61. The tracts near rivers in Malabar from which the large timber had been cleared were recommended for purchase, and Mr. Farish advised that on all lands of which the royalty was purchased, the

Government should retain a prior right to the timber felled, on payment to the proprietor of the usual rate of a rupee for each full-sized tree; while for saplings or young trees, which the Conservator might be allowed to cut for thinnings or otherwise, the rate which the proprietors had received from others should be continued to them, and they should moreover have the privilege of felling timber *bond fide* for their "own buildings within such lands on obtaining due permission."

62. Mr. Farish was of opinion that the effect of the proposed measures would not be fully seen for twenty years, adding, "we are now in 1839 perceiving the effect of the retrograde movement of 1821, and it will not be till the approach of 1860 that the advantage of any changes now adopted will be well appreciated," and therefore the measures which may be adopted "must not be ephemeral or liable to be changed by future Governments; they must be continued for at least 30 years to show their effect, and any record of their success must be made with reference to that distant period."

63. In the office of Conservator, Mr. Farish saw nothing that need have interfered with private rights, but on remodelling it, all powers which were likely to invade those rights should be taken away, and the office placed under the Collector of the district, without any other duties attached to it than those of a Conservator, and with a responsibility to the Collector directly, for the careful preservation of the forests on the principle followed in Travancore.—"If a higher officer be not thought essential when the survey and purchase of the *royalty* has been completed, a steady and intelligent European ship-builder, or other person having some scientific acquaintance with timber, might be found to execute the office, having under him a competent establishment of natives. In such case, the agent for purchasing timber should be a separate officer employed for the occasion."

64. Mr. Farish did not approve of Captain Taylor's proposal to make it more the interest of the proprietors to fell large rather than small timber, by levying a high rate of export duty per tree, as a prohibitory duty on a useful article was not in Mr. Farish's opinion a desirable measure.

65. Being of opinion that the principles and measures advocated in reference to the Malabar forests should be applied to all other forests similarly circumstanced, Mr. Farish proposed to send Lieut. Williams a copy of the correspondence received from Madras, and as therein

recommended, to request that officer personally to inspect and report on the "present extent and condition of the timber for the joint information of the two Governments," so that measures might be taken for the preservation of the forests, and "for the more efficient and more economical supply of the dock-yard and ordnance department."

66. The Government of Bombay, on the 16th April 1839, carried out the suggestion in respect to Lieutenant Williams, and apprised the Madras Government accordingly, forwarding to that Government a copy of the minute by Mr. Farish. The whole subject was also reported to the Court of Directors on the 13th May 1839, in the hope that efficient measures for remedying the evils complained of would be sanctioned by that authority.

67. On the 12th June 1839, the Superintendent of the Indian Navy submitted to the Government of Bombay two letters or reports from Lieutenant Williams, both dated 11th May 1839, from which the following information is gathered regarding the forests and the supply of timber then obtainable from them, as well as respecting that procurable in the market.

LIEUTENANT WILLIAMS'S REPORTS, 1839.—68. In his first letters Lieutenant Williams notices that timber was selling at an unusually high rate, because the timber market, on the abolition of the agency in 1831, had fallen into the hands of three or four moneyed natives, who, by advancing money from time to time to the forest proprietors, contrived to get many of them into their debt, and thus created a monopoly. He succeeded, however, by engagements made personally with the forest proprietors in obtaining promises of supplies to the extent of about six thousand candies at reasonable rates. Lieutenant Williams mentions the timber of the Nelumboor forests as the very best in all Malabar, and the supply not likely to fail for six or eight years.

69. In the second communication Lieutenant Williams, in reply to the instructions to inspect personally and report on the extent and condition of the Teak forests, states his inability to do so then from the rainy season having set in, but he makes a report on a forest in the neighbourhood of Wadakancherry, which he had visited, from which he thought some opinion could be formed of the result of a general inspection, as most of the Malabar forests were stated to be much in the same condition. Lieutenant Williams found "the greater part of the Teak trees had been cut down, and that those which remained

standing were from four to five miles from the nearest water-carriage." He said, "no care has been taken to perpetuate a supply, no seeds have been planted, and such few self-sown from the large trees as may take root are mostly all destroyed in the annual burning of the dried leaves and brushwood. Trees of every age and size have been felled indiscriminately, and very few small trees are now to be met with, for those being of easier carriage and yielding a quicker return were the first to be cut down on the removal of the heavy restrictions which were in force until the year 1834." No precautions appear to have been taken in barking, felling, and seasoning the timber, and in its transport, for instead of being dragged by a proper path to the nearest water-carriage, the logs were pushed over declivities, sometimes of hundreds of feet, thereby causing rents in the timber, and contributing in some measure to its general inferiority. Since the abolition of the office of Conservator, the most reckless devastation had been committed upon the smaller sized trees, every stick that promised to yield a return having been cut down. Within twenty-one preceding months from the time that Lieutenant Williams wrote, it appears that forty thousand young trees had been floated down from the jungles, "the diameter of which did not exceed 12 inches, and a great proportion of which was under six inches. Nothing can more plainly show the ruin the forests are sustaining, and the necessity of prompt measures to avert the inconvenience to which Government are likely to be subjected, by the almost entire loss of one of the most valuable and important products of the country." As it was the practice with some forest proprietors to sell their trees at a rupee each, Lieutenant Williams proposed to purchase a number for Government, leaving them to be felled when required at any future period.

70. The Government of Madras possessed three forests in the vicinity of Palghaut, which contained between five and six hundred trees, but very few young trees and saplings, as mostly all that spring up from self-sown seeds are destroyed in the dry season by the burning of the grass and weeds. Two of these forests contained "many valuable full-grown trees of blackwood," and the third was reported to abound in Cedar trees, but to have fewer Teak trees than either of the other two.

71. Lieutenant Williams further noticed the total absence of all care or endeavour to provide for the future, and adds, that near Wada-

kancherry, in the immediate vicinity of water-carriage, not a seed had been sown. He therefore suggested the propriety of preserving and improving the Palghaut forests, as a reserve to meet in after years the exigencies of the Government.

MINUTE BY MR. FARISH, 25TH JUNE 1839.—72. Upon these reports of Lieutenant Williams, Mr. Farish recorded his remarks and suggestions in a second minute, dated 25th June 1839.

73. Mr. Farish considered that the information afforded by Lieut. Williams strongly corroborated in many points what had been assumed respecting the state of the forests in the minute of the 4th April, and fully established the error of the representations that there was no deficiency of timber, and that the resources of the forests were as abundant as formerly. Mr. Farish, therefore, again advocated precautionary measures for the preservation and improvement of the forests.

74. He considered that the proposition for purchasing trees on the ground by the payment of the *kooty kanum* to the proprietors was a judicious one, "if no method of obtaining the royalty of the forests," as recommended in his previous minute, could be devised, but the purchase should be extensive, so as to embrace all exhausted Teak tracts which were situated favorably for water-carriage, and to include a right of controlling the management of the forest, in order that the burning of the jungle might be prevented as it is in the Travancore forests, and measures adopted for planting young trees and preserving them during their growth."

75. A copy of the above minute, and of each of Lieutenant Williams's reports, seem to have been forwarded to the Government of Madras, and Lieutenant Williams, it would appear, was directed to proceed and "inspect personally other forests and report upon them."

76. In the mean while the Government of Madras, on receiving the letter of the Government of Bombay dated 16th April 1839, transferred it and its accompanying correspondence to the Board of Revenue at that Presidency, on the 3rd May 1839, with a request for a report on the matter. The Board of Revenue, to aid them in forming a judgment on the measures for preserving and increasing the supplies of forest timber which were proposed in Mr. Farish's minute of the 4th April, sent a copy of the papers to the principal collector of Malabar, who in reply made a long report on the forests of that Province from the period that Government took possession of them up to the date of the

report. The Board of Revenue submitted this report to the Government of Madras on the 7th November 1839, with their remarks on it and on the minute by Mr. Farish, but before taking up the Board's letter, the report of the Collector of Malabar will be noted.

MALABAR, 1839.—77. The report on the Malabar forests is dated 12th September 1839, and was drawn up by Mr. Underwood, who was acting principal Collector of the province at the time. Mr. Underwood divides his report under the heads of *Royalty*, *Conservator*, *Re-opening of the timber forests*, and *Proposed measures for preserving the forests*.

78. *Royalty*.—On the subject of royalty, Mr. Underwood states that under the former rajahs the trade was free, and the right of private individuals unfettered, the owners of forests working them or not as they pleased,—the only interference by the ruling authority being the levy of a small duty of about one rupee per candy. When Tippoo Sahib took possession of the Province of Malabar, he, in the exercise of his rights as a conqueror, annihilated this private right and created the forests into a monopoly, working them himself. From Tippoo's own statement, it appears that by this measure he gained a revenue of rupees 90,000 annually, exclusive of charges. "He, however, so far recognized the rights of the proprietors as to make them an allowance of two fanams per tree of 10 inches diameter." Tippoo appears to have first assumed the royalty of the forests in 1784-5, and it is argued that on the cession of the country by him, the Company's Government acquired the same rights, and in fact, on the transfer of the territory, did assume and temporarily exercise those rights, but afterwards threw open the trade and levied a duty of two rupees per candy. The monopoly, however, was re-established,—

"First, by the proclamation of the Collector in 1806, which prohibited the felling and exportation of timber; and secondly, in the proclamation of the Madras Government dated 25th April 1807, wherein the sovereignty of the forests was assumed, and all persons prohibited from cutting or destroying trees or young plants under the penalty of being treated as plunderers."

—Thus it continued till 1822-23, when the office of Conservator was abolished. With reference to these circumstances, Mr. Underwood thought that the Government might in equity assume the royalty over all private forests. He observed,—

"They belong so far to Government that their destruction cannot be permitted, as this would be an infringement of their rights, and on the other hand they are *bond fide* the property of individuals who are entitled to the entire profits to be derived

from the timber ; this latter right has been freely exercised, so as nearly to extinguish the right of Government, and it is now high time that they should take prompt and immediate measures to preserve their interests from destruction by the entire exhaustion of the forests."

79. Referring to the alleged purchase, in 1807, of the proprietary right in some of the forests by Captain Watson, the Conservator, Mr. Underwood, reported that he could not trace the fact in the records. Captain Watson seems to have merely *offered* small sums to individuals, but there was no proof of actual *payment*. The Government therefore were really the proprietors of only three forests which had lapsed to them from the failure of heirs.

80. *Conservator*.—Regarding the office of Conservator, Mr. Underwood gives no further material information than has been already afforded in different parts of this Summary. The first Conservator appointed at Malabar was Captain Watson, and he in a short time, under the assumed sovereignty of the forests, " exercised the same kind of authority as if, by a universal forfeiture, all the trees and all the timber of Malabar and Canara had escheated to the Government." But while Captain Watson was so zealously asserting the right of the Government to the forests, he took no measures whatever for their perpetuation, and his successors seem to have been regardless of that object, for, Mr. Underwood observes, " after a careful search, I cannot discover that any Conservator has planted a single tree, or that they took any effectual or systematic measures to perpetuate the forests in which they felled timber."

81. The state of the forests under successive Conservators has been already detailed. The acts of those officers, and the system pursued by them appeared to Mr. Underwood to have received the support of the Government of Bombay " under the idea that a large portion of the forests of Malabar was the undoubted property of the Company, whereas in truth and in fact they did not possess the right of property in one."

82. *Re-opening of the timber trade*.—The Conservator and his establishment were withdrawn in April 1823, and Mr. Underwood says—" the first effect of the withdrawal of the monopoly" was the assumption by private proprietors of the right of property in the entire forests, and no sooner were they " in possession of their rights than the rage for Teak timber was such that it was felled promiscuously, and trees, small and large, cut down in every direction." These

proceedings were entirely subversive of the rights which Government had asserted in the proclamation of 1807, and yet Mr. Underwood could not discover that those rights had been relinquished by any subsequent public act or proclamation of the Government, or by the measures of the Conservator. He did not think it was intended that liberty so unrestricted of felling timber and destroying saplings was meant to be conceded to the people, and this opinion is confirmed in a great measure by the terms of the Government order for the abolition of the office of Conservator, for it directed the Collectors to "submit such suggestions as may seem to them most proper for preserving the trees in the public forests and for procuring supplies of timber for the public service, without encroaching on the rights or comforts of the people at large"; and in a later order of Government to the Board of Revenue, dated 17th October 1823, it is laid down that,—

"Next to protecting the people from any obstruction in the enjoyment of their property, and in the exercise of their prescriptive privileges, (which it is hoped has already been sufficiently provided for,) the first great object is to secure the valuable property in the public forests from fraudulent or wanton injury, and the second to render the produce of those forests available for useful purposes."

83. Though no definitive arrangements were made by the Board of Revenue up to September 1823, it appears that they had merely awaited the receipt of reports from the local officers, "regarding the tenure of the forests in Malabar and Canara, the extent of the tracts they occupy and the nature and value of their produce"; whence Mr. Underwood inferred that by the abolition of the office of Conservator, it was not intended absolutely to abandon all Government right to the forests, and therefore the Government possessed a "much stronger claim upon the forests than they assume."

84. Referring to the injurious effects of the abolition of the office of Conservator, Mr. Underwood says, a very different result was anticipated from that which followed, and he quotes the following passage from a minute by Sir Thomas Munro, in which the throwing open of the trade in timber was strongly advocated :—

"The people of Malabar and Canara are chiefly agriculturists and merchants, a considerable proportion of the ryots are traders, and their country being intersected by rivers and creeks, enables them to bring the produce to the Coast in their own boats for sale, and they are too good traders not to cultivate Teak, or whatever wood is likely to yield a profit. They are fond of *planting*. They plant trees for sale for their private use, and in order to devote to their temples; and to encourage

them, no regulation is wanted, but a free market. Restore the liberty of trade in private wood; let the public be guarded by its ancient protector, not a stranger, but the collector and the magistrate of the country, and we shall get all the wood the country can yield more certainly than by any restrictive measures. Private timber will be increased by good prices, and trade and agriculture will be freed from vexation."

The Marine Board of Bombay, in a letter to Government dated 15th April 1823, entirely agreed in this opinion, but Mr. Underwood shows that these expectations were frustrated by the perfect freedom which followed the abolition of the office of Conservator.

85. *Proposed Measures.*—The measures which Mr. Underwood proposed, were,—

1st,—The revival of the Company's right of royalty in the forests by a proclamation.

2ndly,—The revival of the office of Conservator with abridged powers.

3rdly,—The purchase of tracts in exhausted forests with a view to their replantation.

4thly,—That Government should work their own forests, cutting down all timber but Teak, in order to replant them with Teak.

5thly,—The appointment of a joint Agent by the Governments of Bombay and Madras for the purchase of timber.

86. Regarding the first measure Mr. Underwood observed that when Tippoo monopolized the forests, the neighbouring Rajahs of Travancore and Cochin "took the hint and seized the forests which they appear never to have relinquished, and if their right be one of assumption, and yet be recognized as a legal tenure"; he thought the Government could "with equity and propriety" assert their claims to the royalty in the restricted sense in which the term had been used by Mr. Farish, which was a right to regulate the felling of timber; and he recommended this being done at once by a proclamation without delay.

87. Touching the second measure, Mr. Underwood stated that the Collector of the Province should be *ex-officio* Conservator, with an assistant under him to be employed expressly upon that duty; the royalty to be vested in the Conservator, who should exercise the following rights:—

"1st,—No tree shall be cut without his permission, it being distinctly understood that he will grant leave to cut all that can be called timber, reserving a tree here and there for seed."

"2ndly,—No tree shall be cut until, say, ten seeds or saplings are sown or planted in its room."

"3rdly,—Young trees are not to be cut without leave, but the Conservator will allow this whenever it is requisite to thin plantations, and he will permit shoots from old trees, or trees that have been felled, to be cut down."

It was conceived that this would allow forest-owners as much small timber as could be necessary.

88. On the third and fourth propositions Mr. Underwood made no particular remarks, but with respect to the fifth, *viz.* the appointment of an Agent, he urged the creation of that office independent of that of Conservator, as the duties of the two were incompatible in the same person. The Conservator would plant and protect, while the Agent would select the trees, and regulate the time and manner of their being cut. The Conservator would follow his steps, and replant where the timber had been felled. The Agent must be left unfettered, to proceed from place to place to find the best market, but the Conservator's presence was indispensably required in the forests.

89. For obtaining supplies of timber, Mr. Underwood suggested three modes; the *first* was to purchase in the market, the *second* to make large contracts, and the *third*, to purchase forests, either in perpetuity or for a series of years, or to obtain the exclusive right of cutting trees upon the payment of a fixed amount. This last mode was considered the most desirable, but whichever might be adopted, it was recommended that the right to plant should under any circumstances be secured.

90. Mr. Underwood thought that if his suggestions were followed, the Government would obtain all the timber they required. The landlords would be subject to no interference, while the private merchant and the ship-builder would both be able to purchase timber. "On the other hand, the forests will be preserved from destruction, and gradually regain the luxuriant condition in which they were when delivered, without restriction to the proprietors, who have delivered them to the unsparing axe of mortgagees; these have devastated them with a cupidity that will, if allowed to continue, ensure their total destruction, and it is to relieve them from the wanton and indiscriminate spoliation of these individuals that the present restrictions are proposed."

91. Mr. Underwood submitted an agreement which a proprietor of forests had sent to him, with a request that he would interfere and prevent the contractors from cutting down the young trees, and on this point he added,—“no doubt most proprietors feel as this man does, and would hail the appointment of the Conservator, as now proposed, as a boon, as would all classes except the mortgagee, whose plans and conduct it is my object to control.” Mr. Underwood also submitted a

statement showing " the number of forests, the trees they contain, the parties who own them, and as far as practicable, the individuals to whom and the rates for which they are mortgaged."

92. The following is an abstract of the statement :—

Abstract Statement of the Teak Forests in Malabar, 1839.

Numbers.	Talooks.	No. of Teak forests.	No. of Proprietors.	No. of Timbers above three canclies.	No. of Timbers below three canclies.	Estimated No. of Trees that can be planted.
1	Temalpooram,	73	4	43,270	159,093	323,700
2	Palghaut, { Private property, ..	38	24	249	5,692	7,410
		3	1	140	575	4,550
3	Walloowanaad,	64	15	4,081	16,525	26,250
4	Nedoonganaad,	23	4	500	4,372	19,530
5	Ernaad,	205	8	2,955	36,818	200,000
6	Wynaad,	40	7	2,402	6,415	} Not stated.
7	Cartenaad,	5	2	103	755	
8	Coormenaad,	23	2	869	5,130	16,685
9	Calicut,	0	0	0	4,710	18,700
	Total, ..	473	67	54,591	240,094	516,845

" *Temalpooram*.—Of the four proprietors in that talook, or district, three had either rented out or mortgaged their forests, but the fourth held his forests unincumbered.

" *Palghaut*.—Of the twenty-four proprietors in this District, three had rented out or mortgaged some of their forests; the remaining forests were held by their proprietors. The Rajah of Palghaut and some other zemindars were " in the habit of renting the privilege of cutting Teak-trees in their respective forests."

" *Walloowanaad*.—Of the sixteen proprietors in this District, only four had leased out their forests.

" *Nedoonganaad*.—One of the four proprietors in this District, the Rajah of Calicut allowed trees to be cut in his forest; between two other proprietors there was a dispute respecting the right of seventeen forests; the forests of the fourth proprietor contained only saplings, and were free from any contracts.

" *Ernaad*.—A few of the forests here were mortgaged, the others were free from the leases or contracts which existed in Palghaut and Temalpooram.

" Many of the forests were stated to be so infested by wild Elephants, that it was found impracticable to ascertain with any degree of accuracy the number of trees in each.

Wynaad.—This talook is above the ghauts, and deprived of the convenience of water-carriage to the coast. Teak-trees were felled only to meet the demand in Mysore, whither the wood was carried on *bandies*, after being cut in convenient sizes. Mr. Underwood thought it was worthy of consideration, whether the timber could not be cut into planks and carried to the Coast at a moderate price, and if the forests could not be purchased by Government for smaller sums than those forests which were below the ghauts.

BOARD OF REVENUE, 1839.—93. On the several points discussed in the minute of Mr. Farish, dated 4th April 1839, and in the above report of Mr. Underwood, the Madras Board of Revenue expressed their sentiments in the letter to the Government of Madras, dated 7th November 1839, (in reply to the requisition of the 3rd May preceding,) already noticed in para. 76.

94. The survey of the forests suggested by Mr. Farish, the Board thought would be a work of useless labor and expense, as Mr. Underwood's report had shown clearly that the Government could claim the proprietary right in no more than three forests situated in Palghaut; they therefore did not recommend a survey. In all other points connected with the forests the Board fully agreed in opinion with Mr. Underwood, and accordingly they recommended the immediate adoption of the several measures suggested in his report, except the fourth proposal,—the purchase of all tracts of forest lands in which the Teak had been totally exhausted for the purpose of replantation. This measure the Board thought should be left for consideration when further experience on the subject had been acquired. The Board further doubted whether the right of royalty after having been abandoned for a considerable period could be legally revived by means of the proclamation which was recommended to be issued; they therefore advised a reference to the legal authorities, and that on issuing a proclamation the term royalty should be carefully defined to mean merely the right to prevent the indiscriminate felling of timber, and to enforce regulations for securing a perpetual supply of trees, and not to include any privilege of monopoly, pre-emption, or fixing of the price. Of Mr. Underwood's suggestions for obtaining supplies of timber, the Board observed that the principal one, the appointment of an Agent on the Coast, had been carried out. They agreed with Mr. Underwood that the office should always be distinct from that of Conservator, and that the same Agent should purchase for the Madras and Bombay Governments to obviate loss from competition.

On the other suggestions the Board refrained from remarking, as they believed that the Agent on the spot could best determine the propriety or otherwise of adopting them.

COURT OF DIRECTORS' ORDER, 26TH FEBRUARY 1840.—95. In February 1840, the Court of Directors wrote to the Government of India regarding the report made to them by the Government of Bombay on the 13th May 1839, which has been alluded to in para. 66.

96. The Court, after briefly reviewing the history of the forests from the date of their order of August 1800 down to the date of Mr. Farish's minute of 4th April 1839, remarked that the plans which were proposed required considerable modification, as in 1805 and the following year surveys of several Districts in Malabar and Canara had been executed and although the supplies of timber which were then reported to exist were inapplicable to 1840, yet they believed that sufficient information had been collected to render a second formal survey unnecessary. The Court also remarked that,—

“ The forests of the districts of Palghaut in Malabar, as well as others of considerable extent in Canara, are admitted to be public property, and if these are inadequate or unfit to supply the demand of Government, a properly qualified person should be deputed to select other and more conveniently situated tracts of which Government should endeavour to obtain the complete ownership. The Bombay Government indeed proposes to purchase merely the royalty or forest right, which is described in a minute by Mr. Farish as the right to exercise the conservancy of the forests and to forbid the felling of timber at a fixed rate which it is proposed to secure to Government, and with the further obligation imposed on the proprietor to abstain from cutting Teak-wood, even for his own use, without permission, would place Government nearly in the position of a perpetual lessee ; and though all public purposes might thus be answered, room would be left for dissatisfaction on the part of the proprietor, who might naturally complain if in consequence of a rise of prices he found himself compelled to dispose of the produce of his estate, for less than the market rate. At the same time there will be no advantage in purchasing more land than may appear sufficient to supply the average quantity of timber required for the public service. The forests not required for this purpose should still be left in the hands of the actual tenants, and we would suggest for your consideration whether it might not be desirable to prevent material injury to the timber by legislative enactment forbidding the felling of Teak-trees under a certain size, except on payment of a high rate of duty.”

97. The Court of Directors, however, desired the Government of India to give the whole subject early and attentive consideration, and to exercise their own discretion with regard to the instructions to be issued to the local Governments. But at the same time the Court added,—

“ We shall merely express our anxious wish that in the prosecution of the survey, if such a measure should appear necessary, and of the ulterior operations, the utmost care may be taken to avoid any infringement of the rights, or any unnecessary interference with the convenience, of private persons. It will probably be found expedient to commit the management of the Government forests to a Conservator, and to subject him in matters connected with the official duty to the orders of the Government of Bombay, but with the view of guarding against a recurrence of the evils which formerly flowed from the particular office, the conservator should at the same time be made responsible to the local authorities, and his powers should be so strictly defined as to afford no pretext for exceeding them.”

98. On the receipt of the foregoing Despatch, the Government of India, on the 22nd of April 1840, called upon the Governments of Madras and Bombay for information, regarding the Malabar and Canara forests.

99. The Government of Madras was required to report the extent of the forests in each of the two Provinces which were admitted to be public property, their condition “ and the situation of the timber thereupon with respect to its fitness to supply the local and Marine demands of Government,” in order to enable the Governor General to determine “ whether additional forests or other forests more conveniently situated,” which were private property, should be “ acquired by the State sufficient to supply the average quantity of timber required for the public service,” and whether it would “ be desirable by some legislative provision to prohibit generally the felling of Teak-trees under a certain size, except on payment of a high rate of duty.”

100. The Government of Bombay was desired “ to furnish any information relative to the timber of these forests, and the objects of inquiry which are suggested in the Hon’ble Court’s Despatch,” that would assist the Governor General in Council in carrying into effect the instructions of the Court for the preservation, and if necessary, for the extension of the Government forests in Malabar and Canara by purchasing new tracts.

101. The Government of Madras, in reply to the foregoing requisition (para. 99), forwarded to the Government of India on the 30th June 1840, in addition to the correspondence regarding the Teak forests of Malabar and Canara, which has been already noticed, a letter from Mr. Conolly, acting principal collector of Malabar.

MALABAR, 12TH JUNE 1840.—102. Mr. Conolly’s letter is dated 12th June 1844. He confirms the fact of the whole country of Malabar,

whether forest or plain, being the property of private individuals, with the exception of three forests in Palghaut which, on the death of the owner Chenat Nair in 1802 and in default of heirs, reverted to Government. These forests had been scarcely worked, but the supply available from them was not much. The private forests, on the other hand, had been "dilapidated by a selfish and short-sighted policy," and urgently called for some measures to put a stop to their total destruction. Mr. Conolly thought that no system could be better than that of prohibiting the felling of Teak-trees under a certain size by a high rate of duty on under-sized trees. He did not approve of the proposal to re-assert the royalty in a modified degree on behalf of Government, as he apprehended its assumption, so long after its virtual relinquishment in 1823, would cause great and general discontent, while the chief advantages anticipated by that measure, would be as effectually obtained by the much less objectionable imposition of a prohibitory duty.

103. Mr. Conolly was favorable to the plan for the "acquisition of private forests sufficient to supply the average quantity of timber required for the public service," but as "it might be a difficult matter with the feelings entertained by the natives of this country of the value of their proprietary rights, and of the loss of honor entailed by alienating them, to make many purchases out-and-out," Mr. Conolly thought the desired end would be "just as effectually secured by taking forests on the usual mortgage-tenure of the country," and by advancing nearly the value of the estate the Government can secure themselves against any intrusion, as "in Malabar mortgages are never foreclosed, but by a common tenure, (*kooty kanum*); the proprietor in case of redemption is bound to pay for all improvements made by the mortgagee." This plan would ensure perpetual possession, where the original sum advanced was equal or nearly so to the value of the property, and it would leave the proprietary right untouched "to feed the harmless vanity of the proprietors, whose sole rights will be sundry seigniorial ones," such as the tusks of elephants that may die within the forests, the wild honey, bees-wax, &c., "which will in no way interfere with the full occupation and use of the ground," and one of the greatest advantages of which will be the power of replanting the tracts that are denuded of Teak.

104. Mr. Conolly further proposed the appointment of an active and trustworthy person, who possessed a knowledge of arboriculture,

with the aid of an establishment to take the general superintendence of the forests under the Collector.

105. The Government of Madras in reviewing the measures proposed in this letter by Mr. Conolly, and those which were advised by Mr. Underwood, (see para. 85) as well as the measures recommended by the Board of Revenue, decided in favor of renting the forests as a plan that "would effectually remove all difficulties that might arise from the assertion of the proprietary rights of the people in opposition to the modified title of royalty, which it is proposed to revive on the part of Government, and that it would at the same time give the Government the entire command of the forests, enabling them to obtain an abundant supply of the best timber, and to nurse the forests." Accordingly, and as it appeared that some forests were then rented on account of the State, the Government of Madras, on the 30th June 1840, instructed Mr. Conolly "to endeavour immediately to ascertain and report upon what terms the several proprietors would be disposed to lease their forests to Government, on the termination" of the leases which then existed, and also to estimate and state as far as was practicable the probable annual expense that would have to be incurred by the adoption of the measure.

106. The Government of Madras on the same date, 30th June 1840, forwarded a copy of the above order and of the papers on which it had been passed to the Government of Bombay, where Mr. Farish reviewed the subject of them, and recorded on the 30th July 1840 a minute, which will be noticed presently; and on the 5th August, the Government of Bombay replied to the requisition of the Government of India of the 22nd April, (see para. 98).

LORD AUCKLAND'S MINUTE, 29TH AUGUST 1840.—107. Upon these papers Lord Auckland wrote a minute, dated 29th August 1840, in which he expressed his approval generally of the measures that had been taken for the preservation prospectively of the Malabar Teak forests, but objected to measures of prohibition, or to duties contrived so as to discourage the felling of small trees in the hope that the prospective supply of long timber would thus become more plentiful, and disapproved in fact of any minute interference by Government, "as it would not be compatible with a good system of forest cultivation in which saplings should be made to succeed to large trees, and should be thinned at intervals until the large timber trees should in the end occupy their natural space." He added, that "more good might be

done with the rajahs and greater proprietors of woods, and they might perhaps be tied down to conditions of management by the purchase of their growing trees, or upon other consideration, and be made to introduce a good system." However, his lordship put off the further consideration of the subject until the receipt of more information from Bombay and Madras. A communication in the terms of this minute was accordingly made to the Governments of Madras and Bombay on the 2nd September 1840.

108. On the 16th September 1840, the Government of Bombay again addressed the Government of India, forwarding the correspondence then recently received from the Madras Government, with the minute of Mr. Farish, dated 30th July, alluded to in para. 106.

MINUTE BY MR. FARISH, 30TH JULY 1840.—109. Mr. Farish approved of the proposal for renting forests by mortgages, but thought that for the interests of Government it was essential that the mortgages should be for a certain period, as otherwise the wealthy timber merchants of Bombay, when the most valuable forests shall have been preserved and carefully nursed by Government, would step in, and by redeeming the mortgages secure for themselves all the advantages for which Government had labored and incurred expense. Mr. Farish suggested, that for the purposes of Government, and as a future reserve, the most desirable forest-tracts were those lying near water-carriage, which though entirely exhausted at that time, once produced fine timber. Similar measures to those contemplated in Malabar should be applied to Canara, and in fact wherever Teak was indigenous, and particularly where it had yielded timber of good quality. Adverting to the details of rearing, preserving, and felling forest-trees, Mr. Farish pointed out particularly the necessity of planting, along with Teak, other trees which grow faster than it, or where such existed, of preserving some of them in order to shelter the young Teak from the violence of the weather, as it had been ascertained that Teak did not grow and thrive without such protection. It was also to be remembered that,—

“The extensive planting and judicious rearing and care of young trees, and the prevention to felling those proper to be preserved to maturity, must as far as possible be made to depend on arrangements not liable to be affected by the fluctuating tenure of our local managers, or the frequent changes of the officers of Government itself. The Government must never forget that a period of not less than thirty years will elapse before the beneficial effect of these contemplated improvements can be fully appreciated, and that their ultimate object is for years far more distant.”

110. Entertaining these views, Mr. Farish advised the permanent appointment of a sub-conservator under the collector and *ex officio* conservator, and recommended his being a "properly qualified person," who should be remunerated by a salary progressively increasing with lengthened periods of approved service, so as to secure his continuance in the office. "He should have particular instructions as to the several points of duty for which he should be held personally responsible, and powers should be vested in him and in the collector to render the conservancy completely effective," and his office establishment must "not be liable to reduction on merely economical considerations." Mr. Farish further advised the appointment of an agent, apart from that of sub-conservator, for the purchase of timber, also other provisions for rendering these measures permanent; and he said, "as a very useful help in keeping a knowledge of the state of the timber resources of India constantly before the authorities, annual correct information should be furnished by the sub-conservator in a report regarding the forests, and by the agent for purchasing timber, regarding every detail of the Malabar timber trade of the season." Mr. Farish looking "beyond Indian interests in this national question," proposed moreover that copies of these reports should be furnished to the Admiralty Board and other departments that took cognizance of the timber resources for the Royal Navy. The high price of the timber which then prevailed was ascribed to the competition that had arisen for the supply of the Gun-carriage department, where only the very best description of timber was used; but the recurrence of this contingency the agent would be able to prevent by a proper conservation of the forests, and by his having at command not merely the supplies in the market, but also those in the forests leased by Government; "all departments of every branch of the Indian Government which draws its timber from Malabar may then be supplied by the agent there, according to the nature of their demands."

111. A copy of the foregoing minute was sent to the Government of Madras, and another copy was forwarded to the Superintendent of the Indian Navy, for communication to Lieutenant Williams.

112. On the 29th October 1840 the Government of Madras again addressed the Government of India, and forwarded a copy of a letter which they had received from Mr. Conolly, then acting principal collector of Malabar, in reply to the requisition of the 30th June, (paragraph 105,) which enjoined that officer "to ascertain and report upon what

terms the several proprietors would be disposed to lease their forests to Government, on the termination" of the existing leases, and to estimate and state as far as practicable, the probable annual expense of such an arrangement.

MR. CONOLLY'S REPORT, 19TH OCTOBER 1840.—113. Mr. Conolly says that immediately on receipt of the above instructions, he communicated with the chief forest proprietors on the subject of renting their forests; his proposals at first were received with a good deal of alarm and suspicion, which were further fostered "by the artful representations of the merchants who had hitherto been the chief renters and mortgagees of the forests, and who were extremely unwilling to lose the benefit of a profitable monopoly"; but having at last succeeded in his object, he felt assured that "little difficulty will be experienced in obtaining large portions of forest lands on the terms of a contract" which had been drawn up in communication with some of the most influential proprietors. Mr. Conolly proposed to rent the forests on the system which generally prevailed in the country, "with one or two additions and improvements." The terms of his contract will be best explained by the following extract from the 3rd para. of his letter :—

"The Government, besides giving a fixed sum or mortgage which is to bear no interest,* and which is to vary of course according to the value of the specific property, are in the first instance to make an advance to the proprietor (also without interest)* of a further sum regulated by the same standard, which is to be liquidated by the timber felled at the rate of 1 rupee per tree, and on this advance being liquidated they are to pay in arrear at the same rate for every tree afterwards felled. It is further stipulated, that to enable the Government to have the full advantage of the trees which it is proposed to plant in the rented forest, and which do not come to full maturity till from 40 to 50 years, the mortgage be renewable every 30 years, on the condition of a fine for the renewal, and payment of half a rupee on each tree so planted at the time of its felling. The latter stipulation is the one which is most advantageous to the proprietor, as he is to receive this sum without any expense or trouble on his part; still I do not think it at all unreasonable. It is, in fact, the rent of the ground for the half century that is required to make the tree fit for cutting, and when it is considered that each tree may be estimated to cost Government about 30 rupees by the time it is ready for actual use as timber, this additional tax is hardly worthy of being taken into account.† It must be remembered also that some clear and tangible benefit must

* "The use of these sums without interest was a point on which much stress was laid by the natives whom I consulted. But the loss to Government on this account will not be considerable. The money given as *panium* on property of this description is generally very small as compared with its real value; that given as *kooty kanum* is a temporary charge which is continually decreasing."

† "A tree of three candies (below which none should be cut) when brought to the sea-coast is worth at present about 50 rupees, but I am presuming that under good Government management the price will be greatly reduced."

be held out to the proprietor, to induce him to alienate his land so thoroughly as he is invited to do, thus departing from the usual system of giving merely a limited mortgage; with this inducement, as also the others of receiving the mortgage-money and advance without interest, and getting renewal fines, but little fear, as I have said above, need be entertained of obtaining for the Government sooner or later a large portion of the wood-land they may require on this or somewhat similar engagement.”*

114. The amount of timber required for the public Service, in the Bombay and Madras Presidencies, Mr. Conolly estimated at about 6,000 candies annually, supposing that one Government vessel is constantly under construction at Bombay. It was estimated that to furnish this quantity an extent of 260 square miles of forest land was necessary, as the Nelumboor Rajah obtained yearly 2,500 candies from his own forests which were 130 square miles in extent. The expense of the measure, Mr. Conolly remarked, would vary according to the terms on which it was obtained, whether by purchase or rent. The chief item was expected to be the establishment, which should be supervised by an assistant conservator, under the collector, on a salary of not less than rupees 400 a month, one-fourth being given as travelling allowance. The establishment which Mr. Conolly proposed as necessary at the outset, on the most moderate scale, was as follows:—

For the Conservator's Office.

1 English Writer,	35
1 Assistant Writer,	20
1 Native Gomashta,	25
1 Assistant Gomashta,	15
	95

For the Conservancy.

3 Native Inspectors at 30 rupees each,	90
3 Native Inspectors at 20 rupees each,	60
1 Duffadar,	10
12 Peons at 6 rupees each,	72
60 Mahaseers at 3 rupees each,	180
12 Head Mahaseers at 4 rupees each,	48
Contingent charges,	25
	580

—or annually, rupees 6,960.

Mr. Conolly strongly recommended the working of the forests by contract, rather than by a Government establishment. He said contracts could be obtained,—

* “Some slight difference may exist in the form of agreement to be entered into with different proprietors, but the essential features will be the same.”

“ * * * to fell and drag timber to the nearest water at a rate not exceeding one rupee per candy for each mile, and calculating that on the average the timber will have to be brought six miles, the charge to be incurred on this account would be for the estimated quantity of 6,000 candies, thirty-six thousand rupees a year. The one rupee per tree for *kooty kanum*, and the expenses of floating the timber to the coast, would cause an addition of about one rupee per candy, making the sum thirty-eight thousand; add to this the yearly expense of the Conservator's establishment, as above.. Rs. 6,960 as also the salary of the Assistant Conservator

Rs. 4,800
11,760

Rupees, and the grand yearly total for the culture and working of the forests will be 49,700 rupees, a little more than 8 rupees per candy. Allowing that the price to be paid for the forests in the first instance should increase this sum two or three rupees more per candy, the Government would still be great gainers. The average price per candy, now paid for the Bombay and Madras Governments' supplies is not less than 17 rupees, so enormously has this article risen within the last few years.”

115. On the 29th October 1840, the Government of Madras expressed their approval of the measures proposed by Mr. Conolly, and directed the Board of Revenue, if they could rely on the correctness of that officer's calculations of the extent of forest-land required for the purposes of Government, to authorize him to enter into agreements with the proprietors as opportunities offered, until the required area was obtained. These measures were reported to the Government of India for their approval, and were communicated to the Government of Bombay for the information of that Government.

ORDER OF THE GOVERNMENT OF INDIA, OF THE 18TH NOVEMBER 1840.

—116. The Government of India on the 18th November 1840 approved of the proceedings of the Government of Madras, and desired to be furnished with reports of the progress of the measures “for securing a permanent resource in the Teak and other products of the Canara district, or the Northern Sircars, where superior descriptions of timber may be found in sufficient quantity to be worthy of preservation or extension on the part of the Government.” On the 20th January following (1841,) the Government of India reported these proceedings to the Court of Directors. The Court were informed of the order which had been given to the Collector of Malabar, to enter into agreements with the proprietors as opportunities offered for holding in mortgage an area of 260 square miles of woodland, the extent which it had been calculated would yield the quantity of timber annually required, and it was explained that the terms of the agreement were the payment by Government of a fixed sum without interest on mortgage, (the amount to vary according to the value of the specific property,)

and of an advance to the proprietor, (likewise without interest,) to be liquidated by the timber felled at the rate of one rupee per tree, and payment of half a rupee for the felling of each tree planted by the Government. The mortgage being renewable every 30 years on payment of an additional 20 per cent. on the original mortgage-money, the lease was virtually made perpetual, as the mortgage could not be foreclosed without the consent of the mortgagee.

117. In reply to the order of the Government of India of the 18th November 1840, mentioned in the preceding paragraph, the Government of Madras, on the 5th January 1841, submitted further correspondence on the subject of the conservation of the Malabar forests. From this correspondence it appears that the Government of Madras, acting upon a suggestion in a minute recorded by Lord Elphinstone, the Governor of that Presidency, applied on the 23rd October 1840 to the Court of Directors to engage the services of persons duly skilled in the science of arboriculture, and send them out for the purpose of being employed as sub-conservators in Malabar and Canara. In the mean while, the Board of Revenue at Madras, adopting the several proposals in Mr. Conolly's report of 19th October 1840, which had been referred to them by Government (see para. 115) for consideration, directed the revenue officers of Malabar and Canara to look out for the most eligible persons on the spot to be temporarily employed under them as sub-conservators. Upon this Mr. Conolly, the acting principal collector of Malabar, proposed the nomination of a Mr. Smith as sub-conservator, on a salary of rupees 150 a month, drew up a set of rules or instructions for his guidance, and defined the powers which should be vested in him to render the conservancy completely effective.

INSTRUCTIONS AND RULES, 1840.—118. Mr. Conolly's instructions for the sub-conservator of the forests were,—

“ 1st,—To obtain a complete knowledge of the quantity and quality of timber in each forest.

“ 2nd,—To prevent any kind of depredation being committed in the forests, whether *bonâ fide* belonging to Government or rented by them.

“ 3rd,—To improve the forests by new planting, and by unremitting attention in fostering the growth of young trees.”

The most effectual means of attaining these ends were stated in the form of rules of which the following is an abstract :—

“ 1st,—To make circuits of the forests, and prepare a register of the number and quality of trees in each, specifying as nearly as possible their age and size, their dis-

tance from water-carriage, and the probable number of other trees, not Teak, which it may be necessary to remove to prevent their interfering with the growth of young Teak trees.

" 2nd,—To prevent private individuals cutting or destroying trees of any description within Government forests, and to seize and make over to the nearest police officer all who violated this order, to ' be dealt with according to the nature and extent of the offence committed.'

" 3rd,—To see that Teak trees were carefully barked and duly seasoned both before and after felling, and that none were cut excepting under his superintendence and orders, and that for every ten Teak trees cut, two were left for seed.

" 4th,—To be provided with a sufficient quantity of seed for sowing at the proper season, to sow and plant with proper care and attention, to protect from injury of all sorts, and to take proper measures for pruning and otherwise fostering them for the first few years.

" 5th,—If the Government forests were worked by contract, to guard against injury being done to young Teak trees; also to have trees that were felled cut as near the ground as possible, and to protect the shoots which spring out of the stumps of felled trees.

" 6th,—To see that the establishment was paid regularly, and that all the wants of the employees were duly attended to.

" 7th,—To report to the Collector all instances of neglect on the part of his subordinates, using his discretion to suspend them pending the Collector's orders."

119. The Board of Revenue at Madras considered the foregoing instructions and rules salutary and proper, and under the manifest necessity for the immediate appointment of an officer to give effect to the views of Government in the preservation of the Malabar forests, recommended the temporary appointment of Mr. Smith, which was approved by the Government of Madras, and subsequently on the 27th January 1841 confirmed by the Government of India.

DUTY.—120. On the 5th April 1841 the Madras Government addressed the Government of India on the subject of a letter from Mr. Conolly, the Collector of Malabar, who stated that large numbers of Teak saplings and under-sized trees continued to be cut with impunity, and recommended either that the practice be visited with a severe penalty under a formal enactment, or that a heavy duty, amounting to a prohibition be laid on all Teak saplings and under-sized trees. Notwithstanding the known objections of the Government of India to measures of the above nature, the Government of Madras urged their re-consideration, under the conviction that the evil demanded an immediate remedy, and that no other more effectual alternative could be discovered. The Government of India, however, saw practical

objections to both proposals; they remarked to the Government of Madras, (in a letter dated the 21st April 1841,) that the removal of the young trees could not be absolutely interdicted, as it was sometimes necessary, to promote the health and growth of large timber. It was presumed that the felling of young trees by unauthorized persons could be punished, and the practice prevented without a special enactment for that particular species of trespass; but it was not clearly understood by the Government of India in what way the enactment of a heavy duty on the sapling could be brought into operation, nor how the proposed impost should be levied, whether as a forest duty, a duty of transit, or one of trade; and if the latter, where it should be collected. However, the Government of India agreed to re-consider either or both propositions, if the Government of Madras submitted drafts of law for effecting the purposes stated. But great doubts were expressed of the practicability and permanency of any other remedies than the conservancy, by the public authorities, of the Government forests, (including of course such grants as might be acquired under mortgage,) and a proper system of felling and plantation, with its eventual extension to private forests and plantations, as the advantages of provident management and a valuable market for their Teak timber became better understood by the zemindars and others.

ESTABLISHMENT.—121. On the 11th August 1841 the Government of India, on the recommendation of the Madras Government, authorized Mr. Conolly to entertain a permanent establishment of rupees 51 a month, and a temporary establishment to the extent of rupees 1,755 in the aggregate, for the preservation and improvement of a tract of forest land which had been procured from the Tricaloor Devassom, for the Government. The only information given of this tract was that it had few trees fit for felling, but there were saplings and plants in different stages of growth which required to be preserved, and large portions of the land were denuded of Teak and required to be re-planted. To provide for the first object, it was necessary to remove the jungle which surrounded the plants, and hindered their growth, as also to separate and transplant such plants as were in too thick clusters. For the second object, it was necessary to collect seeds and sow them with proper care. This part of the work being novel, Mr. Conolly proposed to commence it with a temporary establishment, and to employ the fixed establishment solely in guarding against injury to the property, as the portion of it

which was situated on the bank of the Nelumboor River, was liable to depredation, and therefore required constant watching for its efficient protection.

PURCHASE OF FORESTS.—122. In October 1841 the Madras Government recommended the purchase by Government of four private forests in Malabar, for the sum of rupees 15,000, and the employment of an establishment to the extent of rupees 140 per month for their preservation and improvement. These forests were represented to contain Teak and Blackwood, some felled, and others then fit for felling, of the value of rupees 17,210; also 1,650 young Teak plants, which at the prevailing rate of a rupee for each tree, was rupees 1,650. Besides these there were six to ten thousand Teak saplings and other valuable plants. Under these circumstances, and as it had been ascertained that the owner held the forests in fee simple, and had agreed to make over his full title to Government in perpetuity, the Government of India, on the 1st April 1842, authorized the purchase of the four forests and sanctioned the employment of the proposed establishment.

COURT OF DIRECTORS, 30TH NOVEMBER 1842.—123. In February 1843, the Government of India received a Despatch from the Court of Directors, dated 30th November 1842, in reply to the report of the 20th January 1841, (see para. 116) on the subject of the measures which had been taken, in compliance with the Court's instructions of February 1840, for the preservation and improvement of the Teak forests in Malabar.

124. The Court of Directors thought from the reports of the several officers who had opportunities of examining the Malabar forests, that former accounts of their devastated condition were by no means exaggerated. They remarked that the custom was pretty general among the proprietors of allowing their trees to be felled on payment of a uniform fee of one rupee for each tree, whether large or small, and this had tended to destroy the interest which the owner would otherwise have had in protecting the young timber on his estate. The consequence was that in the more accessible forests every Teak tree was cut down, while no care whatever had been taken to sow seeds or plant young trees for keeping up the supply; and as the seedlings which sprung up spontaneously, were destroyed by the annual burning of the grass and underwood, all traces of forests were gradually being swept away. The Court were also satisfied from the information given in the papers, that the Government had little or no pretension to the proprietor-

ship of the forests. The researches of Mr. Underwood, the Collector of Malabar, led them "to the conclusion, that in the time of the ancient rajahs the forests were held as private property. They were indeed seized by Tippoo Sahib after his conquest of the country, and after its cession to the Company they were taken possession of on behalf of the latter," but having for many years been abandoned to the original proprietor, the Court were of opinion "it would be no less unjust than impolitic to revive a claim to them which seems never to have had any other foundation than Tippoo's usurpation." Under these circumstances, and as the three forests in Palghaut which really belonged to Government, (having escheated to them in 1802, as stated in para. 102.) contained only an inconsiderable supply of timber, the Court of Directors approved of the steps taken by Government, to retain in their own possession the means of supplying the quantity of timber annually required for the public Service; but the Court could not "refrain from expressing some astonishment at the very large extent of country, no less than 260 square miles," which it had been calculated (see para. 114) was required for public forests, and the acquisition of which had been authorized. On this point the Court observed,—

"The average annual quantity of Teak timber required for the public Service at Madras and Bombay, on the supposition that one Government vessel will be constantly under construction at the dock-yard of the latter place, is estimated by Mr. Conolly, acting principal collector in Malabar, at 6,000 candies, or about 2,000 trees, and to supply this quantity annually would, as the Teak tree reaches maturity, in about 60 years require about 120,000 trees, planted in succession. We will not undertake to say with any exactness how much ground each tree should occupy, but we are persuaded that it cannot be nearly so much as six or seven thousand square yards, which is about the space that would be allotted to each tree if the number mentioned were scattered over a tract of 260 square miles."

The Court therefore thought that plantations on a much smaller scale would suffice for all the demands of the public Service, and although it was not easy to over-rate the importance of ensuring a sufficient supply of timber for the public Service both in India and in England, the quantity required for the purpose should have some limit, to overlook which in providing for the future would only be to incur unnecessary trouble, expense, and responsibility.

CONTRACTS.—125. The Court of Directors were of opinion, that the business of felling and conveying Government timber to the Coast should be performed by contract in preference to any other mode, as

the advantages of this course had been "remarkably illustrated by the history of the timber trade in the Tenasserim Provinces. Since that trade has been in the hands of private persons, it has proved highly profitable, although burthened with a duty of 15 per cent., whereas during the short period in which it was engrossed by Government, timber obtained by Government officers from forests belonging to the State seems not to have paid one-half of its expenses"; the Court accordingly desired the employment of the contract system whenever it could be found practicable.

126. The Court of Directors were gratified to find that no intention had been evinced of acting on the suggestions of Mr. Underwood (see para. 85,) and the Board of Revenue at Madras (see para. 94,) for re-asserting the right of Government to the conservancy of all forests, whether held by private persons or made over to Government, in so far as to prevent the indiscriminate felling of trees, and to secure the planting of others in succession. On this subject the Court remarked,—

"The right of Government to interfere in this manner, now that its pretension to the ownership of the forests is tacitly renounced, seems to be more than doubtful, and even if it were not disputed, its exercise would be scarcely less troublesome to Government than vexatious to the individuals who would be exposed to it, while all the advantages that could accrue from it may be obtained indirectly in a manner equally effectual and much less invidious. For although a sufficient supply of timber for the wants of the public Service will be ensured by the possession of the tracts proposed to be held by Government, it will still be proper to protect the community at large from the effects of the improvidence and rapacity which are ruining the forests left to the mercy of private speculators. Among the plans proposed with this view, the best seems to be the imposition of a duty on the exportation of Teak wood, which should vary only according to the length of the logs, without any reference to their breadth. Such a duty, while it would tend to prevent young trees from being cut down expressly for sale, would not, like a tax on the felling of timber, present any obstacles to the clearing of land for cultivation, or to the thinning of plantations, neither would it subject the forest-holders to any interference from Government officers."

The Court of Directors therefore recommended the matter for the consideration of the Government of India.

127. In regard to the forests of Canara, it was not considered by the Court worth while to incur any considerable expense for their conservancy after what had been stated of them by Mr. Blair; and the Teak forests of the Northern Sircars, the Court remarked, were apparently of no consequence.

GOVERNMENT OF INDIA, 22ND FEBRUARY 1843.—128. In order to give effect to the wishes of the Court of Directors, expressed in the fore-

going Despatch, the Government of India recorded thereon a Resolution, dated 22nd February 1843, in which it was explained in reference to the Court's remarks on the large extent (260 square miles) of country reserved for public forests, that the Teak tree in its natural state was found only in patches here and there, and that for one Teak tree in a forest there were at least one hundred other trees. This circumstance, as well as the deteriorated state of the forests generally, and the length of time that Teak took to reach maturity, pointed out the expediency of obtaining the extent of wood-land which had called forth the observations of the Court of Directors. The Government of Madras was however desired, with reference to the Court's remarks, to report the extent of forest-land that had been obtained, and whether, with advertence to its ascertained capability of yielding Teak, it would be necessary to acquire a proprietary right in more lands. At the same time the attention of both the Governments of Madras and Bombay was directed to the Court's instructions for felling and conveying Government timber to the Coast by contract in preference to all other modes, and the Government of Madras was further directed to submit a draft of the rules they would recommend for the imposition of a duty on the exportation of Teak, with the view of protecting private forests from further devastation by the improvidence of speculators. On the 8th March 1843, the Government of India replied to the Court's Despatch of 30th November 1842, in the terms of this Resolution.

129. The Court of Directors having, on the 19th July 1843, again addressed the Government of India, with a request for more precise information as to the title of the vendor of the four forests, the purchase of which on account of Government is mentioned in para. 122, the Government of India on the 30th September 1843 requested the Government of Madras to submit the information required by the Court.

TARIFF.—130. In the mean while, on the 2nd September 1843, the Government of Madras submitted to the Government of India, in compliance with the order of 22nd February 1843, (see para. 128,) a long correspondence on the subject of a revised Tariff, drafted by Mr. Conolly, the collector of Malabar. This Tariff was approved by the Board of Revenue at Madras, and the Government of Madras desired to introduce it into the Provinces of Malabar and Canara, as it appeared to provide effectually against the destructive practice of felling young timber. The Tariff was as follows :—

Schedule exhibiting the present and proposed Tariff Valuation of Teak Wood.

Present Tariff Valuation.	Land Customs.		Sea Customs.		Proposed Tariff Valuation, for both Land and Sea Customs.	Proposed Tariff Valuation on which 5 per cent. Land Customs, and 3 per cent. additional export duty is to be levied.	
	Rs.	As. P.	Rs.	As. P.		Rs.	As. P.
Teak wood Timber, viz.,—							
1st Sort, or above 8 Candles, per Candy,	12	0 0	14	0 0	1st Sort, or above 5 Candles, per Candy,	18	0 0
2nd " or below 3 " and above 30 } Borels in circumference, ... }	9	0 0	12	0 0	2nd " or below 5 and above 3 Candles, ... "	14	0 0
3rd " below 20 Borels in ditto, "	8	0 0	10	0 0	3rd " below 3 Candles and above 30 } Borels in circumference, ... }	13	0 0
Ditto Beams and Planks viz.,—					4th " below 32 and above 20 Borels } in circumference, } per Log.	300	0 0
1st Sort, or above 12 Borels width, ... for 100 kols*					5th " below 20 Borels in circumference, "	350	0 0
2nd " or below 12 and above 6 Borels ditto, "	30	0 0	28	0 0	Timber below 33 Borels in circumference } proved to be branches of large } trees felled, to be valued and } passed at, }	8	0 0
3rd " or below 6 Borels ditto, "			24	0 0	Ditto Beams and Planks, viz.,—		
Reapers, per 1,000 kols,	30	0 0	25	0 0	1st Sort, or above 18 Borels width, per 100 kols,	40	0 0
					2nd " or below 18 and above 12 ditto, ... "	30	0 0
					3rd " or below 12 and above 8 ditto, ... "	25	0 0
					4th " or below 8 and above 5 ditto, ... "	300	0 0
					5th " or below 5 Borels width, "	350	0 0
					Reapers proved to have been cut out of } the 1st, 2nd or 3rd sort Timber, ... }	25	0 0

* 1 Kol contains 24 Borels, equal to 28 Inches.
1 Square Kol is equal to 1 Candy.

N. B. Beams and Planks below the width of 6 Borels, proved to have been sawn out of 1st, 2nd and 3rd sort timber, will, on exportation by Sea, be allowed to be valued as 3rd sort Beams and Planks.

131. From the correspondence submitted with the foregoing table, it appears that Mr. Conolly on receiving instructions to prepare a draft of rules for the imposition of an export duty on Teak, such as might prevent the felling of young trees, made a reference to the Board of Revenue, on what he considered to be an error in the principle on which those rules were required to be framed. He remarked that the Court of Directors desired the scale of duties to be fixed "only according to the length of the logs, without reference to their breadth," (see para. 126); this Mr. Conolly observed was "a mistake of the most vital importance," and quoted the following extract from a letter from Captain Williams, the timber agent, in support of his opinion:—

CAPTAIN WILLIAMS.—"To show the fallacy of fixing the duty with reference to length instead of thickness, it is only necessary to mention that the Teak tree attains two-thirds of its extreme length before the bole acquires any considerable thickness. The small Teak wood, sold under the denomination *khial* or *kyle*, is generally 25 and 30 feet long, but not more than five or six inches in diameter, whereas of the entire quantity of full-grown timber brought to Calicut, not an eighth part will average 25 feet in length. Trees that are only half grown will produce longer timber than those that are full grown, because the branches are sound and cut off clean, and so allow of the branchy portion of the bole being taken into the length. But in a full-grown tree the branches are hollow, and the hollow runs into the trunk or bole of the tree, consequently the length of a full-grown tree is only that portion contained between the root and the part where the superior branches commence. Though timber of 35 and 40 feet in length (full-grown) is sometimes produced, it is but seldom, and not in greater proportion than 1 to 500 timbers of 25 feet and under. Again, many long and large timbers grow in places whence they cannot be brought entire, owing to their great weight; these are now cut into short lengths, and are thus rendered capable of transport; these are the kind of timbers which I procure for and are best suited to the gun-carriage manufactories, where length is no consideration and great girth only is required. The imposition therefore of a heavy duty on such timber, merely because it were short, would be detrimental to the interests of Government."

132. The Board of Revenue considering in consequence that a Tariff framed on the *letter* of the instructions of the Court of Directors would defeat the very object which it was intended to ensure, expressed their opinion that the *spirit* of the Court's order would be best complied with by the preparation of a Schedule, in which the rate of duty should vary *inversely* with the breadth of the timber intended for export. By this measure the duty would fall most heavily on the timber of least girth, and the practice of felling young trees and saplings would thereby be most effectually checked. Accordingly it will be seen that in the revised Tariff table the duty falls most heavily on logs, beams, planks, &c., of the least

girth or width. It was prepared in communication with Mr. Blair, the collector of Canara, and Captain Williams, the agent for timber in Malabar, and had been submitted to the Zamorin Rajah and the Nelumboor zemindar, "men of importance in the Malabar Province, and greatly interested in the subject," who considered it well adapted for attaining the end desired. It will be remarked also that the proposed change is only in the Tariff valuation, the small timber being valued at a much higher rate per candy or kol than that of larger growth. The duty will remain as before, *viz.* 5 per cent. inland, and 3 per cent. on sea export, or 8 per cent., with a credit of 5 per cent. for duty previously paid inland.

133. It was suggested by Captain Williams that the greater part of the duty should be made payable as an inland duty, or it was likely to be evaded by cutting up small timber into plank after its arrival on the coast, and then exporting it as plank converted from large timber. The Board of Revenue, however, considered such cases to have been fully provided for by the Tariff, as it classed beams and planks of the 4th and 5th sorts at a higher valuation than the 4th and 5th classes of timber from which they were cut. The schedules were therefore considered equally effective, though the Board thought that on the abolition of the transit duties the levy of all impost on timber should be confined to its export by sea; and that even in the event of a general reduction of sea customs duty on exports, the existing rates should be maintained for the 4th and 5th classes of timber, beams and planks, entered in the schedules. The Board of Revenue recommended the local Government to introduce the Tariff into the Provinces of Malabar and Canara, and in allusion to the letter of the Government of India, (see para. 120,) observed that the penal enactment therein suggested for preventing the felling of young and under-sized trees, would be rendered unnecessary by this Tariff. The Government of India, on the 7th October 1843, sanctioned the adoption of the Tariff in the Provinces of Malabar and Canara, and on the 23rd March 1844 reported the measure to the Court of Directors in reference to their instructions of the 30th November 1842, noted in para. 126 of this Summary.

134. In April 1844, the Government of Madras forwarded to the Government of India a voluminous correspondence on Teak forests, which contains much useful matter regarding the various experiments that had been made, and the methods which were suggested for promoting the

germination of the Teak seed, and affords information on the several points adverted to in the Despatches of the Court of Directors of the 30th November 1842 and 19th July 1843, (paras. 123 to 127, and 129.)

135. From the papers relating to the experiments for germinating the Teak seed, it appears that Mr. Conolly, the collector of Malabar, selected a tract of land of 25 square miles in extent, in the neighbourhood of the Beypore River, for the purpose of forming Teak nurseries to replenish the forests. In these nurseries the sub-conservator, Mr. Smith, had been employed in sowing and planting on a very extensive scale. He put large quantities of seed into the ground, in the manner usual with any other seed, and planted several thousands of saplings, but the seeds remained in the ground and eventually rotted without having shown any signs of life. The plantations, too, seem to have proved nearly as great failures as the sowings. This want of success was ascribed to Mr. Smith's inefficiency, and as his conduct generally as sub-conservator, had been unsatisfactory, he was removed from his office, and a Mr. Graham was appointed to the place on a lower salary. This officer commenced his duties by also sowing, under Mr. Conolly's instructions, large quantities of Teak seed as his predecessor had done; neither he nor Mr. Conolly being aware that any other method was required, and the result was the same want of success. Mr. Conolly then learnt from some tehseeldars of the district, who had been consulted, that previously to sowing the seed, it was necessary, in order to ensure its germinating, to subject it to some process which would remove its outer coating; but as no exact information of the process could be obtained, Mr. Conolly tried several expedients, and having failed in all of them, again advocated the appointment of a trained arboriculturist as sub-conservator. At this stage of the proceedings Monsieur Perotett, a French Botanist, having landed at Calicut on his way to Pondicherry, Mr. Conolly invited him to visit the nurseries, and state his opinion on the propriety of what had been and should be done; that gentleman after making the necessary investigation, stated his opinions at length in the form of a report. Mr. Conolly also in the same manner ascertained the opinion of Dr. Wight. As it may prove useful to record these opinions, the different plans which were recommended, and the results of those which had been tried, a short notice will be given of this portion of the correspondence.

MR. CONOLLY'S EXPERIMENTS.—136. The tehseeldar who advised Mr. Conolly to prepare the seed, had come to that conclusion from observing that the seeds which germinated in the forests without any cultivation were prepared for growth, or in other words, lost their outer coating by the great heat caused from the fires which annually consumed the brushwood, and that therefore this process should be imitated as closely as possible in artificial sowing; Mr. Conolly accordingly caused a large quantity of seeds to be spread on the ground in a bed, and covered with a light coating of hay. The hay was then gradually burnt, so as only to singe the rind without injuring the kernels of the seeds; they were then sown in beds previously prepared for the purpose, and covered over again lightly with hay, to keep them cool and to prevent the heat of the sun injuring them. However this process also proved unsuccessful, though a few of the seeds vegetated. Mr. Graham, the sub-conservator, then made some other experiments. He says,—

“ Not being satisfied with the above process of preparing seeds for sowing, I applied fire to a few of the seeds, and found from the trial that the coating covering the shell acted like turf, which convinced me that in this process the seed inside of the shell must be destroyed, or in a manner roasted, and therefore be rendered unfit for vegetation; I then threw a few of the seeds into water to see what effect the water had on them, I found on this trial that the coating acted something like a sponge, and contained as much water as convinced me that the shell and seed must rot before the time usual for the seed's vegetation, which is mentioned in the tehseeldar's letter to be forty days.

“ Being unable to get any useful information on the subject from any of the proprietors of forests, in this part of the country, and being convinced that the shell ought to be cleared of the outside spongy coating before being put into the ground,” Mr. Graham had six thousand so cleared with the knife, and had them sown on the 4th of January 1843—

“ * * * in beds of about sixteen yards long and one and a quarter broad, along with fourteen thousand prepared by fire, the whole covered over with a light coating of hay, and in sixteen days after they had been put into the ground on removing the old hay to replace it with fresh, I discovered that five of the seeds cleared with the knife and one of those prepared by fire had vegetated.”

Shortly after the above experiments Mr. Graham discovered that the white ants could be usefully employed in clearing the seeds, he therefore intended trying some seeds from which these insects had taken off the spongy coating and reporting the result.

M. PEROTETT'S REPORT.—137. M. Perotett in his report first notices the necessity of preserving the Teak trees from injury by the natives. He says :—

“ Everywhere I remarked that the trees which constitute these forests were mutilated by the people living in the neighbourhood. Whenever these men are in want of a piece of wood for the handle of a work-tool or any other purpose, they go and procure it for themselves in the woods, cutting at random, and without any precaution, from whence it follows that the trunk thus mutilated shoots again with difficulty, and the shoots produced are crooked and stunted.”

M. Perotett accordingly recommended the fencing of these forests, “ to show that it is forbidden to enter them,” and to hold the tehseeldar responsible for injury done to the trees. The nurseries which were formed in “ separate ground” for the purpose of raising Teak plants M. Perotett entirely condemned, as being in his opinion “ a ruinous system, and one which will never fulfil the end proposed.” He suggested the sowing of seeds in the forests, with only the precautions necessary to their germination, as well as the replanting of shoots from the roots of old trees. In order to prepare the seed before sowing, M. Perotett recommended their being stratified either in boxes or in a damp warm soil sheltered from the rays of the sun. The process to be observed, if a box was used, was to place in it successive layers of earth composed of vegetable manure and seeds, till the box was filled, taking care however that the box was not so deep as to cause the seeds at the bottom to rot. This mass was to be frequently watered for forty days, by which time it was expected the seeds would germinate, when they should be carried to suitable spots in the forests and placed in couples or triplets, or in twos and threes, in holes of about two inches at the deepest, and slightly covered with a small portion of earth. These holes should be at the distance of about 6 feet from each other. The trees when they grow, finding themselves thus near one another, shoot more perpendicularly without throwing out lateral branches. All lateral branches should be cut from the ground to the summit of the tree, but up to the height of 20 feet they should be cut smoothly. When the young plants from the seed have attained a height of between one and two feet, all trees and brambles which at first were necessary to shade them, should be removed to give the Teak air and light, “ elements thenceforth indispensable to the progressive development of these trees.” M. Perotett, however, was more in favor of the system of reproduction by replanting the shoots from the roots of old trees, which he thought an easier and a shorter one for multiplying Teak trees. He said,—

“ I have remarked wherever I have seen Teak trees, that from their roots, and especially from those that were cut close to the ground, young trees were produced, that is to say, from some parts of their roots straight and vigorous shoots sprung forth. We should profit then by these means which Nature points out by going into the forests, slightly uncovering some of the roots and cutting them in some places in order to cause the development of more shoots; we should thus in a short time have trees of handsome growth. Another precaution which I would wish to see taken in this country for the preservation of forests, especially those of Teak, relates to the cutting of trees. Instead of barking, mutilating and hacking the foot of the tree as is done now at pleasure, I would wish, on the contrary, that they should be cut with care, and as close to the ground as possible, for this reason:—I have said above that the Teak tree shoots very willingly from its roots; well, by cutting the tree in question smoothly, and with a good hatchet, you would as a first result see springing from the circumference of the cut (which would be made slanting, or like the mouth of a flute to facilitate the running off of the rain,) several suckers, of which you would only suffer the strongest and straightest to grow, and as a second, you would have fine trees and abundance of them.”

M. Perotett recommended, in conclusion, that his suggestions should be submitted “ to a man instructed in vegetable physiology and arboriculture,” and Mr. Conolly cites this suggestion as confirming his opinion of the necessity of having a properly qualified sub-conservator.

DR. WIGHT'S OPINION.—138. Dr. Wight, referring to the practice of Mr. Graham, wrote that he did not see the “ necessity for the laborious operation of removing the pips from the pulp” previously to sowing the Teak seed, but on the contrary was of opinion that Nature gave the seed the covering for the purpose of promoting its fertility. In support of this opinion he mentions the Cinnamon seed as being covered with a similar coat which at first would appear to be a serious impediment to germination, whereas this coat is really essential to its vegetating. The manner in which vegetation is promoted is by gathering the seeds together in a heap and covering them lightly with straw or fern, when in a few days fermentation is caused, heat is generated, and with the heat vegetation commences. The seeds thus prepared are immediately sown, and a sufficiently large proportion are found to vegetate. Judging therefore from analogy, Dr. Wight thought that instead of the Teak seed rotting, as Mr. Graham supposed, when the spongy coating became full of water, the contrary would be the result, and for that purpose not only must the sponge be filled with water, but it must be kept constantly moist until vegetation begins, and is indicated by the bursting of the shell, and the protrusion of the young plant. This process, owing to the thickness and density of the shell as compared with the size of the seed, takes some

time to accomplish. Dr. Wight assuming then, that as in the case of the Cinnamon seed heat would more speedily excite vegetative action, advised Mr. Conolly to try to promote it in two ways, *first*, by making a heap of the seeds, (which must be previously soaked for an hour in water,) and leaving them to ferment in the same manner as the Cinnamon seed. They might then be sown in shaded beds of very light sandy well moistened soil, and covered over with a quantity of fallen leaves, which could be kept in their places by sprinkling a little earth over them; these arrangements should be completed before the rains, till which time the beds are to be kept moist by occasionally watering them. The *second* plan was to throw the seeds into nearly boiling water, 180° to 200° Far., and leaving them there until the water cooled, to proceed then as in the former case. These plans however, Dr. Wight said, were merely theoretical, and might prove as unsuccessful as the others which had been tried, but he added "of one thing I am quite sure, that much moisture is required, and I strongly suspect, the heat of fermentation, which is naturally produced at the beginning of the rains, where heaps of decaying vegetation happen to be accumulated, and that it is in such situations the seeds sprout."

MR. GRAHAM'S REMARKS.—139. Mr. Conolly referred the reports of M. Perotett and Dr. Wight to Mr. Graham, the sub-conservator, who made his remarks thereon, and afforded some further information regarding the germination of the Teak seed, which is deserving of notice, as being the fruits of experience and observation. The first point which Mr. Graham takes up in his remarks is the stratifying or heating of the seed previously to sowing it; this he maintains will not answer, although the process does not injure the kernel, for he says,—

"When vegetation takes place, the seed bursts a piece out of the side of the shell and comes clear out of it, it is therefore necessary that earth be convenient to the young root, so that it is able to lay hold on it for nourishment; in the event of its not being able to do this and bring itself out of the shell, it in the course of almost an incredible short space of time turns of a bluish color and perishes, and therefore if vegetated in a box, or in heaps, it would perish as soon as vegetation had taken place."

And it would not bear removal, as seeds in this state almost instantly perished on being accidentally turned up by carelessness in watering the beds in which they had been sown, although they were immediately re-covered with proper care. Another objection to the plan of stratifying arose from uncertainty as to the time the seed took to vegetate. The

tehseeldar and M. Perotett allowed forty days for vegetation to be completed, but Mr. Graham had known seeds to vegetate from the eleventh day after sowing. On the question whether the outer coating of the Teak seed was essential or not to its germination, Mr. Graham was of opinion that Nature had provided it to absorb moisture, and by engendering damp (not heat as Dr. Wight said) to destroy the vitality of the seed ; or otherwise argued Mr. Graham, nearly every seed in the forest should germinate, whereas only a very small number did vegetate, and these he asserted were seeds which had been cleared by the white ants, and not by the annual burning of the grass, as of the six thousand seeds which he had cleared with the knife, not less than four thousand had vegetated up to the date of his writing, thus proving that the outer coating of the seed must be removed before sowing, to ensure vegetation. Mr. Graham further remarked that M. Perotett erred in stating that the natives cut Teak for their tools and other implements, as they preferred for such purposes the tough jungle-wood, which was very plentiful, and was mistaken also in his scheme of planting the forests from old roots, as out of eighteen thousand planted by Mr. Smith there were then scarcely thirty in existence. M. Perotett's recommendation that the lateral branches of the Teak trees should cut be off smoothly with the trunk was likewise injudicious, for by so doing the part cut will always shrink into the trunk, leave holes, and thus aggravate the very defects which were to be avoided ; a better plan would be to leave on the trunk a small projection of the branch cut, so as to allow of its shrinking without injuring the trunk. Mr. Graham concluded by recommending nurseries at a distance from water, and on the clearest ground that could be procured, in order to avoid the swarms of insects which, he said, devoured anything newly sprung from the ground. He also informed Mr. Conolly that the simplest mode for ascertaining whether Teak seeds were good was to throw them into a vessel of water, when the good seeds would sink, and the bad ones float.

140. Shortly after writing the above, Mr. Graham resigned the office of sub-conservator ; Mr. Conolly upon this, (for reasons previously given, as well as with a view to further experiments in sowing Teak seed,) urged anew the necessity for an arboriculturist being procured from England. The Board of Revenue at Madras having strongly supported this proposition, the Government of that Presidency favorably recommended it to the Court of Directors, and pending their decision

authorized Mr. Conolly to appoint a native temporary Sub-Conservator on a salary of 50 rupees a month.

141. The other portion of the correspondence received from the Madras Government was submitted in compliance with the requisition of the Government of India of the 22nd February 1843, (see para. 128,) and contains reports, dated respectively 3rd July and 30th November 1843, from Mr. Blair the principal collector of Canara, and Mr. Conolly the collector of Malabar, on the following subjects:—

1st.—The extent, condition, situation, and capabilities of those forests which were the property of Government.

2nd.—The extent and condition of the Teak forests obtained on account of Government from private parties, and the tenure and terms on which they were held.

3rd.—The various measures which had been adopted or seemed advisable for the general conservancy and improvement of both descriptions of forests.

CANARA, 3RD JULY 1843.—142. Mr. Blair refers to his report of 18th August 1838, for information regarding the Canara forests, and adds that since May 1841 the Teak forests along the line of ghauts in the Talooks of Honore and Ankola, which in 1830 he had stated to contain 40,000 trees of a superior description, and in great request for naval purposes, were really more extensive than he had supposed,—as it appeared from a survey of but two-thirds of the forests by a sub-conservator who had been put in charge of them in May 1841, that there were in that portion alone upwards of 64,000 Teak which he classed as follows:

Above 30 years' growth,.....	17,328
Under 30 years' growth,.....	22,195
Under 15 years' growth,.....	24,618
Total,	<u>64,141</u>

Of this number there were 5,367 trees fit for "immediate felling," which it was supposed would yield 20,000 candies. The unsurveyed portion of the forests was of some extent, and was supposed to contain about 30,000 trees. Mr. Blair said,—

"The appointment of the sub-conservator and establishment had been attended with every advantage that was anticipated from it. Under his superintendence an accurate knowledge has been acquired, (so far as the survey has gone,) of the quantity

of Teak timber belonging to Government, and the proportion available for present use. Strict attention has been paid to the prevention of injury to the forests from fire, or the cutting of trees by private individuals, and as far as the means at the disposal of the sub-conservator have admitted of it, the measures alluded to in my letter of the 8th March 1841 for the improvement of the growth of the trees have been attended to."

In the course of the year 1843, a quantity of curved and straight timber, urgently required by the dock-yard at Bombay, was supplied from these forests, but Mr. Blair was of opinion, that to secure a regular succession of seasoned timber in after-years fit for naval purposes, the management of the forests should be entrusted to a person well acquainted with the culture of forest trees, as the natives had no knowledge of the mode of propagating them, "and their prejudices are against any attempt to rear the Teak artificially." The Honore and Ankola forests were supposed capable of yielding Teak for naval purposes to the extent of 3,000 or 4,000 candies annually for ten years, but Mr. Blair was confident that if they were placed under the superintendence of a duly qualified officer, they would continue to yield that supply permanently. Referring to the remark of the Court of Directors, (para. 127,) that no considerable expense need be allowed for the Canara forests, Mr. Blair observed,—

"The value of the Teak forests in Canara would seem not to be duly appreciated owing probably to the imperfect knowledge that had been attained of them when my report of the 18th August 1838 was submitted. The number of trees they are now found to contain is more than double the quantity they were estimated at in my letter above mentioned, and from the report of the conservator, it appears that the greater proportion of those already surveyed may be transported to the banks of neighbouring rivers or nullahs without any considerable difficulty. The average of the increased expense of transporting this timber to the coast, it is estimated will not exceed half a rupee per candy. With regard to the quantity of the Canara timber, it is considered by the natives to be superior to that of Malabar, being harder and containing more of the oily properties of the Teak."

The Teak forests in the four northern talooks of Honore, Ankola, Soopah, and Sondah are the exclusive property of Government, while those in Lower Coorg, which yield a small quantity of Teak generally of a stunted or dwarfish description, are mostly claimed as private property by the ryots, though their proprietary right was, in Mr. Blair's opinion, very questionable. He considered the contract system the cheapest that could be adopted, and approved of the revised Tariff quoted in para. 130.

MALABAR, 30TH NOVEMBER 1843, GOVERNMENT FORESTS.—143. Regarding the forests belonging to the Government in Malabar, information has been already given in Lieutenant Williams's report of the 11th May 1839 (see para 67), and in Mr. Conolly's report of the 12th June 1840 (see para 102). It has been shown in those reports that the Government possess the proprietary right to only three forests in Palghaut, which had lapsed to them in 1802-3 on the death of one Chenat Nair, who left no heirs. Mr. Conolly, in the report under review, states further that these forests are situated within eight miles of the town of Palghaut, are about 25 square miles in extent, and are placed under the general superintendence of the Talook authorities, it not being thought necessary to have a special establishment for their conservancy. Captain Williams, the timber agent, had felled and carried away all the Teak timber that was of sufficient size to be useful in the Bombay dock-yard, about 600 trees; those which remained were chiefly a considerable number of self-sown saplings. Mr. Conolly proposed to extend his operations of sowing, in which it seems he had proved successful, to the available spaces in the Palghaut forests, and to employ for this purpose a few of the hill-men, *Adairs*, as laborers.

ACQUIRED FORESTS.—144. Under the second head, the extent and condition of the Teak forests obtained for Government from private parties, Mr. Conolly states that these consist of the tract of wood-land of about 50 square miles in extent, obtained from the Tricaloor Devassom, "sometimes styled Numbidi" as stated in para. 121, and an extensive forest rented from the Zamorin Rajah. The four forests which the Government of India, on the 1st April 1842, authorized to be purchased for rupees 15,000 (see para. 122) had not been taken, as a question arose before the purchase could be completed, as to the soundness of the title-deeds; and although the Madras Sudder Adawlut subsequently decided that there was no legal flaw in the deeds, Mr. Conolly did not consider it desirable to take the forests in consequence of the supplies of timber in the forests of Canara and in Malabar, which were the property of Government, as well as in the forests of Goojerat, (which will be noted hereafter,) having been found to be greater than were first supposed, and as the cutting of immature trees and the reckless devastation of the forests generally had been checked by the revised Tariff (see para. 130), so that larger quantities of full-sized timber were expected in the market, from which the Government could always

secure what they required. The terms on which the tract taken from the Tricaloor Devassom was obtained are stated in detail in a letter from Mr. Conolly, dated the 11th December 1840; this letter has not, unfortunately, been traced, but it is mentioned in another letter that this forest-land was assigned by the Tricaloor to Government on mortgage for Rupees 8,000, which sum was to be held without interest and to be gradually liquidated by the stump money, or fee of one Rupee (*kooty kanum*) on each tree which might be felled. Of the fifty square miles comprised in this tract, about thirty five were situated in the deep jungle at the foot of the Wynaad Hills beyond Nelumboor; the remainder consisted of land formerly forest, but long denuded of its trees, on the West or Calicut side of the Nelumboor. Mr. Conolly had with the consent of the Nelumboor Rajah made some alteration in the boundaries of this land. The capabilities of the tract were not explicitly stated, but Mr. Conolly intended to sow and replant on it, although his first attempt to do so had failed in consequence of the whole of the laborers having been attacked with "the deadly jungle fever" so prevalent in these jungles.

145. The forest taken from the Zamorin Rajah is represented to be of considerable extent, and to lie in the heart of the Ernaad Valley, near Carcoor. The terms were no other than the payment of the usual *kooty kanum* for each tree that was felled, which was considered to be very favorable to Government. There were very few trees fit for felling in this forest, as "almost every piece of timber that could fetch any price in the market" had been carried away "in the last few years, and much of it surreptitiously." But with time and attention Mr. Conolly had no doubt the forest would recover and prove a valuable acquisition. He had "induced eight hill slaves, or *Adairs*, to take up their residence in the forest to preserve it from future depredation, on a promise of protection and support," and he requested sanction to a monthly disbursement of Rupees 20, to enable him to pay these men "on an average Rupees 3 a head, or for the eight, Rupees 24 per mensem, but some part of this will be realized by the sale of honey, wax, and other hill products which are found in the forest, and the collection of which forms one of the chief occupations of the *Adair* class." These men were to be overlooked, from time to time, by the sub-conservator and his establishment.

CONSERVANCY AND IMPROVEMENT.—146. It has already been shown that the renovation of those tracts of wood-land which were exhausted

had proved a task of great difficulty, both from the extreme unhealthiness, even to an Indian constitution, of those parts of the jungle in which the operations were conducted, more especially at the planting season, and from the want of practical information as to the best mode of propagating the Teak tree, either from seeds or cuttings. But the experience from a subsequent trial at Calicut of the various plans suggested by Dr. Wight and M. Perotett for insuring the germination of the Teak seed, enabled Mr. Conolly "to discern with considerable accuracy the best means of arriving at this wished-for result"; and though the discovery took place too late to enable him to profit that year by the proper season for sowing, he was able to put into the ground, in a favorable locality a few miles below Nelumboor, some 10,000 young plants, of which about 7,000 were in a healthy and prosperous condition. The acting sub-conservator had also put down in the same spot and elsewhere about 3,000 saplings which he transplanted from the surrounding forests; some few of these were reported to be looking well, "but the remainder, owing probably to the injury which plants are so very susceptible of" on removal to new situations, had drooped and were likely to perish. Under these circumstances Mr. Conolly did not advise Government to obtain more land, excepting on very favorable terms: he however wrote,—

"It was absolutely necessary that Government should come forward and take the initiative in the formation of new forests to replace those which have vanished from private carelessness and rapacity. A work too new, too extensive, and too barren of early return to be ever taken up by the native proprietor. But to do this effectually, to ensure the Government resources from being frittered away with no good result, it is essential, as I have shown in my report of 12th June 1840, that the duty and responsibility of the planting be entrusted to some person who is thoroughly qualified to undertake it."

The Board of Revenue at Madras also, in again advocating this measure, wrote,—

"To ensure these noble forests being turned to the best advantage, they should be placed under the especial charge of some person sent from England for the purpose, and who, from his practical acquaintance with the system of planting and with the science of arboriculture generally, may be best qualified for that peculiar duty."

147. The Government of Madras submitted these papers to the Government of India in April 1844, and having again urged the necessity of obtaining the services of a properly qualified person from England, the Government of India on the 22nd June 1844 forwarded the whole

of the correspondence to the Court of Directors, with a recommendation of the proposal that an experienced arboriculturist be obtained from England.

TIMBER TRADE, 1844.—148. In August 1844 the Government of Madras submitted to the Government of India a report from Captain Williams, dated 30th May 1844, of his proceedings in the purchase of timber in Malabar for the season 1844, together with his remarks on the state of the timber trade. The following extracts from Captain Williams's report will more clearly explain its subject:—

“ 2. I regret to say that the present has proved a most unfavorable season for Teak timber, of which but a very small quantity only, either of large size or good quality, has been brought to the Coast. The deficiency is in part attributable to the introduction of prohibitory duties on small timber, for notwithstanding that such have only very lately been officially levied, the intention of Government to impose them was known long previous, and every effort made in consequence to bring down small timber (in preference to large) so long as the opportunity remained open of doing so unrestrictedly; the production of large timber has therefore been interrupted and partially neglected for a time. There is however but little doubt that the principal cause of a falling off in the quantity and quality of timber is a scarcity of material, caused by the near exhaustion of those forests which are situated at a distance convenient for the transport of timber, and there is consequently every reason to anticipate that the supply of wood of large scantling will be found every year progressively to decrease.

“ **MALABAR.—3.** In Malabar the timber trade is evidently in a declining state; many merchants have been compelled within the last two years to relinquish it, and it is now followed by but very few persons; nearly all the forests to which private individuals have had access are either worked out or are on the point of exhaustion, and there are but few other available sources whence supplies of timber can be obtained. There are two very wealthy rajahs, the Terroopaads of Eduwarra and Nelumboor, who are now the only persons who possess extensive forest possessions, but even their jungles have been so over-worked of late years, that it is probable the future supply of large timber from both these rajahs will not exceed from 4 to 5,000 candies annually. There is, as may be expected, much rivalry among all parties concerned in timber to secure the interest of these rajahs and procure the refusal of their supplies. With the Eduwarra Terroopaad I have hitherto had no direct dealing, the strategy of my opponents having prevented his entering into prospective engagements with me, but I have of late succeeded in opening a negotiation, which promises fair to procure me the reversion of all the wood which he may cut for some years to come. With the Nelumboor Terroopaad I have had extensive dealings ever since I came to the coast, and from him I have received the better portion of the supplies which I have sent to the Presidency. There has, however, been a great falling off in the character of the Nelumboor timber during this season, in consequence of the endeavour to bring down the greatest possible quantity of small timber before the time when the prohibitory duties would render it

unsaleable. I have thus been compelled to receive an unusual quantity of second and third sort timber, but being for the most part sound and long, it has cut up into serviceable plank and sheathing-board, and in this form much of it has been sent to the dock-yard and gun-carriage manufactory. I may here add that the further production of small timber is effectually prevented by the prohibitory duties which have lately been imposed and are now in force.

“ 4. The price of large timber has been influenced partly by the deficiency of the supply, but chiefly in consequence of some commission Agents here, (Messrs. Wells and Morley on behalf of Messrs. Campbell, Dallas and Co., of Bombay,) having during the last two seasons purchased some six thousand candies of large timber, for which although the greater part of it was of inferior quality, they have been made to pay very dearly. Of this wood 2,000 candies have already been sent to England; the remainder is under shipment; it is intended for the use of private parties at home who have contracted to build a number of steam-vessels, certain parts of which it is stipulated shall be constructed of East Indian Teak.

“ 5. The quantity of timber which has been brought to the coast this season may be estimated at 13,000 candies, of which 5,000 candies have been purchased by me, 3,000 candies by Messrs. Wells and Morley and others; the remainder is still unsold. In Malabar, nearly the whole of the timber, produced has come to Calicut, and scarcely any to Ponany, the forests in the vicinity of this latter place being, as regards large timber on the very point of exhaustion.

“ COCHIN.—6. In the Cochin country the number of logs of Teak timber brought down this season somewhat exceeded 600; these were for the most part so small in size and indifferent in quality as to prevent my submitting a tender for the whole lot, but I managed to procure from the merchant who bought the entire quantity the selection of such logs as I desired. Out of the whole 600 timbers, ninety-five only were found fit for the purposes of Government; of these, 80 have been sent to the dock-yard and 15 to the gun-carriage manufactory.

“ TRAVANCORE.—7. In the Travancore country the supply of timber for the present season has been large, but the character of the wood was not such as to induce my making an offer for any part of it.

“ CANARA.—8. From the Government forests in Canara, 800 candies of Teak timber have been shipped off to Bombay during the season, but my report on this subject has already been forwarded from Sedasheghur on the 26th of March.”

PALGHAUT.—Captain Williams made an unfavorable report of the result of the working of the Palghaut forests owing to the want of proper nullahs, and the consequent difficulty of transporting timber to the main river communicating with Ponany; it was his intention therefore to discontinue the working of these forests, discharge the establishment engaged for the purpose, and bring the accounts to a close.

149. Captain Williams appears to have driven away from the field all competitors; the Parsee merchants had retired since the death of their agent on the coast, and—

“ The Arabs, whose extensive dealing used formerly in some measure to influence the market, have this year given up the purchase of Teak timber in favor of agency, which they now consider will answer nearly as well for the planking of their buggaloes.”

Captain Williams therefore expected to obtain future supplies on more favorable terms than he had hitherto succeeded in getting. He further advocated the employment of a qualified person to select proper trees for felling, and to arrange in what manner they should be trimmed and deprived of superfluous wood before being brought from the forests, as well as to point out the standing trees likely to yield Timber suitable for the purposes of the dock-yard, that the same might be girdled preparatory to being felled during the following season.

150. The Government of India, however, postponed the consideration of this subject, pending the reply of the Court of Directors to the application of 22nd June 1844, (see para. 147,) for the appointment of an arboriculturist, and on the 17th May 1845 submitted these papers to the Court of Directors.

MALABAR, 1845 ; ESTABLISHMENT.—151. In January 1845 the Government of India, on the recommendation of the Government of Madras, authorized an increase to the Teak plantation establishment of the collector of Malabar, which raised its aggregate cost from rupees 221 to rupees 314-8 per month, including rupees 50, the salary of the native sub-conservator. This increased establishment was represented as necessary in consequence of the extended scale on which planting and sowing were being carried on by Mr. Conolly, whose report on the subject, dated 14th October 1844, calls for some notice.

CONSERVANCY.—152. In his report of the 30th November 1843, Mr. Conolly mentioned that after various experiments the difficulty of inducing Teak seed to germinate had been overcome, but too late to enable him to profit by it that year to any extent. In the report of October 1844, he says, that from November 1843 to the next sowing season, which commenced in May 1844, he employed the conservancy establishment in clearing and preparing a considerable quantity of ground in four different sites, named Manasherry, Ariacode, Yedacode, and Iraelly Cow. The second and third sites were on the Nelumboor or Beypoor River, the first on a tributary stream, and the fourth close to Nelumboor itself, so that the soils and circumstances of each were more or less different. Here Mr. Conolly caused to be put down in the course

of the months of May, June and July 1844, 50,000 young plants, which had been raised in adjacent nurseries and at the date of his writing (in October 1844) he said of them,—

“The generality of these plants look healthy, but there is a marked difference in favor of those raised at Yedacode and Iraelvely Cow, which have a very promising appearance. I have every confidence that this promise will be fulfilled, and that they will become fine saplings. My confidence is founded on the excellent condition of a few hundred plants which I had put down last year so soon as the difficulty with regard to the seed had been mastered. Nothing can surpass the beauty of these plants. In from 12 to 16 months they have shot up to 8 feet or more, with a healthy and strong stem. In fact, I consider the *experiment* of raising healthy saplings to be at an end, and have no hesitation in recommending to the Government that the important object of replanting wastes with Teak be carried on with vigour in the sites which have been proved to be so well suited for it.”

With this view Mr. Conolly intended confining himself, at Manasherry and Ariacode, to the care of the plants raised there, and to planting on an extensive scale at Yedacode and Iraelvely Cow, which seemed to be the sites best adapted for the purpose, and where there was abundance of available space. There was however yet another difficulty to be overcome before the plans pursued by Mr. Conolly could be perfected; this was the pruning and tending the young plantations. On this point Mr. Conolly was endeavouring to afford all the assistance he could to the sub-conservator, who was a native of the district, by instructing him from books which had been sent out for the purpose by the Court of Directors instead of the arboriculturist, for whose services so many applications had been made.

TIMBER AGENT'S ESTABLISHMENT, 1845.—153. In May 1845, the Government of India sanctioned for a period of six months the following establishment being entertained by the Government Agent for the purchase of timber in Malabar :—

1 English Writer,	20	0
1 Measurer,	7	8
3 Peons, at 5 each,	15	0
	42	8

The establishment and expenses of the timber agency at this period were as follows :—

Captain Williams, Agent,	1,000	0	0
Office-Rent,	50	0	0

Mr. Poulter, Assistant,	50		
Batta,	60		
Travelling Allowance,	60		
		170	0 0
Calicut Establishment,		167	8 0
Beypoor ditto,		35	0 0
Poonany ditto,		54	8 0
Forest ditto,		50	0 0
Palanquin Allowance and Head Money to Civil Surgeon of Calicut,		33	0 0
		<hr/>	
Total, per Month,		1,560	0 0

But in addition to the above sum, Captain Williams was allowed to charge, in quarterly contingent bills, such extraordinary expenses as he incurred in travelling to and from the different timber stations. In July 1847, the Government of India increased Mr. Poulter's salary to Rs. 300 per month, but the Court of Directors, in their Despatch No. 1 of the 27th February 1849, disapproved of the arrangement.

154. The progress of Mr. Conolly's operations may be gathered from the following Minute of the Marquis of Tweeddale, the Governor of Madras, dated 8th December 1846:—

“MINUTE BY THE MARQUIS OF TWEEDDALE, 8TH DECEMBER 1846.—I have carefully examined the Teak plantations which have been planted under the direction of Mr. Conolly, Collector of Malabar, and under the immediate superintendence of a Native of that District, trained by himself.

“As the Government had not provided that officer with the assistance of a European, educated as a forester, or with any agent who understood practically the rearing of young plants, the management of young trees, the selection of soils adapted to the growth of particular plants, the transplanting seedlings from the seed bed, the appropriate distance at which the plants should be placed from one another, the thinning and pruning of young trees, and the causes which require it, and who possessed such other practical information as is necessary for the successful cultivation of plantations, and for bringing them to maturity, Mr. Conolly felt it to be his duty to make the attempt with the assistance of books and a small forester's guide sent to him by the Court of Directors.

“These plantations are now 1, 2, 3 and 4 years' old, and Mr. Conolly has himself told me that the more he reads, and the older his plantations become, the greater difficulties he has to contend with, from not possessing practical knowledge himself, either as a nursery-man or forester; nor does he feel assured that his endeavors to

forward the Court's views will be fully successful, unless he can procure the assistance of a forester who has had experience himself in planting, pruning trees, and felling timber, and who can impart his knowledge to the Natives—there is on their part no want of inclination to learn, on the contrary there is every inclination and great aptitude—but they must be convinced that the person who superintends is master of his business.

“ A district of many square miles in extent was purchased on account of Government, affording a wide field of operations. The oldest plantation on it which I examined was rising four years.

“ The plan pursued by Mr. Conolly, appears to have been very judiciously conceived and executed. The spot selected for the first essay was the banks of the Nelumboor or Beypoor, a navigable river, over an extent of five miles.

“ The first operation was to clear the face of the banks, extending to a certain distance into the interior, of all jungle and trees, in the most economical manner.

“ The difficulty of getting the seeds to germinate in their hard shell was, after much delay and frequent failures, at length overcome by steeping them in boiling water so as to produce the same effect by the heat so generated as the constant fires in the jungle do on the seeds which there germinate.

“ By this process the plants spring rapidly from the seed bed, and when three months old they are transplanted, holes are dug in the ground and the soil is trenched twelve inches deep, at intervals of 8 feet, so as to give air to the plants and little opposition to their tap roots (in their delicate state after transplanting) on their downward search for food.

“ I may observe, that the future prosperity of the Teak plantations depends upon the soil selected being of that quality and in that situation in which Nature has ordained the tree shall alone thrive, so as to provide it with sufficient nourishment and with a suitable exposure. On these circumstances will chiefly depend the close grain of its timber and its durability when exposed to varieties of climate: these will alone also prevent the canker of the heart of the tree which is sure to follow if the tap root penetrates soil not suited to its wants.

“ After minute inspection of the plants of different ages in the plantations, and of all the arrangements connected with them, I was so much struck with the efficiency and ability which marked all the arrangements, that it appeared to me that the director of the undertaking must either have had practical experience as a nursery-man, or that he possessed a mind so practically formed that he could select from the mass of information written on the planting and management of forests from time to time, such as was necessary to carry on the work in a practical and satisfactory manner. The latter I found to be the case, and I can assure the Hon'ble Court, that their expression of confidence in Mr. Conolly's exertions for establishing a good system of management in the Teak forests, as far as the plantations are now advanced, is well merited.

“ I have had much experience in plantations and woods on my own account at home as well as in those of other proprietors, but I never saw a better commencement than in the Government Teak plantations of Malabar.

“ The proximity to water-carriage, the gradual clearing of jungle towards the interior for security to health, and to prepare for extending the plantations into the interior, the education of so many workmen and *maistries*, not only for working the plantations, but also for the management of the natural woods (and making good roads of communications as the plantations advance,) are all objects of essential consequence to future success in a new undertaking, and have all been carefully attended to.

“ I have thus far expressed an opinion upon what I have seen. I do not pretend to offer any opinion upon the result, as I am unacquainted with the quality of the soil or sub-soil generally throughout Malabar, but I have been able to assist Mr. Conolly by informing him that the best mode of suiting the tree to the soil is to dig pits (in the neighbourhood of full and fine-grown Teak trees,) as deep as the end of the tap roots penetrate, and experience will afterwards teach him from the appearance of the surface-soil what kinds of sub-soil he may expect to meet and how far the situation selected is adapted for bringing the Teak timber to maturity ; I believe I may give the above opinion as an axiom not to be controverted.

“ In Great Britain this labour is not required, as the stratification of the soil is generally known from means not possessed in this country.

“ I may remark from all I have heard and observed, that Teak requires the same soil as Oak, *viz.*, a strong pure clay, and from the peculiar localities in which the Teak forests of Malabar and Canara are found, dotted as they are over the immense tracts of jungle and forests of other woods, there is sufficient evidence of their partiality for particular soils and situations, and it may be found that there is an imperative necessity for Teak being planted in the quality of soil it naturally prefers—at all events a due consideration should be early given to this vital point by Mr. Conolly, as a tree at the last moment of its growth may become defective from not giving timely attention to these circumstances.

“ In the thinning and pruning of the plantations, great practical experience is required, and I should say from my observations, more particularly in Malabar than in any other country in which I have travelled, this arises from the great rapidity of vegetation.

“ In the four year old plantation, an experienced planter could tell the age of the trees from the marked difference of the bark on each year's growth, which is beyond any former experience of mine in other countries.

“ From the great weight of leaves on the upper stem of the last year's growth plantations, if they were well saturated with rain, and that a squall of wind followed, would I think run the greatest risk of being much injured by the tops of the plants being broken off, and both experience and careful superintendence on the spot would at such times be necessary.

“ The plants generally averaged twenty feet high at four years' old ; it is at this period (or perhaps during the previous year) of the growth of a plant, that a knowledge of the proper means of counteracting its rapid growth in height is necessary.

“ Thinning the plants, and allowing the air to circulate around them, gives encouragement to the lateral branches to shoot out, and by the sap flowing into them the inclination of the plant to spire up is checked ; great care is necessary that this process should be gradual, and only to the extent, in one year, to create the desired effect.

“When the lateral shoots are well pronounced, all having a tendency to grow upwards should be cut off, a judicious selection of the main branches to be left should then be made, and the smaller branches pruned.

“On selecting the height on the boll of the plant, at which the first lateral branch should be allowed to stand, consideration must be given to the natural height to which a Teak tree grows, and the branches should be left on the four sides, so as to counterpoise one another, and to stop the upward growth of the tree until its roots take a firm hold of the ground, and are able to supply a sufficient quantity of sap for its nourishment, so that the plant may gradually increase in substance in proportion to its height.

“In the use of instruments, a sharp knife is necessary for pruning plantations; in all such cases a clean cut must be given, so as to prevent the tree from being wounded.

“The rude instruments I saw in use will never answer in a well-conducted forest or plantation, where clean sound timber is to be produced. In the case of pruning natural-grown forest-trees, a saw may be necessary for amputating a large limb, but the wound should be dressed over by the clean cut of a knife or small axe, or some sharp instrument, to prevent dampness or rain affecting it, or causing decay to follow the roots of the branch into the centre (or green-wood) of the tree; great care must be taken to prevent forking in the branches, as decayed vegetable matter soon lodges in the clefts, moisture is then attracted, or wet from the rain is retained, and a rot is generally conveyed to the centre of the tree.

“It would appear to me, where so great an interest in the successful preservation and increase of Teak plantations and forests is taken by the Honorable Company, that a competent person should be employed whose whole time and attention should be devoted to that duty. I know that it would be satisfactory to Mr. Conolly if he had an intelligent practical forester under him, and from the conversations I have held with that gentleman, I am assured that unless he has a person possessing these qualifications, he does not see how he can himself do justice to a charge so purely practical; nor will his other duties allow him more time than occasionally to superintend such an establishment as will be necessary for doing the work required in the plantations or Teak forests.

“In my own opinion also it appears impossible for Mr. Conolly to give sufficient attention to so large a concern, and I do not see how either the plantations or the forests can have justice done to them without the constant supervision of an experienced European eye. I would not remove the duty from his charge, but I would allow him a practical forester, whose time and attention should be given under Mr. Conolly's direction, to the management of the plantations and forests, and if found practicable and advisable, his attention might likewise be directed to the growth of Cardamums, Cinnamon, and other spice and valuable timber-trees.

“The more I conversed with competent judges and examined the defects of the plank timber sent down from the Company's forests to Captain Williams, (inspector of the Teak timber for the dock-yards of Bombay, at Calicut and Cochin,) the greater necessity appeared to exist that my recommendation should be followed out.

“The same defects in the planks occur here as at home, proceeding generally from the same causes.

“ If my recommendation should be complied with, nearly all difficulties would be overcome on this head, and this most valuable produce of Malabar, so abundant a source of wealth and so important to the State, would probably be raised to an extent and brought to a perfection hitherto unknown; but if competent practical skill and undivided attention is not given to the Teak, I see no ground of hope that the supply will be greatly if at all increased, or a field of supply created to any extent. I cannot, therefore, too strongly express my opinion of the great importance I attach to fostering the plans and supporting the exertions of Mr. Conolly.”

COIMBATORE ESTABLISHMENT.—155. In July 1845, the Government of India sanctioned an establishment at a monthly charge of Rs. 246-8 for working the Wallair forests in the Coimbatore District, with the view of supplying timber to the Bombay Government, and at the same time authorized an advance of Rs. 15,000 to the Collector to meet the expenses for felling, barking, and the carriage of the timber in those forests.

COIMBATORE FORESTS.—156. This is the first and only correspondence regarding the Coimbatore forests that has been obtained from the Home Office, and it contains no detailed information regarding them. It shows merely that Captain Williams, the agent for the purchase of timber on the Malabar Coast, having experienced some difficulty in procuring timber of a particular description from the Malabar and Canara forests, applied to the principal collector of Coimbatore for permission for his contractor to work the Teak forest of “ Anna Mala” for the timber which was urgently required, on the condition of his supplying all he cut exclusively for the public Service. The collector, Mr. Wroughton, stated in reply that some “ restrictive orders of Government” prevailed in the District which disallowed the felling of timber in Coimbatore without the special sanction of Government. Upon this Captain Williams referred the matter to the Bombay Government, who addressed the Government of Madras, when the Collector of Coimbatore was called upon to report on the subject; this he did in a letter, dated 14th September 1844, in which he gave his opinion as to the propriety of permitting Mr. Gardener, the contractor, to fell timber in the “ Anna Mala” jungles for the Bombay Government, and reported generally on the condition of the forests and the mode in which they should be managed. This letter is not forthcoming. From the remarks made upon it by the Board of Revenue at Madras, it appears that Mr. Wroughton did not think it would be expedient to allow Mr. Gardener, or any other renter or contractor to

work the Coimbatore forests, but as local arrangements could be made to meet the demands of the Bombay Government to any extent he recommended the forests being kept under "*Aumaine*," and worked by a Superintendent or Conservator assisted by a competent establishment. This proposal the Board of Revenue concurred in, and recommended further that the transport of the timber to the Western ports should be effected by contract, conformably with the wishes of the Court of Directors on this point. The Government of Madras approved of the recommendations of the Board of Revenue, and on the 14th November 1844 called for a statement of cost of the required establishment, with an estimate of charges for the conservancy and working of the forests. At the same time the collector of Coimbatore was desired to place himself in communication with Captain Williams and to use every exertion to meet the immediate demands of that Government for timber, without awaiting the completion of his establishment, or of arrangements for working the forests.

157. On receiving the above orders, Mr. Wroughton proceeded at once to "*Anna Mala*" to inspect the forests there, but he found they could not be properly worked until the commencement of the S. W. Monsoon, in May or June, in consequence of the great scarcity of water: he therefore directed his attention to the Wallair forests, and as they contained 4 or 5,000 Teak trees admirably adapted for the Bombay Government, and water-carriage was available, he decided on working them. With this view Mr. Wroughton engaged a native, named M. Gooroo Bux Ram Sing, as conservator and agent, on a salary of rupees 100 a month, and employed an establishment to the extent of rupees 146-8, and at the same time he applied to Government for advances "for the discretionary disbursement of rupees (15,000) fifteen thousand, to be applied to the purpose of felling, barking, and carriage of the timber" to the Nurgumpully River, on the banks of which it was to be stored. The establishment and advance were sanctioned, as already stated in para. 155.

BOMBAY FORESTS.—158. The correspondence which follows (in the order of date) relates to the proceedings of the Government of Bombay for the protection of the forests of that Presidency, and must be noticed here so as to continue the narrative, but it must be observed at the same time that the papers which have been traced on this subject go back as far only as December 1843, while the protective measures of

the Bombay Government were taken as early as March 1840, when Dr. Gibson, Superintendent of the Botanical Gardens, was directed to visit the forests and report on their resources, and on the best means to be adopted for their preservation and improvement. There is no precise information, therefore, in this Office of the proceedings of the Bombay Government, or regarding the forests during the four years from March

* Dated 9th December 1840 to December 1843. From a minute* 1843.

written by Colonel Jervis, the Chief Engineer at Bombay, in his capacity of Member of the Military Board, the following brief account of the situation, extent and condition of the Bombay forests in 1843, has been obtained :—

“ On the Eastern skirts of the Goojerat Province, from Deesa downwards to the Nerbudda, are forests of varying breadth. These forests are the broadest and the trees in them largest where the country stretches towards Malwa. The more useful timber in these tracts are chiefly Pullus, Sissoo, Tunnus and Mhowa. The whole tract of these forests were said to belong to thakoors and petty rajahs, some independent, but mostly feudatories of the Guicowar.

“ Crossing the Nerbudda, are the Rajpeepla Jungles, a wide broad expanse which was imperfectly known. They stretch upwards towards the Lautpoora range, thinning as they approach the Taptee. Teak is found here in addition to the woods mentioned above.

“ Above the ghauts leading to Kandesh are some Teak forests, but the most extensive portion is below, in the hilly and jungle tract skirting the Surat Districts.

“ Southward of this is Shroongana, containing a good deal of Teak.

“ Westward are the Dhurrumpore Rajah's jungles, where Teak formerly was plentiful, but the quantity has been much reduced.

“ Next come the Dumaun jungles, where Teak was mostly preserved, but it was not plentiful, and cuttings for ship-building had been large.

“ Proceeding South to the Pith and Hursool country, lying Eastward of Gumber Ghur to the ghauts, Teak was formerly very extensive, but had been largely cut away chiefly for export to the Dekhan. It is sent even as far as Dholapoor. By proper care and conservation it was expected that this tract would soon yield large supplies.

“ Thence crossing a *wag* nuddee into the territory of the Jewar Rajah, which extends Southward to beyond Boputghur, much Teak was formerly grown, but in 1843 it was very thin, having been disposed of mostly by contract, to persons exporting it to the coast.

“ From this part commence the jungles of Kolwun, forming the North-East corner of the Tanna Collectorate. Here Teak is inferior in size and straightness to that of Jowar or Hursool. It has been mostly cut away, leaving merely stumps and crooked shoots. There is also in these Kolwun jungles much valuable wood of other kinds fitted for building, &c., such as Hedoo, Bibla and Kulum. Sissoo is sparingly found here, and of small size.

“ The hills stretching Westward from Doogaur and Vijirabhoj to the sea were formerly covered with wood, but in 1843, on their sea face, there was hardly a bush to be seen; all had been cut away for the Bombay market.

“ In Salsette there are some small plantations preserved, but of these the greater part are in villages which had been gradually acquired by Parsees.

“ Southward from Kolwun, as far as Aptie, the country is mostly bare, with the exception of a strip of jungle extending from Bhowndy by Potgaum, Bowmullum, &c. In this are many remains of what have been good Teak trees, but they are now chiefly shoots from stumps.

“ Beyond Aptie is a good deal of Teak, formerly planted and conserved by the Angria family. This extends Eastward to near Jamboolpara, and formed a large source of supply for the Poona market. In 1843 the trees were not of great size.

“ In the talooks of Nagotna, Bohee Goregaum, Nizampore, &c., belonging to the British Government, there is a good deal of Teak. In many villages, such as Putwoos, &c. it has been long preserved, with the exception of the cuttings allowed by the Collectors and their Assistants and by the kamavisdars. Formerly a man petitioned for leave to cut down trees for a particular purpose, chose the best, and through connivance of inferiors helped himself most liberally. This in a great measure tended to the destruction of the forests.

“ Further West in these Talooks, the Teak-wood seems to have been cut down annually for burning in fields. Since the stoppage of Teak cutting three or four years before 1843, under the orders of Government, the hills have become covered with thriving young Teak trees, which in the course of ten or fifteen years may be expected to afford a large source of supply for smaller wood, applicable to the houses of the people.

“ On the Bankote Creek there were, in 1843, several plantations of Teak.

“ In ten or twelve villages of the Ryeghur Talooka are rather extensive plantations, just beginning to recover from the cutting formerly allowed under the contract system, which permitted a man on paying a certain sum to have the privilege of cutting within certain boundaries for so many years. This is the system which has been already so often condemned.

“ South of the Latwun Khind, and from thence to Vingorla, the villages being entirely on the *khote* system, that is, under the management of a hereditary rentor, exempt from control as to the interior economy of the village, the intentions of Government for the preservation of Teak could not be carried into effect here. Hence in this forest-tract there is little Teak to be seen, as it is cut away along with the brushwood for burning in the fields. Nevertheless in this tract are two extensive plantations which were formed by the providence of the Angria family. One tract lies in ten villages of the Severndroog Talook, in which the Teak is said to have been nearly all cut away when Mr. Pelly was Collector of Bankote. The trees now (in 1843) existing are thriving shoots from the old stumps. In this tract, however, the Teak of late has considerably propagated itself by the fall of seeds, and the plantations are now regularly conserved by the Collector's establishment. The other tract is situated North-East of Malwan, between that port and Ramghur. It was cut down under the contract system some fourteen years ago, and the present trees are mere shoots. The soil here is better than that to the Northward; the trees consequently are more luxuriant.

“ Regarding the forests lying East of the ridge of the Western Ghats, and South of the River Nerbudda, it is stated that a large tract of forest extends from the longitude of this ridge along the valley of the Nerbudda, and Southward as far almost as the immediate banks of the River Taptee to the very sources of those rivers.

“ Next come the plantations South of Somghur, scattered, and of little account for external commercial purposes, but capable of being turned to profitable use if conserved, so as to secure a succession of cuttings, all of which are applicable to increase the comfort of the dwellings of the people, and this is of the more consequence here, as the country is otherwise bare of wood.

“ In the upper parts of the valley of the Gor River the hills are steep, and afford excellent protection for young Teak trees. Accordingly it is found that they had formerly been planted in all this valley by the provident care of Nana Furnavese and others. They have unfortunately been subjected to a destructive process of thinning, owing to the payment of the expenses of conservancy being made to depend directly on this source. Hence the best shoots have been annually cut away, and only the worst left. The cutting has been lately stopped, and since this young Teak plantations have sprung up in five or six other villages of the valley. There can be no doubt but that Teak seeds scattered in many such valleys above the ghats might, with very little trouble, form the basis of extensive plantations that would prove most useful hereafter. And it should be borne in mind that Teak seeds vegetate only when scattered on the surface, but not if regularly planted in the soil.

“ At Chas Kuman is a small plantation formed by the family of Roopram Chowdry, to whom the village formerly belonged.

“ At six villages under the Northern face of Singhur are plantations, rather extensive, thriving, and well kept. From the leaves of these (used for thatching at Poona) a considerable revenue is derived, and the grass fostered by the shadow of the trees attains a larger size than it does on the open hills or plains, and its value (near a populous city) is thereby proportionally enhanced.

“ Southward in the country of the Punt Suchew and in that near Sherwul, West of Poorundhur, are many plantations on the hills, but it does not appear that they have ever been allowed to reach any size, though the nature of the country (valleys shut in by steep hills) is favorable for their growth.

“ In the Southern Mahratta Country, West of Pelgaum and Dharwar, are forests believed to be extensive, and showing by their luxuriance of growth the superiority of the soil and that the climate is eminently fitted for them. From specimens of the wood of these forests lately brought to Bombay, it would appear that the timber is equal, if not superior in breadth and quality, to that of Malabar.”

159. All the Teak forests mentioned contain also a great variety of other timber-trees, which are very useful in particular departments of public works. The Shewun is valuable for its lightness and flexibility, the Sissoo for its dense fibre, and consequent strength to support heavy weights or resist friction, and there are other woods useful to the turner, the wheelwright, and modeller.

160. It will be seen from preceding paragraphs that no care was taken of the forests of the Bombay Presidency previously to 1840, but after the appointment of Dr. Gibson, in March of that year, to examine them and suggest means for their preservation and improvement, the Government of Bombay, acting probably on that officer's advice, appear to have made some endeavours to protect the forests. The measures adopted failed however, owing, it was stated, to the want of unity of superintendence, as under the plan pursued one part of the forests was under the Military Department, another under the Political, and a third under the Revenue Department, without there being any immediate controlling authority. In December 1843, the deteriorated condition of the forests, and the difficulty of obtaining good timber, attracted the notice of the Military Board of Bombay, and Colonel Jervis, the Chief Engineer and Member of the Board, recorded the minute of which mention has been already made. In it and in two other papers on the subject he made several valuable suggestions for the care and conservancy of the timber forests. In compliance with these suggestions, the Military Board recommended the Government to organize an establishment under a qualified person, for the conservation of all the forests, and applied to be vested with the whole control and management of them, on the ground that "each department of Government requiring supplies of timber, whether Public Works, Ordnance, or Shipping, has in some one of the persons, either of the Members or of the Secretaries of the Military Board, its appropriate representative."

161. Before the Bombay Government took this proposal into consideration, they called for a return of all persons who drew any salary or derived any emolument from the management or conservation of the forests; this return has not been traced. In the mean while the Military Board, at the desire of the Government of Bombay, submitted a scheme for an establishment of conservancy under Dr. Gibson, who they recommended should be Conservator without giving up his appointment of Superintendent of the Botanical Gardens. In a subsequent letter, dated 30th April 1844, the Board further suggested that Dr. Gibson, in his capacity of "Interim Conservator," should be employed to carry out the views proposed by them for the preservation of forests. It is not stated why Dr. Gibson was to be employed as "Interim Conservator," but it is supposed that title was fixed upon with

reference to the applications which had been made to the Court of Directors to send out an arboriculturist from England. The Government of Bombay, seeing the necessity for placing the Department in a more intelligible and efficient condition, directed the Military Board to enforce such general measures as involved no particular outlay, and could be superintended by the local officers with the occasional aid of Dr. Gibson as "Interim Conservator," until an active and efficient system could be introduced with the sanction of the Supreme Government. In November 1845, the Government of Bombay submitted the whole of the correspondence for the consideration of the Government of India, with a long report, in which their views and intentions are expressed in detail, and in which they applied for sanction to employ an Assistant Conservator under Dr. Gibson, on a salary of rupees 200 per month, and to entertain an establishment to the extent of rupees 93 per mensem, or in all, a forest establishment of rupees 293 monthly.

162. The Government of India replied on the 14th March 1846, and required to be informed whether the conservancy measures which were proposed were intended to apply to Government forests only or were to be extended equally to forests, which were not the property of Government, and whether the duties of the Conservator were to be exercised over the forests within the limits of the Presidency of Bombay only, or were to embrace those on the Western Coast under the Presidency of Madras also, and if so, whether the Government of Madras was aware of this intention and had expressed any opinion respecting it. In September following, the Government of Bombay explained that although the conservative measures had mainly in view forest-tracts which were the exclusive property of Government, yet the nature and extent of individual claims over some of the tracts in secluded localities had not, in all cases, been fully ascertained, and their ascertainment and treatment, with a view to the promotion of the general object, would form one of the duties of the Conservator. It was intended also, wherever it could be effected without political inconvenience or injustice, to apply the proposed conservancy arrangements to all forests belonging to independent chiefs, of which description there were many.

163. The Government of Bombay also explained that the forests within the Madras Presidency did not form a principal object in the scheme, but it was thought that they might with convenience and public advantage be comprehended in it, and it was not anticipated that

the Government of Madras would object to the arrangement, though pending the orders of the Government of India on the proposal, the Government of Bombay had postponed addressing the Government of Madras on the subject. On this explanation, the Government of India, on the 19th December 1846, authorized "the employment of an establishment for the management of the forests under the Bombay Presidency, at a monthly charge of rupees 293," and on the 22nd March 1847, the Government of Bombay appointed Dr. Gibson conservator, and authorized him to entertain the establishment which had been sanctioned by the Government of India. In February 1848, the Government of Bombay communicated to the Government of Madras the appointment of Dr. Gibson, as conservator, and the arrangements which had been made in consequence, and suggested the transfer of the Canara and Sondah forests, North of the Gungawallee creek, to their supervision, with the view of placing them under Dr. Gibson. The Government of Madras, however, did not approve of such an arrangement, while the judicial, revenue and police authority of the forest districts, proposed to be transferred to Bombay, remained in their hands, but considering that every necessary object would be secured by a ready co-operation with Dr. Gibson on the part of the authorities in Canara, and by a strict attention to his views in regard to the preservation of the jungles and the rearing of young trees, they suggested (what appears to have been finally arranged with the Government of Bombay and approved by the Government of India) that Dr. Gibson should visit the Canara and Sondah forests, and assist the authorities with his advice for their preservation and improvement. Under this arrangement Dr. Gibson seems to have visited the Canara forests on two or three occasions, and to have reported at length on them. His reports have not been obtained, but he appears to have suggested the replanting of certain tracts, and the protection and preservation of other tracts in the Northern parts of Canara, for which purpose applications for additional establishment were made from Madras to the Government of India in November 1846, in December 1847, and in September 1848. On the 21st October 1848, the Government of India sanctioned an addition to the existing establishment in Canara, to the extent of rupees 180 per month.

CANARA FORESTS, 1847.—164. The correspondence submitted by the Madras Government with their three letters noted in the preceding

paragraphs, contains several letters from Mr. Blane, (the successor of Mr. Blair, as Collector of Canara,) on the subject of the forests, in which the following points are discussed :—

1st,—The conservancy of the forests.

2nd,—The effect which the extensive clearance of wood-land has upon the general climate and fertility of a country.

3rd,—The necessity of restricting the *cumere* cultivation.

4th,—The right of Government to all such forests as could not be clearly established to be private property.

165. The conservancy of the forests has been already fully discussed, and as Mr. Blane merely went over beaten ground, it is unnecessary to state his views, particularly as they were generally anticipated by the measures of the Government.

166. On the subject of the effect on the climate from the extensive clearance of wood-lands, Mr. Blane and Dr. Gibson quote authorities to show that the climate of a country is very much modified by the clearing away of forests. In Canara where the clearance was rapid and extensive, it is alleged that much less rain had fallen than in former years, when the country was covered with woods; whence it was supposed that the gradual filling up of the mouths of the large rivers, which was observed along the whole length of the coast, was in a great degree attributable to the decreasing body of water which flows from the upper country, and by the force of which the silt was formerly carried into the sea, and the channels of the rivers kept deep. To show the rapidity with which the wood-land in Canara had been destroyed, it is stated that within thirty or forty years the forests had receded from the coast to within a few miles of the ghauts, and large tracts of country were pointed out which were formerly within no distant time covered with wood, but which now had hardly "a stick large enough for firewood." This destruction had been carried on to such an extent in the neighbourhood of Mangalore "that the article of firewood, formerly so abundant, is now one of the chief items of expense to the poorer classes of people, and is a deprivation severely felt by them." Many causes had conduced to bring about this scarcity, but the chief was, "the improvidence with which the wood was treated, every tree and bush being felled at first, and the shoots and saplings which would have grown up and supplied their places being cut down every year until the roots die off, leaving nothing but the bare laterite hills which will remain for ever afterwards utterly sterile and useless."

CUMERE CULTIVATION.—167. Another cause of the destruction of the wood-land was the *cumere* cultivation: this however was confined to the neighbourhood of the ghauts, because it was there alone that any forests remained, and it was carried on with such increasing activity every year as to bid fair to destroy the whole of the large virgin forests in a short time. Mr. Blane stated that the practice was so wasteful and improvident that it ought not to be tolerated excepting in a very wild and unpeopled country, and he was of opinion that it should be placed under considerable check and regulation, if not entirely prohibited. The great difficulty, however, in the way of controlling the destruction of the forests in lower Canara, was the absence of all definition of the rights of private individuals, and the facility which it afforded the people of asserting claims to a private property in the forests, which Mr. Blane was persuaded would on due inquiry prove to have no foundation whatever, as “there is nothing scarcely which the people of Canara will *not* claim as a right if they think there is any chance of its being conceded.” As a remarkable exemplification of this, Mr. Blane refers to Mr. Blair’s report of August 1838, (see para. 24,) in which that gentleman stated that the forests in the Coorg Mogamies were for the most part claimed as private property, and that “this claim is founded more on presumptive right established by previous enjoyment, than in the possession of sunnuds or other documents conferring a proprietary right.” Mr. Blane having inquired into these claims had the strongest reason for believing that the supposed existence of any such prescriptive right was an error, and that the Coorg ryots neither had nor ever had pretended to have any right to the forests before the Province came under the Company’s Government. Up to that time the right to all the valuable kinds of timber were, as in the rest of Canara previously to its acquisition by the Company, exclusively reserved by the rajah.

“The forests were carefully preserved, and were in many places full of the finest timber. They soon attracted the notice of the timber merchants in Mangalore, and a set of speculators proceeded into these Mogamies and offered to purchase the right to fell timber from the neighbouring ryots, who, as may readily be imagined, had no objection to sell what they knew was not their own. No check was placed upon their proceedings by the Sircar, and they were not slow to adopt the convenient Canarese theory of large wings, including within their limits all the waste and wood-land in the vicinity. The consequence has been that within the space of little more than 12 years the greater part of these forests have been cleared of their valuable timber, and thou-

sands of the finest Teak and Poon trees brought down to the Coast and exported by private individuals.”

PRESERVATION OF TIMBER.—168. In December 1843, Mr. Blair issued a proclamation for the preservation of certain descriptions of timber in which Teak was included, but this had no effect practically, for timber merchants continued to cut Teak whenever they found it convenient to do so, on the plea that they cut it on private property with the permission of the owners. Their operations proceeded actively till Mr. Blane joined the district as Collector, when a dispute was referred to him respecting the right to the Teak timber upon a fine tract of forest which one of the timber merchants had commenced working. The plea of the merchant was that he had purchased the right to cut from the neighbouring ryots, but that right was now called in question, being claimed by the Rajah of Coomblah, in virtue of his office of trustee to the Adoor Pagodah, to which he alleged the forest-land belonged. Mr. Blane considered it advisable to consult the old servants of the Coorg Rajah upon the subject, and from them he elicited that neither the ryots nor the trustees of the Pagodah had, in custom or otherwise, the slightest ground for their several pretensions. The ryots had been allowed to cut jungle-wood for their own use upon application to the Amildars, but the Teak had always been preserved, and the felling of it and of other useful timber for wholesale export by sea, had never been heard of. Mr. Blane had no doubt, therefore, but that this was the true state of the case throughout the Province, judging from this fact as well as from the former custom in Canara, and the consequently fine state of preservation in which the forests were when the country came into the possession of the Company.

169. With a view to enforce the order against the cutting of valuable timber, Mr. Blane directed that where forests were claimed as private property the right should be established before the timber is cut. He did not however expect that this order would be obeyed until means were taken for vindicating the right of Government, either by prosecuting the claimants for damages or punishing them criminally for destroying Government property. Mr. Blane therefore recommended if it was desired effectually to preserve what remained of the Teak forests, the Government should distinctly assert their right to all such forests as could not be clearly shown to be private property.

170. Mr. Blane's recommendations were approved by the Government of Madras and by the Government of India, and accordingly he was authorized to restrict the cultivation of *cumere* to such places and to such an extent as in his opinion might be expedient for the preservation of the forests and the general welfare of the Province, and to assert the rights of Government to all forest-lands to which a title could not be clearly established by private individuals.

DUTY.—171. In May 1848, the Government of Madras referring to Act VI. of 1848, which abolished all export duty on the port to port trade of India, and removed the restriction which the Tariff of 1843 had imposed on the felling of young trees, the property of private parties, applied to the Government of India for instructions as to the course that should be followed for preventing the indiscriminate felling of young Teak trees. The Collector of Malabar, with a view to preserve the forests, had issued instructions prohibiting the exportation of Teak timber of less than thirty-two inches in circumference. The Government of Madras, however, considering the measure to be open to serious objections, as a great part of the forest-land in Malabar was private property, had directed it to be cancelled; but as the subject was one of the utmost importance in reference to the future provision of timber, a discretionary power was given to the Collectors of Malabar and Canara to adopt in all forests of which the Government were owners or renters, whatever conservancy arrangements they thought best adapted under the circumstances for the preservation of the young trees. To this end the Government of India was solicited to pass an Act, either to prohibit the export of under-sized Teak timber from the ports of Malabar and Canara, except under the special authority of Government, or to modify Act VI. of 1848 to such an extent as would empower the Collectors of those Districts to levy a duty as before on under-sized Teak timber exported from those Provinces, leaving other timber and Teak of large girth free from all duty.

172. On the 17th June 1848, before entering upon the subject of the letter of the Government of Madras, the Government of India called for a copy of all rules which were in force in that Presidency, in Bombay, and in the Tenasserim Provinces, for the conservancy of forests. The Government of Bombay replied to this requisition on the 6th September 1848, that the rules for the conservancy of the forests in that Presidency had not been definitively determined on, and the

Government of Madras reported, on the 7th December following, that there were none in that Presidency either, but that in Malabar the rules which have been quoted in para. 118 of this Summary were observed by the Collector of the Province, while in Canara the Collector had framed the following rules for the Government of the forests in that Province:—

“*RULES.* 1st,—To cut down such Teak trees as are known to be ripe for the axe, and to have them conveyed to the coast.

“2nd,—To preserve and improve the growing timber by the removal of all dead trees and branches, clearing away under-wood, weeds, &c., which choke and impede the growth of the young trees, and especially to thin the forests where the trees are too crowded, and to prune the branches.

“3rd,—To guard the Teak forests against injury from fire.”

173. In January 1849 the Government of India addressed the Government of Bombay, and with reference to the suggestions made by the Government of Madras (see para. 171) for preventing the felling of young and under-sized Teak trees, desired to be informed “whether any and, if any, what measures are in force under the Bombay Presidency for preventing the felling of immature trees in forests which are private property,” and at the same time an opinion was required upon the propositions of the Government of Madras. In reply to this requisition, the Government of Bombay, on the 26th April 1849, forwarded a letter from Dr. Gibson, the conservator, in whose sentiments on the subject they concurred.

DR. GIBSON.—174. Dr. Gibson expressed himself as follows:—

“2nd,—In the few cases wherein private parties in this Presidency have property in Teak timber, there is not any rule to hinder their cutting the same at any time and in any manner they may choose to do. In fact, the parties in question work their jungles so much for present profit that (as may be seen in the principalities of Ramnugger and Jowar,) the prospective supply from young Teak is very small.

“3rd,—With respect to the call for a legislative enactment interdicting the export of under-sized Teak timber, I am of opinion that in Malabar and Canara such an enactment would be of much service.

“4th,—I have carefully weighed a consideration of some importance as connected with this subject, *viz.*, that an unqualified prohibition such as is contemplated might in its working be oppressive, inasmuch as it will prevent the possibility of exporting Teak rafters and smaller roofing timber. When, however, we advert to the fact that seaward exports of Teak from Malabar and Canara are chiefly made to ports at a great distance, such as Bombay, Kattywar, Kutchi, and Arabia, it is obvious that dealers will prefer exporting roof timber in the solid log (to be afterwards sawn up), to the more bulky and unstowable rafter and ridge pieces.

" 5th.—Further, for this smaller quantity of roofing timber, in case the dealers could be induced to choose only those trees which grow in high and exposed situations, such as are never likely to be of any value for large timber, no harm might ensue from permitting the export, but it were obviously impracticable to restrict dealers to cutting smaller timber in such places, and it is far more probable that they would in all cases choose the best young trees found near rivers and streams, in fact the very sort which it is most desirable to preserve.

" 6th.—For these reasons, I think that the restriction as regards Malabar and Canara should be unqualified with respect to straight timber.

" 7th.—Professional men possessing local experience superior to mine can best offer an opinion as to whether any qualification be necessary in regard to smaller curves for the building of boats and pattimars.

" 8th.—Were it intended to extend the provisions of the Act to the Bombay Presidency, I am of opinion that here a qualifying clause may be found necessary. My reasons are these.—In many of my former reports, it will be observed that I have stated that the supply of Teak furnished by this Presidency, at least between the Daman River and the Goa border is of small size, that much of it will never grow large, and that although we have an immense quantity now in progress and daily becoming applicable to the wants of the people, and affording material for profitable export, the quantity worthy of preservation for naval purposes will be comparatively small, and that for our main supply of ship-building timber we must continue to look to the Northern forests, to Canara and to Malabar.

" 9th.—Under these circumstances there should, I think, be no obstacle to the export of the smaller wood from the ports of Bombay, when Government may see that the time has arrived, (which is yet by no means the case,) for opening these young forests to the public, but even then it will be found necessary to fix the 'seignorage' on this smaller wood at a rate so high as may suffice to discourage the cutting of immature trees."

GOVERNMENT OF INDIA, 26TH MAY 1849.—175. On the 26th May 1849, the Government of India informed the Government of Madras, in reply to their several letters, that having given the suggestions which were made by them the consideration which their importance demanded,—

" The President in Council has no doubt that if it were advisable to impose restraint at all by legislative enactment in this matter, there could be no method of doing it so little objectionable as that proposed of levying a high export duty upon under-sized timber. But independently of the inconvenience that would arise from a partial repeal of Act VI. of 1848, which this course would render necessary, His Honor in Council is unable to satisfy himself of the propriety of legislating even in this indirect manner for the purpose of interfering with individuals in the management of their private property: he considers that legislation of such a tendency should be resorted to only under very pressing circumstances indeed, and on the present occasion His Honor in Council cannot perceive that a sufficiently strong case is made out.

“It does not appear in the first place that the Government forests, in which of course any conservancy arrangement that may appear desirable can be introduced without a law, are not alone sufficient for public purposes. In the next place His Honor in Council finds it difficult to believe that proprietors of forests will be found, as a body, to pursue to an excessive degree the unwise and improvident course the existence of which is assumed as sufficient proof of the necessity for the interference of the law to restrain them in the management of their own property. A few such may possibly be found, but with regard to the majority, His Honor in Council cannot suppose but that they are likely to discern for themselves and to follow that course which is most conducive to their real interests, and that no such general and wholesale destruction of the forests will be found to take place as appears to be apprehended.”

GOOJERAT FORESTS.—176. Regarding the forests of Goojerat, the following information has been obtained.

177. In 1841 the Government timber agent at Surat, Mr. Boyce, having experienced some difficulty in procuring good sized timber for the Government of Bombay, resolved on visiting the forests, and by personal examination ascertaining,—

“1st,—The distance from the bunders to the principal forest, with the names of the different places intervening.

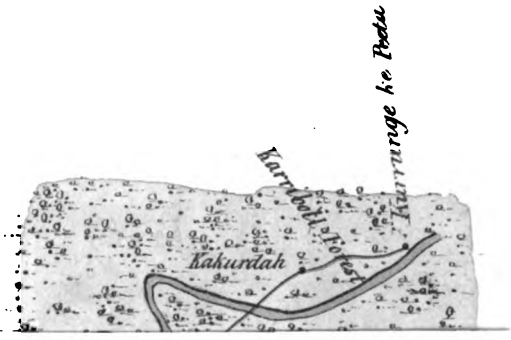
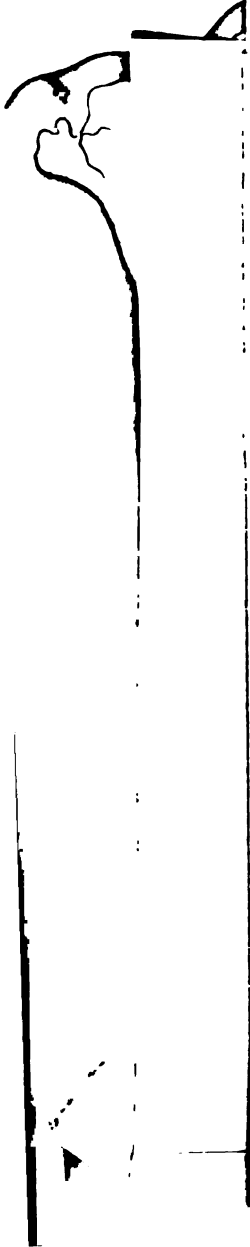
“2nd,—The state of the roads and the obstacles presenting themselves on it.

“3rd,—The quality and size of the Teak trees, and whether plentiful or not.

“4th,—The possibility of any of the rivers in the vicinity of the forest being made available for floating down timber.”

178. The annexed rough map will clearly explain the position of the forests, and the nature of the country, and the table attached to it will give the distances of the different places between the timber depôts and the forests. Mr. Boyce however visited only the Karribell forest, as it was the most important forest ; it was under the control of a Bheel rajah named Ooda-Singh. “The state of the roads and the obstacles presenting themselves on it” are thus described by Mr. Boyce :—

“Between Bulsar and Chicklee are two rivers, the Kurrera and Kaveree; these present great obstacles to the carts, their beds being composed of large uneven rocks, and great delay is experienced in surmounting them; not unfrequently the carts break down: owing to these rivers, a very small quantity of first sort timber is brought to Bulsar. From Chicklee to Wewul, the road extends over a large plain, and presents no obstacle worthy of notice. Leaving Wewul on the left, the Umbeeka or Eeb river intersects the road, and offers a very material obstacle from the rocky nature of its bed. The next impediment is the Oolaun river, a branch of the Umbeeka beyond Dadura, from whence to Untapore no other exists. From Untapore there is a good road to Omenia. Between Omenia and a village called Kakurdah the Poorna river presents a very formidable obstacle, the road crossing it obliquely for at least 200 yards; its bed is very rocky, and even at this advanced stage of the season (6th May) it contains



water. From Kakurda to Kurrunge-ke-Peeta (in the Karribell forest,) which latter is only a clear space in the jungle of about 100 yards square, where the coolies bivouac, the road presents two or three minor difficulties in the shape of rocks, which might easily be removed; nearly the whole of the road from the forest to the bunders has a gentle descent, which is very advantageous to the loaded carts returning. From Mungaldass to Allipore the ground is undulating, and the road much in want of repair. From Allipore to Rankooa the country is level and the road good. From Rankooa the same road is pursued as previously explained."

179. Of the quality and size of the Teak and the quantity in the forest, Mr. Boyce says, although the forests may be said to commence immediately after quitting Untapore, from which place the road winds through valleys, the hills on each side of which are covered with trees from the base to their summit, he saw no Teak of any size until he reached Kurrunge-ke-Peeta, (where he met a relative of the Bheel Rajah, who accompanied him in to the jungles.) Here Mr. Boyce found the Teak to be very plentiful, principally on the sides of hills, but generally surrounded by other trees and growing only at intervals, much scattered, and in clusters of from five to twenty, and requiring great labor to procure it, as all the intervening trees towards the nearest footpath must be cut down before the Teak tree can be removed. The further Mr. Boyce penetrated into the interior of the forests, the larger, finer and more numerous the Teak appeared. From this fact, and from all he could learn, he was satisfied that Teak equal in size to superior Malabar timber was very plentiful, though Mr. Boyce's personal inspection was unavoidably confined to the Karribell forest; but he had every reason to believe that,—

"Forests producing splendid Teak timber extend North and South from the Southern bank of the Taptée river, in the Beara Pergunnah, to the territory of the Bausda Rajah. Other forests continue to the Southward, but owing to some peculiarity of soil, the trees after attaining a moderate size became hollow; this is particularly observable in the timber obtained from the Dhurumpore forest."

A great deal of fine timber is obtained from Peepree and Rhamboj, which are also in the Bheel districts, but he had not then been able to visit them.

180. Mr. Boyce's attention was drawn to several large blocks of fine Teak four or five feet in length, and two feet and upwards in diameter, which were lying close to the stumps of recently felled trees, and on inquiry he learnt that the coolies after felling a tree, which they did without previously lopping off the branches and clearing the stem, cut

off a piece at each end to reduce the trunk to the length most convenient for being carried ; they then with axes chip down each end of the log to reduce it to a convenient weight, and thus waste at least one-half of a valuable tree. This confirmed the opinion which Mr. Boyce had always entertained that nearly all the first sort of timber brought to the bunders for sale had been originally nearly double the size. The manner of cutting down the other trees, including dwarf Teak trees, which surrounded the good Teak, was also performed without judgment, and with a total recklessness as to the injury done to the forests.

181. The mode of getting timber down to the depôts on carts dragged by bullocks was objectionable on several grounds. Mr. Boyce thought that as the country was intersected by several streams, these could be made available for rafting timber down to the coast ; this method had been attempted by dealers, but ineffectually ; it was however considered probable that another attempt, if made by Government, would be attended with better results.

182. In order to the procuring a plentiful supply of superior timber and at moderate rates, Mr. Boyce thought it would be necessary to check the improper practices which prevailed in felling, cutting and removing timber ; to improve the mode of carriage ; and lastly, to arrange direct with the coolies or ryots for supplies without the intervention of the dealers ; or “ to enlist one of the principal dealers on the side of Government by the offer of a liberal salary or other consideration, this would insure the services of all the coolies hitherto employed by him,” and that being secured, “ timber equal to what was sold in Bombay for 16 and 18 rupees per candy might be purchased at the bunders at 12 and 13 rupees per candy, new measurement, a saving which would enable Government to entertain any extra establishment which this new system would require.”

183. Mr. Boyce's paper was submitted to the Government of Bombay in June 1841 by Sir Robert Oliver, with a recommendation that the political authorities should be instructed to use their influence with the native powers to protect their forests and improve and encourage the growth of timber thereon. In regard to the supplies of timber, Sir Robert Oliver stated that in his opinion open competition was the best method for obtaining them, “ unless the Bheel Rajah can be induced to give the preference of his supplies to Government, on nearly similar terms to those entered into by the Terroopaad and Collongode Rajahs.”

184. On the 10th July 1841, the Government of Bombay forwarded the papers noticed in the preceding paragraphs to the Governor's agent, Mr. Elliott, and to the principal collector of Surat, Mr. Simson, with a request for them to report what mode they would propose for securing to Government a direct supply of timber from the Northern forests, and whether in their opinion any measures were practicable for protecting the forests from waste, and for securing an easier transit for the timber to the coast. These gentlemen replied, in August following (1841,) that the whole subject proposed for their consideration embraced a variety of important particulars, to review which with any degree of accuracy, so as to shape out a practicable general plan for attaining the purpose desired, would require some time.—Information would have to be obtained as to the mode in which timber was procured; what were the obstacles to its transit, whether in the nature of fees levied *en route*, or local impediments; whether the roads which existed were the best and shortest, and whether water-carriage could not be substituted with advantage over much of the distance between the forests and the ports. The most productive tracts being leased to farmers, it was of consequence further to devise some means whereby they may be either restored to the proprietor, or taken under the direct control of Government; and it would be necessary to consider the expediency of purchasing the right to levy fees on timber in transit, as the actual price to the dealers was composed merely of these fees added to the cost of cutting and conveying the timber to the principal markets, which were Bulsar and Mungaldass. Messrs. Elliot and Simson had therefore deferred their final report to Government till receipt of information, for which they had applied to the Resident at Baroda and the Collector of Kandesh, as to the fees levied on timber in transit by the Guicowar and other chieftains having forest-lands, and as to treaties or deeds executed with their consent or knowledge, transferring forest-tracts to farmers or other temporary tenants.

185. In the mean while Messrs. Elliott and Simson having ascertained that the Karribell forest, already described, had been leased out for a period of six years, from 1836, for the trifling sum of rupees two thousand, recommended that the Government should extricate the proprietor, the Bheel Rajah, from the hands of the farmers of the forest, and from money-lenders to whom his estate also had been mortgaged, and then conclude some permanent arrangement by which the rajah's interest might be consulted and the important object of the Government

at the same time promoted. But as the season was then far advanced, Messrs. Elliot and Simson proposed that Mr. Boyce should try his plan for obtaining timber direct from the forests, through the coolies or ryots, without the intervention of the dealers, and that he should be allowed a salary of two or three hundred rupees per month to enable him to visit the forests and select the trees for felling, and provide for the protection and nurture of those trees that might not be fit for immediate use. This arrangement Mr. Boyce calculated would cause a saving of about thirteen thousand rupees to Government during the season, if the usual supply was taken, as during the two preceding years, timber to the value of a lac of rupees had been purchased on account of Government, and the dealers had realized from the sales a profit of 50 per cent. on their advances to the coolies.

186. Adverting to Sir Robert Oliver's opinion in favor of an open competition in the market for obtaining supplies of timber for Government, Messrs. Elliott and Simson remarked that the dealers were banded together, and would league to defeat any attempt to reduce their profits. The proof of this was the uniformity of the agreements tendered by the several dealers, their reluctance to give information about the trade, and their universal and determined opposition to a new and fairer measurement of the timber which was proposed by Mr. Boyce.

187. On the 4th September 1841, the Government of Bombay sanctioned the introduction for one year of the plan proposed by Mr. Boyce for obtaining supplies of timber, and authorized Messrs. Elliott and Simson to communicate with the native chiefs to whom the forests belonged, with a view to effect the proposed arrangements. On the same date an application was submitted to the Government of India for their approval of these proceedings. The Government of India, on the 29th September 1841, intimated in reply, that although they felt disposed to prefer the plan suggested by Sir Robert Oliver, of trusting to public competition for a supply of timber, they would not, for the reasons set forth in Mr. Boyce's memorandum, object to that officer's employment, in the manner directed by the Government of Bombay, as an experiment; but they desired to be informed of the result of his proceedings as soon as the collection and purchase of the timber of the season had been completed.

188. In April and June 1842, the Government of Bombay addressed the Government of India, and submitted a long correspondence on the subject of Mr. Boyce's arrangements with the owners of the Karribell,

Peepree and Rhamboj forests for securing to Government the right to all timber in them, and to the usual fees therein leviable, but no report was made of the result of Mr. Boyce's efforts for obtaining timber direct from the foresters instead of through the timber dealers.

189. The Karribell forest was leased to the Government for an annual payment of rupees 2,300, the Peepree forest for an annual payment of rupees 1,800, and the Rhamboj forest for an annual payment of rupees 850, or all three forests for rupees 4,950 annually. These terms were considered very favorable, as independently of the unlimited supply of fine Teak timber which they contained, there was a variety of other valuable productions from which a revenue was derivable. These were described to be,—

Tunnus timber.	|	Sandal-wood.
Huldaree timber.	|	Black-wood.
Bamboos and their seeds.		

Moordar Singh, Kaephul, Jerkuchurah,	}	Drugs in great demand in the Native pharmacœia, and very expensive.
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190. The Bamboo it was stated bore at certain seasons a description of seed which was eagerly sought by the natives, and realized a considerable sum: it resembled wheat, and when ground made a delicate kind of bread. It was supposed that a careful examination of these forests would disclose other productions of value in a commercial as well as in a scientific point of view, and at the same time allow of a large quantity of land within their limits being brought into cultivation. With this view Mr. Boyce intended making a survey of the country leased to the Government. In the mean while, arrangements were made for facilitating the transport of the timber, for the conservation of the forests, and for levying the fees and transit duties at the different passes, but as the information on these points in the correspondence submitted, is very meagre, the measures which were taken cannot be explained fully. Mr. Boyce's salary was proposed to be raised to rupees 700 per month as timber agent and conservator, and an establishment, including an assistant conservator, was recommended to enable him to manage the forests. These measures and the salary and establishment for Mr. Boyce were sanctioned by the Government of India in August 1842, after which date there appears no further correspondence on the subject of these forests.

191. The foregoing correspondence is the last among the papers relating to the forests of Madras and Bombay, which have been traced in the records of the Secretariats of this Presidency.

W. R. BAILLIE.

Bengal Secretariat, 1851.

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RELATING TO THE
TEAK FORESTS,
IN THE
TENASSERIM PROVINCES,
AND IN THE
MADRAS AND BOMBAY PRESIDENCIES.

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A P P E N D I X.

INFORMATION ON THE FACILITIES AFFORDED

BY

THE PORT OF MOULMEIN,

FOR

SHIP BUILDING.

BY COMMANDER E. P. HALSTED, R. N.

AUTHORITIES.

E. A. BLUNDELL, Esq.,

Commissioner of the Tenasserim Provinces.

J. W. HELFER, M. D.,

Employed by the Indian Government to examine the Tenasserim Provinces, with the view to the development of their natural resources.

CAPTAIN MARSHALL,

Late of the Bengal Native Infantry, having an interest in the forests.

MR. CHARLES BREMNER,

Employed by the Bengal Government to superintend the construction of a large steamer building at Moulmein for the Hon'ble Company.

MR. C. J. SUTHERLAND,

Agent for the house of Cockerell and Co., superintending the Building Establishment at Natmoo.

CAPTAIN WARWICK,

Formerly employed by Government in the forests: the first European who worked them, and the founder of the Natmoo Establishment.

MR. R. WALES,

A resident of Moulmein, having an interest in the forests.

MOULMEIN CHRONICLE,

The extracts from which are selected by Mr. Blundell.

MY OWN OBSERVATIONS.

M A T E R I A L.

TEAK-WOOD.

Question 1. For how many years have you had means of observation on, and experience in the use of the Teak of Moulmein, for the construction of ships?

Mr. Bremner.—I have had an experience of nine years; eight years at Calcutta as builder and superintendent with the late Mr. James Kyd and the Calcutta Docking Association, and one year as Superintendent for the Hon'ble Company, over three packets, one bark, and a steamer of 769 tons.

Mr. Wales.—My experience in the forests commenced in 1832, shortly after which I commenced building, but on a small scale, employing myself more as a forester and timber merchant.

Captain Warwick.—Eleven years.

Q. 2. What are the qualities, good and bad, which you have found it to possess for such purposes?

Mr. Bremner and Captain Warwick.—Its qualities I consider inferior to none, with exception of some Java Teak I had to convert in 1832. It is valuable for its lightness; its freedom from the attack of the white ant; the small quantity of pyroligneous acid it contains, and consequent fitness for iron fastenings; its length and size, its flexibility and toughness; and above all, its great durability;—qualities constituting it an invaluable timber for ship-building.

Mr. Wales.—Its good qualities are its durability and buoyancy, withstanding better than any other wood the effects of a tropical climate. When green, it is open to the attacks of both land-slug and marine worm; but not so in its seasoned state.

Q. 3. What are its qualities compared with those of the Teak of Malabar?

Mr. Bremner.—I have not had so much experience in the Teak of Malabar, but from what I do know of it, I have no hesitation in saying that the Moulmein Teak is in every respect equal, in some, superior to it. Its flexibility is greater as 900 is to 850, its specific gravity less as 43 to 45, it is more kindly to work, and is freer from knots and rindgalls than Malabar Teak.

Mr. Wales.—The Malabar Teak is of greater specific gravity and darker color, resembling the wood of the lower grounds in these Provinces. In durability, I consider them equal.

Captain Warwick.—I supplied to the Commissary of Ordnance at Madras specimens of Moulmein Teak for trial comparatively with that of Malabar.

Q. 4. State the result of any actual trial of its strength and other qualities to which it has been subjected?

Mr. Bremner submits the following statement:—

Report of Experiments on the Strength of 10 specimens of Teak-wood received from Moulmein, 12th December 1839.

APPENDIX.

Date.	Number of Specimens.	Nature of the Wood.	Length.		Dimensions Square.	Specimen's Weight.			Rent with			Broke with lbs. including Scale 50 lbs.	REMARKS.
			Feet.	Inches.		Lbs.	Ozs.	Drams.	Half-Cwts.	Half-Cwts.	Half-Cwts.		
1839. December 18th,	2	Attaran,	3	0	1½	1	12	7	8	10	12	926	{ Broke ½ a minute after the 16th weight.
	3	Ditto,	3	0	1½	1	13	4	8	10	13	926		Ditto 1 minute ditto 16th ditto.
	5	Hill-wood, Salween, Karennee,	3	0	1½	1	12	5	8	10	12	926	Ditto ½ ditto ditto 16th ditto.
	6	Ditto ditto,	3	0	1½	1	11	7	8	10	12	926	Ditto 2 ditto ditto 16th ditto.
	1	Attaran,	3	0	1½	1	12	14	8	10	12	870	Ditto ½ ditto ditto 15th ditto.
	4	Ditto,	3	0	1½	1	12	8	8	10	13	870	{ Cracked in ½ a minute with 14 weights, and broke 1 minute after the 15th weight.
	9	Hill-wood, Salween, Karennee,	3	0	1½	1	11	11	8	10	13	870	{ Broke ½ a minute after the 15th weight.
	10	Ditto ditto,	3	0	1½	1	12	1	8	10	13	870	Ditto 3 minutes ditto 15th ditto.
	7	Hill-wood, fallen tree, ditto,	3	0	1½	1	13	10	8	10	13	758	{ Cracked in 4 minutes with 12 weights, and broke ½ a minute after the 13th weight.
	8	Hill-wood, ditto,	3	0	1½	1	11	8	8	10	85	646	{ Broke when putting on the 12th weight.

Malabar Teak reaches only 850 lbs.

Q. 5. State what means of observation on its durability have been afforded you by ships of its construction coming under your inspection or observation for repair ?

Mr. Bremner.—It has not been so long in use as to afford much opportunity for examining its durability ; but for these nine years that I have been in the habit of repairing ships of its construction, none have exhibited signs of decay.

Mr. Wales.—I have known of no Moulmein-built ship coming for repair from defect of material.

Captain Warwick.—I mention the following fact in proof of its great durability. The trunk of a large tree was found by me in the forest, it having been blown down. Its roots and branches had decayed away so as not to leave remaining a vestige of them. The ground whence it had fallen had returned to its level ; about 6 inches of each end of the trunk which was decayed was cut off, and the remnant found as sound as any wood in the forest. This tree must have fallen at a time when only the Teak is blown down, *viz.*, during the S. W. monsoon, when the rains have moistened the earth at the roots, and the branches are heavy with the large leaf ; its sap must therefore have been up, and I consider it to have lain at least 40 years.

Q. 6. Have you always found a ready supply of it for the construction of ships you have had to build ?

Mr. Bremner.—In my experience, the supply of timber keeps pace with the demand. I have known no difficulty in procuring it. Having forests of my own, and a stock on hand, I have never wanted supplies for the few ships I have built, even when loading.

Mr. Wales.—Ships at once for exportation, detention occurring only when a particular size, for a particular market, has been demanded.

Captain Warwick.—Always,—having extensive forests of my own at work.

Mr. Sutherland.—Since the establishment at Natmoo has been in the hands of Messrs. Cockerell and Co., there has been there at all times an immense supply of timber, over and above that required for construction, or demanded for exportation. To exhibit the size and quantity, which could be supplied from hence,—in February last, 700 tons of Teak, in squared logs of from 1½ to 3 tons' weight each, were sent to England for the British Government.

Q. 7. What time has elapsed between the demand and supply of the largest quantities (stating them) you have required, and have such supplies been of sound and well seasoned wood ?

Mr. Bremner.—I have not been in the habit of purchasing or ordering timber to time ; but what has been brought has usually been good and well seasoned wood, a matter easily detected, as it then floats one-third out of water ; unseasoned it will not float at all.

Mr. Wales.—Assuming the trees to be already killed, and notice given in October, (end of the monsoon), by the following October a very large supply could without fail be procured, crooks and planks, for large ships, sided and sawed in the forest.

Captain Warwick.—Supplies of large round timber are made yearly. Of plank and thick stuff, in four months after order issued.

Mr. Sutherland.—Supplies to this establishment (Natmoo) are continually arriving throughout the season. 400 trees have just been received, and notice has reached me that two rafts, one of 360 trees, and one of 1,200 crooks are now on their way down.

Q. 8. Is the supply of crooks equal to, and of equal quality with that of straight timber ?

Mr. Bremner.—The supply of crooks is not so plentiful as that of straight timber ; but they may be had in sufficient quantities if proper measures be adopted. Their quality is superior, being harder, tougher and closer in grain than the straight timber.

Mr. Wales.—The supply of crooks I believe to be equal to that of straight timber, but it might be increased. In qualities I consider them equal, durability being if anything in favor of the crook.

Captain Warwick.—The quantity of crooks preponderates. In quality, those of the northern forests, on the Gyne, and formed of the trunks of trees, are superior to those of the Attaran formed from large branches, which are more brittle.

Q. 9. Will you state the average size of the timber you have been supplied with, and also the size and length of the largest you have known ?

Mr. Bremner.—The largest mast-pieces run as long as 85 feet, and 8 and 9 feet in girth ; keel pieces, from 38 to 50 feet long, squaring from 15 to 24 inches ; logs for sawing from 26 to 30 feet long, and from 5 to 7 feet in girth ; and loozars from 16 to 18 feet long, and from 15 to 18 feet in girth. These latter are trunks of immense trees cut into lengths (generally four) by natives who possess not the means of transporting them whole. This timber is much valued, as it does not split in sawing nor cast in working.

Mr. Wales.—No tree under 18 inches diameter may be cut ; from this they range to 8 and even 9 feet in diameter, though such trees are rarely sound. From one such, however, which I once converted in the forest, I procured 13 pairs of bend plank, 30 by 12 + 6. I have brought down pieces of 72 feet long, squaring 26 inches, and have known some of 85 feet in length shipped from hence. Average short wood 16 to 18 feet long, 2 to 3-6 feet in diameter. Average long wood 30 upwards, 18 to 24 inches square. (Mast and keel-pieces not included).

Captain Warwick.—Average size from 30 to 50 feet long ; mast-pieces, from 60 to 75 feet long, and from 5 to 9 in girth. I have seen many in the forests measuring 6 feet in diameter.

Mr. Sutherland.—The largest I have ever known was a piece shipped from this yard in 1833, measuring 103 feet in length, and squaring 26 inches at its small end.

Q. 10. Of what size have been the largest ships you have constructed or known to be constructed of it ?

Mr. Bremner.—I have constructed of it, and superintended the construction of ships from 160 to 770 tons, of 5,000 tons in all, and have known ships of 1,400 tons built of it.

Mr. Wales.—I have built myself nothing larger than 140 tons. The "Northumberland," of 800 tons, is the largest built here.

Captain Warwick.—700 tons is the largest I have built at Natmoo.

Q. 11. Are you of opinion, founded on knowledge and experience, that a ready supply of timber fit in every respect for the construction of the largest ships of war could be procured on demand at Moulmein ?

Mr. Bremner.—I have no doubt, but that if proper time were allowed, and despatch used, timber might be collected here in quantity and quality adapted for the construction of the largest men of war.

Mr. Wales.—Certainly not on demand. At least twelve months must elapse, great care and attention be used in the collection, and advances made.

Captain Warwick.—Certainly; the only difficulty being that of providing timber for the floors and second futtocks; it would be necessary to send into the forests expressly for this timber, at a distance of about 60 miles from Moulmein, and care would have to be used in the cutting of it, as from the slovenly way in which the Burmese cut crooks, not ten would be found serviceable out of every hundred.

Mr. Sutherland.—From 15,000 to 16,000 tons of timber of all sizes are now lying in the creeks and on the premises at Natmoo, a great deal of which is in every respect adapted for such a purpose.

Captain Halsted.—My own observation on the spot fully confirms this last statement.

Q. 12. Within what time does your experience lead you to believe that a supply of 3,000 tons of such timber could be procured at Moulmein?

Mr. Bremner.—If advances were made, and liberal contracts entered into, I have no hesitation in saying, that if 6 months' notice were given, before the setting in of the rains, that 3,000 tons of such timber would arrive in 18 months, or two seasons.

Mr. Wales.—A demand and ready advance would materially increase the supply. In 1838 myself and a person connected with me exported an amount considerably larger than that specified.

Captain Warwick.—Should it be desired to procure it from the forests, and independent of the supply in Moulmein (depending on the number of ships constructing there at the time), I should say one year.

Mr. Sutherland.—The statement just sent to me by the surveyor of the forests attached to this establishment (Natmoo), informs me that 7,400 trees, nearly one-half of which have been killed for 3 years, are now either felled or ready for felling, and that an amount of many hundreds have been also killed this year.

Q. 13. What is the present price per ton in Moulmein of the best converted and unconverted timber?

Mr. Bremner.—The present price in Moulmein of picked converted timber is from 28 to 33 rupees per ton.

Mr. Wales.—Short unconverted 16 rupees, long unconverted 25 rupees per ton; short converted 20 to 25 rupees, long converted 30 to 37-8 per ton. (Scantling not less than 3×12 .)

Captain Warwick.—Bazaar timber, short and long, from 30 to 35 rupees per ton.

Q. 14. Do you apprehend that a demand such as that proposed in Q. 12 would raise—and if so, to what probable amount—the price per ton in the Moulmein market?

Mr. Bremner.—A demand such as that alluded to would raise the price from 35 to 40 per cent.

Mr. Wales.—Let the advances of demand be made gradually, and with circumspection, and I should apprehend no great rise in price; but at any rate in no case exceeding the price it maintained from 1829 to 1834, *viz.*, 50 rupees per ton.

Captain Warwick.—I apprehend it would, to 1 Rupee per cubic foot. From my experience in working the establishment of Natmoo, I should say that timbers, plank, &c., of the best quality for large ships, could not be supplied for less.

Q. 15. Has the quantity of Moulmein timber in demand, both for construction on the spot and for exportation, increased of late years, and if so, has it been attended with a rise in the price ?

Mr. Wales.—I conceive the supply of late years to have been greater than the demand, the large exports of 1837-38 having overstocked the markets of Calcutta and Madras, and caused the present low prices.

Captain Warwick.—It has increased to a great degree for construction, and for such purpose is still increasing, but not for exportation. There has been no rise of price, but for very long and superior timber.

Q. 16. Can you state in tons or loads the quantity of timber consumed or exported from Moulmein during the last two years, 1838-1839 ?

<i>Mr. Blundell.</i> —Export from 1st May 1838 to 1st May 1839, ..	5,895 tons.
Ditto do. 1839 to do. 1840,	5,580 ..
Tonnage of Ships launched in 1838,	1,500 ..
Ditto do. 1839,	2,100 ..

Note.—There are now on the stocks about 2,500 tons, and there have been constructed since 1830 about 50 vessels of from 30 to 800 tons, amounting in all to 15,000 tons.

Q. 17. What are the quantities, qualities, and price of the Teak from the Shan country, compared with that of the Moulmein forests ?

Mr. Bremner.—I have not paid attention to their relative properties ; in my estimation the Teak of the Attaran is the best which reaches us.

Captain Marshall.—Compared with that of Moulmein, the Shan Teak is in quantity in the market less, in quality better, and in price higher, being generally sound, fine-grained, straight timber.

Mr. Wales.—It is straight, clear and free, and in quality on a par with our own best hill timber, but on exposure under the process of conversion, I think it more apt to split ; this may be from some fault in the killing it.

Captain Warwick.—In qualities it is very superior.

Q. 18. Is the quantity of Teak from the Shan country increasing or otherwise in the Moulmein market ?

Captain Marshall.—It is now four years since the first Shan Teak was brought into the Moulmein market ; its quantity has since increased yearly, though not much was brought down last year.

Mr. Wales.—Undoubtedly increasing, and from report likely to do so to a still further amount.

Captain Warwick.—Increasing to a great extent.

Q. 19. Do the obstructions on the Salween river seem to preclude an extensive supply of Teak from the Shan country ?

Captain Marshall.—The obstructions on the Salween are trifling ; there are difficulties, however, in reaching the Salween by the smaller streams, except in the rains.

Mr. Wales.—By no means ; the persons employed in conducting the timber over them are daily acquiring more knowledge, experience, and confidence.

Captain Warwick.—Not in the least ; it can be sent down over them at the lowest ebb of the river, and as the water rises in the river at that place 70 feet in the rains, the rocks are then overed, and strong eddies alone are found at the falls.

Q. 20. On what terms are the British allowed to cut timber in the Shan country, and are they so guaranteed as to justify dependence on the forests for a supply ?

Captain Marshall.—Permission from the chief Shan of the district is first necessary ; it is never refused on his receiving suitable presents. An impost of 1½ rupee is then imposed for each tree taken away ; I hold a grant on these terms, and consider it guaranteed to me.

Mr. Wales.—I am not aware of any guarantee beyond the good faith of vendor and purchaser, particularly the latter.

Captain Warwick.—At present on payment of 1½ rupee for each tree cut ; I hold the forest of Melongy on these terms, but without any security, and at the will of a despotic government.

Q. 21. What is the distance of the Moulmein forests from that place, and what their extent ?

Mr. Wales.—The nearest Teak districts commence two good spring-tides above Moulmein ; thence a light, well-manned canoe may pull for 8 days through them without reaching their termination. Their real extent in fact, in the absence of any survey, is not known. My own impressions from experience are, that more timber exists in the interior than has as yet been discovered on the river banks. (*Note.*—This refers to the Attaran alone.)

Captain Warwick.—The Attaran forests, from 30 to 100 miles ; the Thoung-yeen from 130 to 250, and between them the forests of the Gyne. I have travelled throughout the whole extent of country, as well as up and down the creeks and rivers of the province.

Dr. Helfer.—The Teak forests of Tenasserim are limited to the province of Amberst, the tree not being found southward of 16° N. ; from that they extend to the northern frontier in 17° 40' N., and shunning the immediate neighbourhood of the coast, average a breadth of from 40 to 50 miles. They may be divided into three several districts, situated on the rivers Salween, Thoung-yeen, and Attaran ; the latter is the nearest to Moulmein, but for that very reason it has been wrought for the longest period. The most convenient timber for transport cut, and at present the Attaran forests in use, are nearly as distant from Moulmein as those of the Salween and Thoung-yeen, a journey by water of several days.

Q. 22. Are there localities in their neighbourhood of that soil and situation which would enable their extent to be increased by planting, and if so, to what probable extent ?

Dr. Helfer.—Yes, doubtless many. A plain towards the northern boundary of the Provinces, of great fertility, covered with the finest forest trees, of a light, sandy soil, mixed with clay, and everywhere intersected with rivulets, is admirably adapted for the planting and growth of Teak. It extends 80 miles to the S. E., and is from 3 to 8 miles in width. It would admit of a plantation of many millions of trees.

Mr. Wales.—Yes, to the greatest extent imaginable ; but the young plantations must be looked after, to prevent the depredations of the wild elephant.

Captain Warwick.—There are, to a great extent; but the young plantations should be secured from the yearly fires, by cutting through them roads or openings. I have seen a young plantation of firs in a patch or island formed by the diverging and reuniting of two elephant roads, perfectly protected, while all around them was consumed.

Q. 23. Are you aware of the time required to bring the Teak-tree to maturity?

Mr. Wales.—I am not; but I know that its early growth is very rapid.

Captain Warwick.—From my continued observation of Teak-trees, I should say 70 years; many known to be upwards of 100 years old, reaching a height of 150 feet and a diameter of 5 or 6 feet, are now standing, but they are over-grown and their timber brittle.

Q. 24. On what terms are individuals allowed to cut timber in the forests, and are those terms alterable, or the permission resumable at will by the Government?

Moulmein Chronicle.—Government give permission to cut on any hitherto ungranted spots which may be pointed out, and will take their duty on what is brought down, but they do not give the spot, and the permission is revocable.

Mr. Blundell.—The permission itself to cut timber, being revocable at will by the Government, the terms of such permission are alterable also. But the right has never yet been enforced.

Mr. Wales.—A duty of 15 per cent. in either cash or kind, at the option of the cutter, is levied on the timber brought to Moulmein. I am not aware whether these terms are alterable or not, but any alteration (save a reduction of duty), or resumption, would involve, I should say, a breach of faith on the part of the Government, and an injury to private interests.

Captain Warwick.—By paying 15 per cent. on a nominal market rate, I should say—in the case of Burmese and others, who merely lay out the amount of 1,000 rupees yearly, and do 10,000 rupees' worth of harm, having no establishments erected for either conversion or ship-building—that it was. But where immense sums have been laid out in establishments for those purposes, and whose value to their proprietors without the forests attached to them would be destroyed, I should say that Government in justice could not resume the right.

Q. 25. Are the rights of the Government sufficiently enforced in the forests to secure them in their present valuable state, by preventing the disforestation of the land from wanton and improper cutting of the timber, or other cause?—If not, state what evils you know to exist in this particular, and any remedy you may have to suggest for them?

Dr. Helfer.—The unrestrained liberty accorded to any individual to appropriate to himself any unoccupied forest, contributed without doubt in the first instance to the rapid prosperity of Moulmein. But it cannot be denied, that a continuation in the same system will lead, in a few years, to the extermination of all available Teak forests, deprive Moulmein of this valuable resource, and render Calcutta once more dependent on a foreign importation of Teak timber. It cannot be expected that individuals whose only care it is to render themselves independent in as short a time as possible, should care about the preservation of the forests; and experience has taught that by far more trees are destroyed than used. A particular survey of the Teak forests; well-drawn lines of demarcation; an improved system of regulations; the appointment of a

respectable European to enforce those regulations; and new plantations laid out in all those places where Teak formerly grew, and whence it is now extirpated, are means necessary to be introduced in order to ensure an uninterrupted supply of Teak timber for the future.

The system at present pursued, of granting tracts of forest land, on the simple tenure of working them, is perhaps open to fewer objections than most others, but without supervision it is open to abuse in more than one way; first by destroying young wood, and again by trespassing beyond allotted lands, both leading to such evil results, that in the end our dock-yards will have to depend upon Rangoon for their supply of timber. The few Karens who inhabit the plains in the neighbourhood of the forests, are engaged in husbandry; it therefore becomes necessary to transport workmen in canoes from Moulmein, the forests being accessible only by water. That these men commit great depredations there can be no doubt, not only in woods which their employers are privileged to work, by destroying half-grown trees, but also by entering and committing the same offence in the allotted lands of others. This great evil demands restrictive measures of a severe nature imposed by Government in order to put an instant check on it, and in regard to it, I am prompted to make the following suggestions as a remedy,—first, a person of enterprising habits should be employed in exploring and making a complete survey of the forests, his attention being directed to every part of the subject,—the probable age, size, and situation of each forest, its quality of timber, and nature of soil, with a view to classification: besides Teak, there are other trees perhaps equally valuable for their timber; their durability, strength, and fitness for use, should be proved from experiment: Secondly, each grant-holder should be required to place two or more men under the orders of the Superintendent, (their names registered by the Police Magistrate,) to give information respecting boundaries, and to receive orders respecting the marking, felling, and planting of timber. The grant-holders already hold their forests on too easy terms, yet they would doubtless not fail to oppose any improvement which should go to curtail their enormous profits. Many of them unfortunately possess neither skill, capital, nor respectability; with slender means and imperfect notions of business, they are bent only on acquiring rapid fortunes, and anything which interferes with that purpose is not likely to meet their approval.

Moulmein Chronicle.—The Teak forests are the property of the Government, but it has thrown them all open without reserve, both to Natives and Europeans, being satisfied with only the paltry consideration of a small duty on the timber when brought down the river and arrived at this place. Hitherto the Government has maintained a native superintendent, with peons, writers, &c., to see that the regulations are faithfully observed. We do not mean to imply that this establishment is inadequate, or that the conditions of the licences are unfulfilled. But when we consider the importance of preserving timber of a certain growth, and of planting others where the ground has been made vacant by the cutting of mature wood, we cannot but think that the question of improvement in the control which the Government exercises over the forests is one which might well be entertained. What may be the demand for Teak timber when it becomes generally known among commercial men throughout India, that good Teak-

wood ships can be built at Moulmein at about one-half or two-thirds the cost at which they can be built at any other port in India, it is impossible to conjecture. It would be quite contrary to the natural course of mankind, in their commercial pursuits, were they not to turn their attention to the dock-yards at Moulmein as the most advantageous place for building ships, and there is nothing in fact that we are able to discover to prevent Moulmein from surpassing any other place in India for building ships, In this point of view, the Teak forests, though extensive, are not invulnerable, and in this point of view also, the importance of keeping up the growth of timber becomes a subject of too great importance to be longer disregarded. At present it is well known that the large profits arising from the cutting and selling the timber of the Teak forests, are confined to the purses of a few enterprising and industrious individuals. We of course do not object to this. If the Government throws away a jewel, those who pick it up may well be congratulated on their good fortune.

Mr. Wales.—A good survey, accompanied by the labours of scientific gentlemen in other branches, is a great desideratum, and would no doubt amply repay its expenses, not only as regards Teak, but other timber and natural resources.

Captain Warwick.—They are not sufficiently enforced in my opinion. The Burmese who undertake the cutting of timber on their own account, not having sufficient capital to employ elephants enough for porting, are in the habit of felling small trees not arrived at full growth. For the same reason they are accustomed to cut up into pieces (generally four) the largest trees of 70 feet and upwards in length; the pieces are called loozars, and fetch in the market at Moulmein about 8 rupees each. The whole piece would have been worth 100 rupees at the very lowest market price. The Government is by this means very much curtailed of its duty, as you will perceive, thus,—

		R. A. P.
4 pieces at 8 Rupees each	= 32,	at 15 per cent. duty ... 4 11 2
1 piece	= 100,	at do. do. .. 15 0 0

The most valuable timber for masts, &c., is rendered totally unfit for any ship building purpose; the forests are cut to disadvantage, and the mischief is irremediable. I should venture to suggest, that some proper person be appointed as Purveyor, in order to point out and mark for killing and felling all trees of full growth or good age, in the allotted lands of individuals to whom permission has been granted to cut timber.

Q. 26. Is there any, and if so, what extent of forest for the timber of which water conveyance is available, but which has been as yet ungranted?

Mr. Blundell.—There is no known part of the forests answering to this description, to which permission to cut has not been extended. But the forest lands have never yet been surveyed.

Captain Warwick.—Yes; the forests above Kyoon-Kyoung on the Attaran; the forests above Marrawaddie, in fact throughout the whole of the Thoung-yeen river, where the Burmese have just commenced spoiling, by killing timber not arrived at its full growth.

Q. 27. Have you any personal interest in any of the Moulmein Teak forests?

Mr. Wales.—I have had since the year 1832.

Captain Warwick.—I have in the forests of Pando, Limbro, and Cazine, on the Gyne river, where the principal crooked timber of the Provinces is found.

Mr. Sutherland.—Messrs. Cockerell and Co. possess twelve forests principally on the Attaran, attached to their establishment at Natmoo, eight of which are at present in work.

Q. 28. Have you any and what personal acquaintance with, and experience in the present mode of working the forests ?

Mr. Wales.—Since the year 1832 I have yearly spent many months in the forests, superintending their working myself.

Captain Warwick.—I have been constantly in the forests for these last eleven years.

Q. 29. State the method at present in practice of killing, felling, seasoning and conveying the timber, with any evils it entails ?

Mr. Wales.—The method of working the forests at present are purely native, and in my opinion both injudicious and involving considerable waste, with a deterioration of the quality of the timber. The tree is girdled through the sap, about 3 feet above the ground, just before the rains, when the sap is low, and allowed to stand in that state for 2 or 3 years. It is then felled, and from its dry state, out of perhaps 5 or 6 limbs which had been reckoned on for crooks, the whole of them will perhaps be found shivered and the trunk itself shaken from end to end internally, and only visible under the process of conversion. Were the system in practice in Europe introduced, I hesitate not to say that the forests would produce double the quantity of timber they now do. The most material objection to such an alteration is the greater liability of the timber, when down, to destruction by the large annual fires, some times the result of accident, more frequently of design, in order to cover some breach of contract,—the felling and conveying of timber being always done by contract.

Captain Warwick.—The timber is killed and seasoned by cutting through the sap all round the tree, and allowing it to stand for two years. The bark of the Attaran, but not of the northern timber, then falls off. The tree is cut down and will float; if of large size and the property of Burmese, it will generally be cut into pieces as described in answer 25. But where an establishment of elephants is kept, these animals are employed in drawing the timber to the water on the large carriages used during the dry season for that purpose, and capable of conveying a tree of 5 or 6 tons measurement weight over the wet ground, during the S. W. monsoon; it is dragged by from 4 to 6 elephants. Where large timber is so situated as to make it very difficult to drag, sawyers are generally employed for its conversion on the spot. The terms of contract with these people generally run to the purport that the converted timber shall be 30 feet in length, when the custom is (from want of possessing sufficient means to raise the piece whole for cutting) to cut off and convert the 30 feet, the remaining part being rendered worthless and left in the woods. The manner of felling on the Attaran is also peculiar. A stage 6 feet or more high is raised, and the tree cut from thence at a height of 8 or 10 feet from the ground. The excuse always assigned for this practice is, that the trees are always more or less hollow near the ground,—an excuse admissible only as regards very old and over-grown trees, which should have been cut 40 years since, and no justification for a practice, most wasteful, as regards the sound tree equally subjected to it. This is always a contract job, and the fact is, that the Teak being a tree which spreads very much towards its roots, the smaller part of the tree is selected for cutting. To the northward, the tree is always cut close down.

Q. 30. State any suggestions you may have to make for the remedy of these evils, specifying any which actual experiment may have proved to be effectual?

Mr. Wales.—I know of no tree so easily seasoned from a green state as the Teak, and I would act with it on this principle—"Fell your timber, and the quicker you can season it, the more of its natural qualities it will retain." I much doubt if any difference of quality could be shown to exist between timber seasoned in the log and that seasoned after conversion; I strongly advocate the latter method where practicable. Fell a green Teak tree, and convert it at once into plank, beam, &c., immerse it in water for 6 or 7 days, haul it up on the dry sand-banks abounding on the river, and in 6 or 7 days more your timber will float, without having lost a particle of its good qualities. The water will displace the sap, and in its turn will be dried off by solar evaporation. I do not say that timber so treated would become thus thoroughly seasoned, but it may be conveyed away in this state, and piled in a place of safety for such purpose, as is customary in England. I have known timber converted green, and so treated, to float as soon as that converted from the seasoned log; but it has occurred but rarely, and then accidentally,—timber so converted being seizable by Government.

Captain Warwick.—I would venture to suggest that an immediate stop be put to cutting up of mast-pieces into loozars; to the felling of young trees not of proper age; and to the wandering manner the Burmese at present have of proceeding to all parts of the Thoung-yeen forests, cutting all the trees which one or two elephants can pull, and cutting into peices all the said elephants cannot. And if it be intended to perpetuate the forests by planting, roads must be cut and kept clear, through all the young plantations, to check the spread of the large annual fires.

PINE.

Q. 31. Is the Pine of Tenasserim of size and quality to make it valuable for masts, spars or plank; and is water conveyance available for it?

Captain Marshall.—Yes, large enough for masts; and water conveyance is available for it in the rains.

Captain Warwick.—Yes, large enough for spars and plank, but not for large ships' masts. The water carriage is about 120 miles down the Thoung-yeen, and thence the same distance on the Salween, to Moulmein.

Q. 32. Of what extent are the Pine forests, and in what part of the Provinces situated?

Captain Marshall.—I have not been over the whole of the Pine forests, but the natives say they are extensive, situated to the eastward on the banks of the Thoung-yeen river.

Captain Warwick.—The forest runs in a S. E. direction across the Thoung-yeen, a day's march above the village of Marrawaddie. It is situated about 3 miles westward of that village, which is on the Thoung-yeen, and from thence it extends to the southward.

Q. 33. Does the Pine contain that quantity of resinous matter as to make it valuable as a source of supply of tar and turpentine where water conveyance may not be available for its transport?

Captain Marshall.—I think it does.

Captain Warwick.—It does ; a specimen of the turpentine distilled from it was sent to Calcutta, and there pronounced superior in quality to that brought from England. It can be ported on elephants' backs to the Houndrow river, in two days.

Q. 34. Are the Pine forests of the Shan country extensive, and is water conveyance for the timber to Moulmein available ?

Captain Marshall.—They are extensive ; there is water conveyance in the rains.

Captain Warwick.—There are very fine Pine forests in the Shan country, to the north of the road to Zimmè, three days after crossing the Thoung-yeen. The trees are of great height and girth, but there is not water carriage. Pine also begins to show itself on the northern aspects of mountains on the Salween, 30 miles above the mouth of the Thoung-yeen. Ascending the river, north, it increases in length and size, and courses to within 2 or 3 miles of the river.

Q. 35. State what you know of the species, size and qualities of the timber, any actual measurements of them you may have made, and the probable distance by water of the forests from Moulmein ?

Captain Marshall.—The species may probably be the Pineaster. The distance from Moulmein by water about 250 miles.

Captain Warwick.—The Pine has the appearance of the Riga-wood. It is red in colour, tough and full of turpentine. That situated on the Thoung-yeen and within 2 or 3 miles of the river, runs from 1 to 3 feet in diameter, and from 30 to 60 feet in length.

Captain Halsted.—During the stay of the "Childers" at Moulmein, the first spar from the Thoung-yeen arrived there. It was the property of Captain Warwick, and had been sent down by him as a specimen of the wood only, and not proposed as a spar, it having been cut three years before by a native in clearing his grounds ; it ran 36 feet in length and 15 inches in diameter, and fully bore out the character and qualities above stated of it. I examined it in company with the master and carpenter of the "Childers," and took away portions of it for the purposes of further inspection and trial of its properties.

Q. 36. Would the amount of resinous matter in the trees make them valuable as a source of supply of tar, turpentine, &c., in case of inability to transport them ; and would permission to cut them by the British be extended in all probability on the same terms to the manufacture of those articles ?

Captain Marshall.—I think it would ; private individuals would have no difficulty in making arrangements with the Shans, to cut the trees and manufacture tar and turpentine to any amount.

Captain Warwick.—It is my opinion that it would, and that the same terms would be granted for the purpose.

COPPER.

Q. 37. Whence are the Copper-fastenings and sheathings brought to Moulmein for the construction of ships there, and to what price per ton does it amount when used ?

Mr. Bremner.—It is brought from England *vid* Calcutta. Copper bolts fluctuate in price at Calcutta between 50 and 75 Rs. per maund, (82 lbs.), and sheet Copper and nails are unsteady here, at from 45 to 53 rupees per maund.

Mr. Wales.—Prices here have fluctuated between 33 and 55 rupees the maund for sheathing and nails, since 1832.

Captain Warwick.—From Calcutta, amounting to 1,200 rupees a ton.

Q. 38. Are you aware of any other means or route by which it could be procured at a less rate,—if so, state it?

Mr. Bremner.—It is my opinion that Copper bolts, sheets, and nails, might be supplied at Moulmein at a much cheaper rate direct from England.

Mr. Wales.—If imported direct from England, the price would be 25 per cent. less than the minimum I have quoted above.

Captain Warwick.—From England direct, avoiding the double commission, duty and freight; the latter is as heavy from Calcutta here as from England to Calcutta.

IRON.

Q. 39. Whence is the Iron-work used in the construction of ships at Moulmein, brought, and at what expense per ton when used?

Messrs. Bremner and Wales.—Gruff Iron work such as rag-bolts, through-bolts, rings, and light work, is done here. The heavier Iron work comes from Calcutta on order. The price of rough Iron work in Calcutta is from 4 to 6½ rupees the maund. Heavier and finer Iron work from 16 to 25 rupees the maund.

Captain Warwick.—From Calcutta; unwrought Iron is delivered at Moulmein at 180 rupees per ton. Wrought Iron knees, breast-hooks, &c., at 500 rupees per ton.

Q. 40. Are you aware of any other source or route whence it could be procured at a less cost or in shorter time?

Messrs. Bremner and Wales.—The remarks made respecting the supply of Copper direct from England apply equally to Iron.

Captain Warwick.—From England direct, avoiding double freight, commission and duty; but from thence it could not be procured at so short a time.

Q. 41. Does Iron ore exist in quantity in the Tenasserim Provinces, and if so, is water conveyance for its transport available?

Dr. Helfer.—Iron is undoubtedly the commonest mineral throughout the Provinces, being found in one form or another everywhere. The best of all however, in point of quantity, quality and locality, is the Iron ore near Tavoy, an hour distant from the town, on the road to Na-bao-leegua. The hill containing the Iron is 24 miles distant from the river; the space between occupied by rice fields a few feet above the level of high water. The river itself is accessible to vessels of 200 tons burden at that place. A canal from the river's edge could be constructed at little cost; on the banks the smelting furnances could be placed, and supplied with coal from Mergui, or with fuel from the extensive forests on the river: considering all the Iron localities now known in India, there is none which combines all the advantages which might be expected from such an undertaking, in so eminent a degree.

Captain Warwick.—Iron ore exists in all parts of Amherst Province, some within 20 yards of the Salween.

Q. 42. Has any of it been smelted, and if so, what is the per-centage of metal to the ore, and what its quality?

Dr. Helfer.—The existence of this ore has been known to the Burmese before, but as far as I know, it has never been wrought. It is known however, that this ore yields the best bar Iron, and that the per-centage of metal is of the highest known, being considered peroxyd. '69 and protoxyd. '31, yielding on an average from 85 to 87 per cent. of smelted Iron.

Captain Warwick.—None that I am aware of.

COAL.

Q. 43. Is the Coal of Mergui of that quality to make it available for the purposes of either the furnace or the forge ?

Mr. Blundell.—“ I consider the Coal above alluded to, one of the very best Coals for getting up steam in Engine furnaces I have ever in England or elsewhere met with ; and further, that though rather wasteful in the forge, it in many situations will be found useful for smithery purposes.”

(Signed) W. N. FORBES, *Mint Master.*

Mint, Calcutta, 29th June, 1838.

Member of Coal and Iron Committee.

“ When used in the forge, the clear copious blaze is rather objectionable, it wastes the heat, and more Coal is therefore expended, but a very good weld was effected with it in the presence of Captain Forbes. In the same manner the great quantity of volatile matter makes it unprofitable for coking, (yielding but one-half instead of three-fourths its weight). But the coke itself is very close and good, being as free from earthy impurity as much of the English Coal.

(Signed) J. PRINSEP, *Secretary.*

22nd June, 1838.

Messrs. Bremner and Wales.—From the specimens I have seen of it, it is my opinion that it is well suited to the furnace, but not at all to the forge.

Q. 44. Can you state its composition and qualities from experiment and proof ?

Dr. Helfer.—Its quality is one of the best known. Following the division of Dr. Jameson, it belongs to the species “ Black Coal,” sub-species “ Cannel Coal,” massive, resinous lustre, fracture conchoidal, brittle, specific gravity from 1.24 to 1.28. It burns freely with a reddish flame, evolves a great quantity of gas, and is completely clear from Sulphur and Iron pyrites. It can be reckoned equal to the best English Coal.

Q. 45. Does it exist in quantity sufficient to answer a large demand, and is water carriage available for it to the Coast ?

Dr. Helfer.—Though its full extent is but very imperfectly known, it is yet established that the upper stratum alone contains a supply inexhaustible by a century's demand. The thickness of this upper stratum varies from 5 to 8½ feet, and has been almost uninterruptedly traced for 4 miles. A part of the river (Tenasserim) navigable throughout the year for boats is distant from the Coal-fields 22 miles ; from thence to the sea is 68 miles, 41 of which are navigable for vessels of 200 tons burden.

Mr. Blundell.—Since the above report was sent in to Government, other localities in the same district and producing the same species of Coal have been found. One of them on the Great Tenasserim is now being worked by the Government. Barges can

proceed to the mouth of the mine, but till steam power arrives to tow them on their return back against the current of the river, bamboo rafts are the temporary means adopted for its transport. Five hundred tons are now collected at Mergui, and since the mine came into operation, in April last, 600 tons have been brought down.

Captain Halsted.—A different species of Coal, though highly combustible, was discovered, and a small specimen brought down by a native to Moulmein during the stay of the "Childers" there. It came from some part of the Thoung-yeen, and was said to exist there in large quantities; it burnt equally readily as the Mergui Coal, but retained its heat longer, as far as could be judged by the small quantity tried.

Q. 46. At what price is it now procurable at Moulmein?

Mr. Blundell.—Until the mines shall have been brought into more extensive operation, no fixed market price can be placed on the produce,—the quantity at present brought down being considered more in the light of an experiment as yet.

Q. 47. What is the price per ton of English Coal at Moulmein?

Mr. Bremner.—At Calcutta its price fluctuates very much between $\frac{2}{3}$ and 1 rupee per maund. The freight to this place from thence amounts to 1 rupee per cwt., and its price varies from 45 to 50 rupees per ton.

LABOUR.

Q. 48. What is the number of ships of all sizes (naming the extremes of tonnage), at present under construction on the Moulmein river, and the number of artificers employed on them?

Mr. Bremner.—The number of vessels now building on the Moulmein river is comparatively small, amounting to 9, ranging from 150 to 77 tons. The number of Burmese employed is 650, of Chinese 260, Bengallees 60, Madras caulkers 100.

Captain Warwick.—While in progress, a ship of 500 tons usually employs from 100 to 150 artificers daily, besides Chinese joiners; smaller vessels in proportion.

Q. 49. Could that number of workmen be increased on demand from the population at present in and about Moulmein, and if so, to what probable amount?

Mr. Bremner.—No doubt it could to a considerable amount. The Burmese when not demanded for the shipping are employed on other labour, as timber-cutting, house carpentering, &c., and are always within call. The number of Chinese is considerably larger than the demand.

Mr. Wales.—The present high price of provisions seems to point out that already too many are taken away from agriculture.

Captain Warwick.—I should say that the number employed in building during these last 11 years could be doubled at any time.

Q. 50. Could that number be increased from any other parts of the Tenasserim Provinces, and if so, to what probable amount?

Mr. Bremner.—The number could be no doubt increased, though to no very large amount, from Tavoy and Mergui.

Mr. Wales.—I doubt it much.

Captain Warwick.—I cannot say.

Q. 51. Are you aware of any more remote source, whence on demand the workmen at Moulmein could probably be increased?

Mr. Bremner.—More Chinese are procurable from Singapore, Penang, and Rangoon, and any number wanted might be procured from Calcutta, Coringa, Chittagong, and other ports of the Bay.

Mr. Wales.—From the building ports of the Malabar Coast, where for want of employment they are starving and without the means of emigrating, and from Coringa on the opposite coast, where they are said to be as badly off.

Captain Warwick.—From England, Calcutta, and Coringa, on the Coromandel Coast,

Q. 52. Has the number of ships under construction at Moulmein increased, or otherwise, during these last three years? If it has, has an increase of artificers also taken place?

Mr. Bremner.—The number of vessels built in Moulmein has not materially increased these last three years, but the number of artificers has,—the unsettled state of Rangoon having driven the best Burmese shipwrights to this place.

Mr. Wales.—There are fewer vessels now constructing than have been these last three years; but of artificers I should say that their number had increased.

Captain Warwick.—The number has increased, as also the number of artificers.

Q. 53. What are the qualities of the best artificers at Moulmein compared with those of any other natives of India you have known, and compared with an English shipwright?

Mr. Bremner.—The qualities of the best Burmese shipwrights are good; they are hardy, have great personal strength, and are more regardless of weather than those of Calcutta, and are cheerful and obedient when at work. I should consider two Burmese shipwrights as equal to one good English one. The Chinese are excellent for the finer portions of work; they work beautifully neat and true, but slow. One good ship-joiner in England would do as much as three of them.

Mr. Wales.—In framing and planking, the Burmese are little inferior to an English shipwright, though slower. As a body, they are superior to any other natives of India. The Chinese are preferred for laying decks, joiners' work, masts and spars.

Captain Warwick.—There are amongst them some equal to English shipwrights; and generally those who profess to be shipwrights, and who are not of the first description, are much superior to the other natives of India.

Q. 54. What are the qualities of the more ordinary artificers at Moulmein, compared with those of other natives of India, and do they as a class exhibit an increasing ability or otherwise?

Mr. Bremner.—They now exhibit the same superiority over other natives of India, with whom I have dealt, as the superior class do. They are improving fast in ship-building, and I consider the Burmese capable of becoming excellent shipwrights.

Mr. Wales.—No class of men that I know exhibit a greater desire to learn and improve than the Burmese. Unlike the Chinese, they have no prejudices to overcome in the use of tools or mode of work, but readily adopt whatever they are shown and made to understand.

Captain Warwick.—The ordinary artificers are equal to that class in other parts of India, and exhibit increasing abilities.

Q. 55. What are the working-hours per day of the artificers employed in the different building-yards at Moulmein throughout the year?

Messrs. Bremner and Wales, and Captain Warwick.—The working-hours of all classes at Moulmein and Natmoo are from 6 in the morning to 6 at night throughout the year. The Burmese take an hour to breakfast at 9, the Chinese at 11 A. M.

Q. 56. Do religious prejudices or festivals offer any impediment to steady labour; if so, state to what probable amount?

Mr. Bremner.—Both Burmese and Chinese have many holidays, amounting, I should say, at the least to two months out of the twelve.

Mr. Wales.—Very considerable.

Captain Warwick.—They do very materially, but to what amount I cannot say.

Q. 57. Are the tools in use among them efficient, and do they reject or exhibit any great reluctance to the adoption of improvements, either in them or in their ordinary mode of work, which may be pointed out to them?

Mr. Bremner.—Both Burmese and Chinese use good tools, and are willing to adopt any improved method of working you may show them to be such.

Mr. Wales.—The tools of the Burmese are adopted from our own.

Captain Warwick.—No people can use the adze better; the plane and saw they also use well, but not so generally, many preferring the chisel to the latter; but in the use of tools, or method of work, they are perfectly willing to adopt improvements pointed out to them.

Q. 58. Do they require any great amount of oversight to keep them steadily at work?

Mr. Bremner.—Both classes require being closely looked after, as they are very fond of face work, close out but open inside. Under contract they work fast, but hang on at day-work.

Mr. Wales.—Considerable oversight.

Captain Warwick.—A very great amount.

Q. 59. What are the present prices of labour among the different classes of artificers at Moulmein, and would an increased demand for it be probably attended with a rise of price?

Messrs. Bremner and Wales.—The wages of a head Burmese carpenter is 1 rupee a day, of a good man 12 annas (1s. 6d.), a common man 10 annas (1s. 3d.), and a cooly 8 annas (1s.) a day. The wages of all Chinese 1½ rupee (2s. 6d.) a day. I do not think an increased demand would raise these rates if the master shipwright were steady.

Captain Warwick.—The present prices may be thus stated; coolies, 8 annas a day; Burmese artificers, from 1 rupee to 12 annas a day; Chinese, 35 rupees a month. I should say that no increase of wages would attend an increase of demand.

Q. 60. What have you found to be the qualities of the smiths employed in the yard at Moulmein?

Mr. Bremner.—The blacksmiths at this place are good workmen, though rather slow.

Mr. Wales.—They vary much, but those Bengalees in this establishment (Tavoy Zoo) are equal to any European in India, and their work would compete with English. The Chinese are good, but a Burmese is a mere make-shift.

Captain Warwick.—Burmese are employed as far as making rag-bolts, Chinese for lighter work, and Bengalees for all heavy work. These latter are excellent workmen.

Q. 61. Would they in your estimation be found equal to supply the necessary quantity and quality of labour for the formation of all the heavier Iron work for large ships?

Mr. Bremner.—In this case their number would have to be considerably increased, which it might be to the necessary amount from Bengal.

Mr. Wales.—In quality I have no fear, but not in quantity without an increase of smiths.

Captain Warwick.—I should say a sufficient supply could be done, but if not, Calcutta could furnish it to any required amount.

Q. 62. What is the present rate of smiths' wages, and would an increased demand for them be probably attended with an increase of that rate?

Mr. Bremner.—Bengalees receive from 25 to 30 rupees a month, and Chinese 40 rupees a month. I do not think that an increased demand would raise the price of the labour.

Mr. Wales.—Bengalees from 15 to 30 rupees a month, according to ability.

Captain Warwick.—Smiths' wages vary according to their capabilities, viz.,—

A set to each forge	}	1 man 12 rupees a month.
		1 ditto 18 ditto ditto.
		1 ditto 25 ditto ditto.

Q. 63. At what actual cost have ships, past and at present in construction under your inspection at Moulmein, been put in frame and completed?

Mr. Bremner.—The price of merchant vessels, iron-fastened, with anchors, chains, sails, cordage, and stores ready for sea, is about 160 rupees a ton; of hull, masts, yards, only from 110 to 120 rupees a ton.

Captain Warwick.—100 rupees a ton.

Captain Halsted.—The steamer under construction at Moulmein for the Hon'ble Company would be completed with masts and yards only, at about 170 rupees per ton,—considered a very liberal contract. In company with the master and carpenter of the "Childers," I examined carefully her construction and material, both under the common conviction that we had never seen any equal to them,—a feeling of regret being commonly expressed at seeing the waste incurred by selecting such magnificent timber to be used on a vessel so small. A vessel at Natmoo of the same superior workmanship and material, and of 610 tons burden, was also examined by myself and the master. In this latter, only two shifts of plank were employed throughout her length, of 110 feet. In the steamer, 3 shifts of from 50 to 60 feet in length each, the butts being 5 and 6 feet apart. I was informed at Natmoo, from calculations which had been made on the subject, that with all its resources brought into play by any permanent demand or contract which might justify a large outlay for the purpose, that establishment would be enabled to construct the largest ships of the same superiority of material and workmanship, at a cost of 90 rupees per ton, hull, masts and yards.

A large portion of the expenses at present incurred in working any establishment at Moulmein, arises from the high price of labour for mere coolies, and the want of horses for draft. But where continued and large demand might be expected, such difficulty

would be met by employment extensively of the perhaps superior labour afforded by the strength, docility, and intelligence of the elephant.

FACILITIES FOR CONSTRUCTION.

During the stay of the "Childers" at Moulmein, the depths of water off the principal building ships were sounded and found at low water as follows,—At 10 yards distance from low water-mark, 2 fathoms; 20 yards further out, 3 fathoms; in the stream $3\frac{1}{2}$, gradually increasing to 4 fathoms in the fair way. The "Childers" was moored off the town about 2 cables length from the shore in $3\frac{1}{2}$ low water when swung to the flood, and 4 fathoms when swung to the ebb. The greatest rise during her stay was $16\frac{1}{2}$ feet. The river in width rather more than a mile; the bank steep and solid, composed of a strongly ferruginous and gravelly clay, affording ample stability for ways for very large ships, which with sufficient steam-power to tow, might very safely be taken out of the river at the springs, at a draft, I should say, of 20 feet and even upwards.

Natmoo or Devil's Point, situated on a point of the Island of Puloo-Gyoon, on the opposite side of the river to Moulmein, and about 10 miles below it, is the largest building establishment on the river. It was first possessed and laid out by Capt. Warwick, but has now fallen into the hands of Messrs. Cockerell and Co., of Calcutta, who at present seem merely anxious to work it to profit in its present state, without incurring any outlay for the development of its large resources. Twelve large forests on the Attaran are attached to it, and the property immediately around the establishment itself is very extensive; a large portion of a most fertile though uncultivated plain, surrounded by a creek, one mouth of which is close to the yard, constitutes it a convenient, safe, and extensive depôt for its large stores of timber. A village for the workmen of the establishment stands behind the yard, the premises having no other inhabitants. It possesses two dry docks, simply dug out of the river banks,—the compact and adhesive, though easily wrought soil requiring no lining for the sides, and affording a material so impervious to water, that the entrances of the docks when used are simply banked or banded up with it to prevent the re-entry of the river at high water. The beach of the point is steep, and formed of the same material as that at Moulmein, but more compact: it has a rise on it of 20 and 21 feet in the springs; deep water from 7 to 18 fathoms runs close past it to the width of nearly half a mile, with a strong current. A bark of 610 tons launched during the "Childers'" stay at Moulmein, found 14 fathoms under her chains immediately on dropping off the slips. A bay, of which it forms the immediate southern extreme, lies directly north of it, having from 5 to 8 fathoms (L. W.) over a space large enough for the moorings of 3 or 4 first-rates in still water, retired from the strong stream and 3 or 4 cables' length from the northern face of the yard. Here in the smooth water, enjoyed throughout the year, the vessels launched are equipped. From this bay the channel of the river in 5 and 6 fathoms (H. W.) crosses to an anchorage about 4 miles on the opposite side, having 6 and 7 fathoms (L. W.) and about 4 miles above the "flats" of the river. These "flats," with a narrow shallow about two miles above them, and with an equal depth of water on them, constitute the last and lowest impediments of the river. They are 2 miles in extent, and in the channel over them is 9 feet of water at the driest period of the river, with a rise of 21 feet in the springs. From them the channel to the Buoy off Amherst, at the river entrance, has from 6 to 8

fathoms (low water.) With sufficient steam-power to secure their exit from the river the very largest ships may be built, launched from, and equipped at Natmoo at all periods of the year. But in case of ever constructing large men-of-war there, the end of the S. W. Monsoon would seem to offer the best season for the latter two operations; the river is then still swollen with the rains, the weather is fine, and by the time her equipment was completed, the N. E. Monsoon would be ready to take her across the Bay to Trincomalie, or at once to the Cape. Adding to the consideration of the facilities thus already pointed out, as possessed by this establishment, that of the important fact of its forests, and even far larger ones beyond them, being intersected throughout their extent by large rivers, which uniting into one noble stream close above, bring all its material directly and inexpensively from the spot where it is cut, to that where it is used; that it is situated in a most fertile, though at present, but a partially cultivated country, yet affording provisions for the working classes at the lowest rate; in a climate one of the healthiest in India for Europeans; (the thermometer in July and August, by day, being frequently as low as 73° and 74°, during the "Childers'" stay,) and with the prospect of its being perhaps speedily, equally in a centre of supply of good Coal and good Iron, I have thought that perhaps few, if any situations, either in India or elsewhere, could afford to compete in advantages for ship-building to the greatest amount, in the points of eligible position, cheapness, quantity or quality of material, with those enjoyed by this establishment at Natmoo.

E. P. HALSTED, R. N.

Commander.

H. M.'s SLOOP "CHILDERS,"
Moulmein, 2nd August 1840. }

NOTE.—The following information regarding other timber trees is included in Commander Halsted's report:—

BLACK-WOOD.

No. 1.—This tree is of a moderate size, ranging from 5 to 10 feet in circumference. The specific gravity of the wood is perhaps greater than that of any other useful timber found in these Provinces. It would be very valuable for the foundations of either building or machinery where weight is of no consequence. It may be considered almost imperishable.

BASTARD ROSE-WOOD.

No. 2.—This is a most magnificent tree, towering to the height of 100 feet and upwards, and from 10 to 18 feet in circumference. It bears annually a beautiful fragrant flower of a delicate yellow colour. The wood unites the valuable properties of strength, toughness, and durability, the grand *desideratum*. When of mature age, and well seasoned, the sun, rain, or wind, or any kind of weather scarcely affects it. It is peculiarly adapted for mechanical purposes, where strength is required and great friction to be resisted. I have selected knotty specimens of this timber, which when

sawed into plank, 3 feet 6 inches broad, was highly prized by the cabinet-makers in India. The close, confused, and mottled appearance of the wood, combined with a slight aromatic flavor, renders it valuable for converting into furniture.

There exudes from the tree, when wounded, a colourless fluid which crystallizes by the action of the air, the gum being partially transparent and of a pale pink colour. It is a prevalent growth through certain sections of the country.

DOG-WOOD.

No. 3.—A species of the Dog-wood, resembling the *Cornus Florida* of Linnæus. This may be classed with the first of forest trees, bearing a red berry, esteemed a delicious fruit by the Burmese. The growth is remarkably straight, and consequently the wood is particularly preferred by the higher ranks in the Burmese territories for the posts of the public and private buildings. The posts of the old palace of Pegu, built by one of the Talien race of kings, are of this timber. On examination in 1826, I found them to be perfectly sound,—a certain proof of durability. The present specimen was taken from a Poonghee house, erected in Moulmein 12 years ago.

THE BENTICK OR PEEMAH.

No. 4.—The tree is of large dimensions, bearing annually a beautiful blue blossom, resembling the lilac in England. There are two kinds of this wood, viz. red and white; the former, although of not so handsome a growth as the latter, has decidedly the preference, being of a closer grain, and not so liable to split on exposure to the sun. The paddles and oars of the Ava war-canoes are made of this wood. The characteristics are pliability, strength, and durability.

BASTARD ELM.

No. 5.—Tree of large and straight growth, and is found intermixed with Teak and other forest trees throughout the Tenasserim Provinces.

This tree is characterized by its great tenacity, and is admirably adapted for poles and shafts of carriages, levers, and every other purpose where it is necessary to have strength, elasticity, and durability combined in the same material. When dry, the wood floats lightly on the water.

OBSERVATIONS
IN
CONNEXION WITH THE ROUTE ACROSS
TO THE
HEAD OF THE HOUNDROW RIVER.

~~~~~  
By E. O'REILLY, Esq.  
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WITH the exception of those portions up the Weinyo and Zimmè rivers and their tributaries joining the original Teak localities in this quarter, it would appear from the route maps in the possession of Government, that no information had hitherto been supplied of the higher portions of these streams, their geographical position, or the resources of that portion of the British territory forming the boundary between these Provinces and Siam, in a North-Eastern direction from the Three Pagodas. To supply this deficiency, as well as for the purpose of informing myself on the subject of the Teak forests reserved by Government on the Thengan-Nyee-Nyoung, the extent of the Teak forests through which my route lay along the course of those streams, the progress of reproduction in the original forest, as well as by means of planting in accordance with the forest regulations, and in fact for the attainment of every particular bearing upon the subject,—such was the object of the undertaking; but in consequence of the loss of elephants, unforeseen difficulties in the nature of the country traversed, and other obstacles attending an investigation divested of all official character or authority, it will be seen from the following remarks, that the object in view has been but partially accomplished.

The nature of this portion of the subject must necessarily be brief, and may be described in few words. Of the original Teak localities, which appear to have been extensive, and from the stumps remaining of medium size, nothing remains throughout their whole extent but a few defective trees of no value, and the aforesaid stumps, (from many of which young shoots have sprung,) to indicate the former existence of the tree in the forest.

Object of the journey to the Houndrow River.

Teak forests of the Western bank of the Weinyo.

This being a "reserved" forest, I anticipated the existence of a considerable number of Teak of all ages; but after a minute examination on both banks of the stream for several days, the evidence of the same indiscriminate cuttings of the Teak was sufficiently apparent in the number of stumps of the smaller sized timber (which from its size offered the greatest facilities for its removal), interspersed with the largest sized short logs, some of them defective in the heart, and others sound, but from want of power to remove them, left to be destroyed by the white ant and the annual fires of the jungle. The quantity so destroyed may be stated at about $\frac{1}{4}$ th of the original number of trees on this stream.

The Teak of this locality is widely dispersed throughout the forest, bearing but a very small proportion to the other forest trees; the number remaining and apparently sound may be computed at about 200, but as they consist of the largest size, say from 6 to 10 cubits in girth, it is probable that they have the same defect as those of large dimensions cut into short logs as already noticed, hence the value of this forest as a reserve for future supplies is of the lowest scale of importance.

From the above I proceeded to the Upper Megwa stream, the site, I was informed by the Karens, of a formerly existing forest of splendid trees, with an abundance of young plants distributed throughout. The following is an extract from my diary at this locality:

"The forest upon this locality, but more especially at halting place, and for the whole distance down the stream to its junction with the mother stream which falls into the Zimmè, has been worked by straggling parties in former years, and *worked with a vengeance*. Throughout the space above noted, the whole of the smaller trees have been cut and carried away; those remaining are, like the timber of the Thengan-Nyee-Nyoung, of the largest size, some of them measuring 10 to 12 cubits in girth, and few under 6 cubits. For several miles down the stream, on both sides, the ground is strewn with immense trees, some of them cut into short lengths, others into long logs of 25 to 30 cubits, all however injured more or less by fire. The largest pieces are for the most part defective in the heart, but by judicious conversion would yield valuable broad plank, such as is used for furniture, and of the logs of smaller lengths (loozars), many in the original tree would have made capital mast-pieces, but these in common with the rest, lie in all directions destroyed by fire. A more deplorable and wanton destruction of property than this forest exhibits cannot be found. The trees remaining are still numerous, but from their large dimensions are in all probability defective in the heart; they afford sufficient evidence, however, that this forest in its original state must have been extensive, and possessing valuable timber."

A reference to the map* will show that small patches of Teak were originally found on the banks of the streams near the head of the Zimmè; the same process of destruction however has been employed throughout, leaving only the stumps and large logs in a state of decay to mark the site of their former existence.

* The map is not forthcoming.

The geological character of this part of the country differs so widely from that forming the habitat of the Teak, more especially in its higher altitude, that not a single tree was met with throughout the whole distance.

Commencing from the re-appearance of the upraised limestone, after passing the secondary formations as described in the map, a few patches of Teak, of small extent and widely separated, are found on the banks of the streams falling into the Houndrow; the whole, however, rifled of the best trees, and at one locality, situated above the falls of the 99 Islands, where owing to the favorable nature of the soil (composed of the detritus of granite and schistose rocks mixed with the alluvium), the trees were of magnificent growth and dimensions; the Teak had been completely annihilated, and after conversion into short logs, had been abandoned, in consequence it was said of some obstruction which prevented their conveyance through the channels of the Islands. Unlike the large Teak of the forests on the Weinyo and Zimmè, this patch appears to have been composed of the most valuable timber for mast-pieces; the logs after an exposure on the bank of the river for the last ten years, with the exception of being weather-worn outside, are sound throughout, some of them measuring 10 cubits in girth, and from the original spar converted into 4 lengths of 10 to 12 cubits each.

The forest No. 1 on the map, is situated on the upper and smaller branches of the Upper Megwa, separated from the latter by a congeries of small hills, round whose abrupt bases the streams wind tortuously and flow into the Megwa. The hills form a complete amphitheatre (Toung Wyn) and, it may be owing principally to its isolated situation as well as in all probability to its possessing water only during the S. W. monsoon, that it has hitherto escaped the depredations of the Teak destroyers. The Teak on this locality is of various ages and sizes, measuring from 3 to 8 cubits in girth, the greater proportion being of the medium dimensions, and on a careful average of several days' inspection, I have concluded the number of available trees at from 5,000 to 6,000 of all sizes.

The forest No. 2 is situated on a branch of the upper portion of the Mayee-tan, the smaller streams descending from a range of sandstone hills in which on its western side arise the sources of the Lemyne river. Owing to the difficulty of access up the rocky bed of the Mayee-tan, I was compelled to separate from my baggage, and from want of rice, was obliged to return without examining this forest; from the statement of the Karens, however, who accompanied me, I am inclined to believe it to be of considerable extent. Should this prove correct, the practicability of conveying the timber down the rocky course of the Mayee-tan is very doubtful; hence the question arises as to its easier extraction down the valleys and small streams which feed the Lemyne river, which can be ascertained only by further investigation.

Throughout the whole route, both in the above-stated localities as well as in those exhausted ones noticed, I have not seen either young Teak-trees or plants; those of the latter, said by the Karens to exist, proving on examination to be nothing

The absence of young trees and seedlings.

more than the young shoots from the stumps of felled trees; nor could I discover, on inquiry, that any attempt at propagation of the tree had been made by any of the parties who exhausted these forests.

In common with the generality of the timber trees of the forests, the Teak sheds its seed at a period unpropitious to its vegetation, *viz.*, after the rains of the monsoon have ceased, and when the surface soil from a rapid evaporation has become hardened and deprived in a great measure of those stimulating properties so essential to the vegetation of the fallen seed; but even under the more favorable circumstances of seasonable ripeness of the seed and subsequent vegetation, the destruction of the young plants by the fires which annually sweep the forests would be certain, and the effect the same,—hence the absence of young trees of almost all descriptions of those found in the forest.

The question of reproduction, by planting the seed collected in the forest, has been most satisfactorily decided by the experiments of Dr. Falconer, who has raised plants to a large amount from seed transmitted to him from these forests, which it is presumed was collected after several months' exposure during the N. E. monsoons.

The inference to be drawn from the foregoing is plainly that,—

A.—As the original Teak-producing localities in this quarter are at the point of complete exhaustion, whether it be practicable to re-produce the tree on the same localities?—or

B.—By a systematic plan of cultivation extended to all forest-land nearer the coast similar to that pursued by the Dutch Government in their Java forests, secure to these Provinces, a future resource, upon which their commercial interests must necessarily depend for many years to come;—and

C.—The lands available for this purpose, their adaptation, extent, &c., &c.

A.—Up to the head of the Zimmé river—Teak occurs for the most part in localities possessing a soil composed of the debris of sandstone resting upon and mixed with the cavernous limestone of the plains; these patches are invariably met with on the flanks of sandstone hills in the immediate vicinity of the water-courses, and in those approaching the higher ranges of the same rock to the Westward, a soil occurs formed from the decomposition “ mica and felspar of the primary formations, mixed with a large proportion of the sandstone detritus, and as these soils are by no means uniform or extensive in any one locality, the Teak is found in patches, interspersed with the other forest-trees, and rarely at any considerable distance from the water-courses, the largest trees being immediately on the bank, or in close proximity to the streams.

It has been stated that the Teak seed will not vegetate on the same soil and situation as that producing the parent tree, but such an opinion can have little weight when opposed to the fact that in certain localities in the Zimmé forests protected from the ravages of the annual fires by some peculiar advantage of position and low vegetation, that young plants are found mixed with the stumps of former forests, and I have the corroborative testimony of the Karens on this subject, to the effect that of several hundreds of seeds planted in the original sites the greater portion have sprung, to be annihilated, however, by the next dry season's fires.

The practicability, therefore, of propagating the tree on its original sites when the composition of the soils as described is unobjectionable, must be sufficiently evident, but unless a *cultivation* be carried out to the fullest extent of its import, and measures be instituted to prevent the Karens from spreading their devastating fires through the jungles annually, such an undertaking in the localities under notice is not to be contemplated.

B.—But in preference to propagating the Teak at a distance from the seat of Government, and in localities fraught with fever for six months of the year, offering almost insuperable obstacles to an effectual supervision, I would suggest the employment of all the unoccupied forest-lands on the banks of the various rivers and creeks, (which occur at short intervals throughout the whole Coast line;) and the occupation of the Islands for this purpose. Here secured against destruction by fire, with a soil of the best quality and the smallest amount of care bestowed upon the plant in killing the surrounding jungle, leaving only such trees as are of known good properties and of useful application, a new system of Teak forests would be created, affording the prospect of future supplies of a material superior in every respect to that obtained from the uncultivated tree of the present exhausted localities.

C.—The extent of the forest-lands available for the above purpose may be roughly estimated at from 6,000 to 8,000 square miles, or $\frac{1}{2}$ of the whole area of the Provinces, including the Islands within the British Territory.

The soils to which I allude are formed principally from the decomposition of granite and gneiss rocks, they are highly felspathic and contain in combination with the alkali of the felspar from 7 to 12 per cent. of oxide of iron; the great fertility of these soils and their adaptation to all purposes of tropical cultivation are too well known to require further comment, the noble forests which clothe their surface affording ample evidence of their qualities as timber-producing lands.

As a concurrent means of securing attention to any new Teak plantations that may be undertaken, I would suggest that with the Teak in localities where the open nature of the jungle affords sufficient space, that Sapan-wood be planted, which thrives in every description of lands above the level of the alluvial plains, and besides supplying the requisite shade for the seedling Teak in the earlier stages of its growth, attains maturity within 5 years from planting, at which period its coloring properties arrive at the highest point of development, and by the sale of its produce, would afford a quick and certain return to Government for the outlay incurred.

In conclusion, I would earnestly direct the attention of the Government to the preservation of all kinds of timber of known good properties which still remain in the forests. The principal ones, or those in general use with the natives in the construction of houses, boats, masts, &c., are the "Anan" 1, "Thengan" 2, "Peenmah" 3, "Toung-being" 4, "Kank-hmoo" 5, "Padouk," "Yein-dick," "Peengado," "Bamhwai," and several others of less note. The Anan stands pre-eminently at the head of all others (Teak included,) for durability under all circumstances, but from its great density and hardness does not float after killing. Nos. 2 to 5, are capable of floating after killing as with Teak, and from these, but especially from the Thengan and

Preservation of the other useful timber of the forests.

Sapan-wood to be planted with the Teak.

Peenmah, some of the finest mast-pieces in India may be had from the Teak exhausted localities; and, after a close observation for the last 12 years of the properties of these timbers, I feel confident that a fair trial would disclose their value for the purpose stated, and which, surpassing Teak in every respect, is so generally known and appreciated by the natives.

The largest size canoes and trading boats, are constructed from single trees of the Thengan and Kank-hmoo, many of which are cut annually throughout the Provinces without any restriction on the part of Government, and unless some stringent measures be speedily adopted for their preservation, after the discovery of their value, as with Teak, any measures of conservancy that may then be deemed necessary will be found to have been too long delayed, and that the forests in which they now exist have become exhausted.

(Signed) EDWARD O'REILLY.

AMHERST TOWN, }
15th April, 1849. }

SELECTIONS
FROM
THE RECORDS
OF
THE BENGAL GOVERNMENT.

Published by Authority.

N^o. X.
REPORT
ON THE
ESTABLISHMENT OF WATER-WORKS
TO SUPPLY THE
CITY OF CALCUTTA.

By F. W. SIMMS, Esq.,
CONSULTING ENGINEER TO THE GOVERNMENT OF INDIA.

WITH OTHER PAPERS
ON
WATERING AND DRAINING THE CITY.

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REPORT
ON THE
ESTABLISHMENT OF WATER-WORKS
TO SUPPLY THE
CITY OF CALCUTTA.

FROM F. W. SIMMS, ESQUIRE,

*Consulting Engineer to the Government of India,
and Director of the Railway Department,*

TO F. J. HALLIDAY, ESQUIRE,

Secretary to the Government of Bengal,

DATED CALCUTTA, 27TH FEBRUARY, 1847.

SIR,

I have the honor of submitting, by desire of the Hon'ble Sir T. Herbert Maddock, the following outline of a plan for supplying the City of Calcutta with water from the River Hooghly between Pultha Ghât and the Gunpowder Works at the entrance of Nabobgung Khall. This spot is above the influence of the Salt Water, except perhaps occasionally at extraordinary high tides about the time of the vernal equinox, during which short period the pumping Engine can cease drawing the supply. The distance of the spot whence the water would be taken is 105 miles from the mouth of the Hooghly, opposite Middleton Point on Saugor Island, and 18 miles above Fort William at Calcutta, measured along the centre of the river.

2. The first point for determination is the quantity of water per diem required to be delivered into the City; and this will be regulated by the number of houses and inhabitants amongst whom the supply is

B

to be distributed. The correct determination of this data is of the first importance in providing an adequate supply to a City.

3. The daily supply of water for the use of each person is differently estimated in various places, depending in some degree upon the climate; in the more northern latitudes much less water is used than in warm countries. Besides the water required for personal use, a large quantity is used for watering and cleansing streets, extinguishing fires, &c. In some towns of Scotland, so little as eight gallons per diem has been allowed for each person, but in general about twelve is the usual quantity; in London it is extended to about fifteen gallons, allowing for waste, &c., as above stated.

4. In the year 1809 the total supply of water to London by the several Water Companies was 118,469,175 hogsheads to 91,841 buildings, including manufactories and large premises, being about 191 gallons per diem to each; and in 1820, the same rate of supply appears to have been preserved, the grand total being 155,381,038 to 120,000 buildings.

According to a Parliamentary Return made in 1834, the supply by the principal Water Companies was as follows :

WATER WORKS AT LONDON 1834.

NAME OF COMPANY.	No. of Buildings supplied.	Average rate per Building.	Average daily supply to each.	Mean elevation at which it is supplied.	Highest elevation at which it is supplied.	Average charge for 1,000 hogsheads.
		£ s. d.	Gallons.			
New River,	70,145	1 6 6	221	84½	145	0 17 1½
Chelsea,	13,892	1 13 3	168	85	135	1 9 0
Middlesex, ... ..	.....	... ..	185	155	.....	2 5 6*
East London, ... ..	.....	1 2 9	120½	60	107	1 8 0
South London, ... ..	.....	0 15 0	100	.....	80	... ..
Lambeth,	16,682	0 17 0	124	55	185	1 4 8
Grand Junction, ... ..	.....	2 8 6	363	100	156½	1 4 1
Southwark,	7,100	1 1 3	156	38	60	1 1 0

5. The population of Calcutta, according to documents supplied to me by Mr. Secretary Halliday, (given in the Appendix), was estimated

* Conveyed an average distance of 5 miles.

in 1801 (see No 1) at 500,000, and in 1814 at 700,000, but, judging from the subsequent returns, those numbers appear to have been greatly in excess of the truth. In 1821, when four assessors were employed, the total number of inhabitants was reckoned at 179,917; but the Magistrates in their report estimated the fixed residents at 230,552, which conclusion they arrived at from knowing the number of houses, and allowing a certain number of inmates to each house: secondly, the same Authorities by other means make the fixed residents to amount to 205,600.

In 1837 the total population, according to document No. 2 of Appendix, was 229,714, very nearly agreeing with the statement of the Magistrates above quoted, and showing that between 1821 and 1837, a period of sixteen years, no apparent increase of population had taken place.

6. The number of houses in 1821 (see No. 1 of Appendix) was, of two-storied 5,430, and of one-storied 8,800, making a total of pucca houses 14,230; and the native huts, both tiled and straw-roofed, was 51,289, making a grand total of 65,519 dwellings. It further appears that in 1837 the pucca houses numbered 14,623, and the huts 50,871, making a grand total of 65,494, being nearly the same as in 1821. This result corroborates the deduction in the last paragraph, that during the said sixteen years no increase of population had taken place. Assuming that to be the fact, and from the absence of any apparent cause for such to have occurred during the subsequent ten years, the population at the present time may, with sufficient accuracy for practical purposes, be assumed as numbering 230,000 souls; likewise the number of pucca houses, into which it would be required to deliver the water, may be taken at 15,000; namely, of two-storied 6,000, and of one-storied 9,000. The inhabitants of the 51,000 huts would draw their supply of water from stand-pipes or fountains in the streets, as none of their owners would in all probability go to the cost of having the water laid on from the mains, an expense always defrayed by the landlords of the premises.

7. Assuming that thirty gallons of water per diem would, upon an average, be sufficient for each person, the required daily supply would amount to 6,900,000 gallons, and allowing one-tenth more for contingencies, would raise it to 7,590,000, equal to 1,214,400 cubic feet; and for each building, huts included, this would give an average daily supply of 115 gallons, which quantity, although apparently short of the

supply given in London, as shown in para. 4, yet when we consider the greater population contained in the buildings of the metropolis of England, than in those of Calcutta, and that the average also includes the manufactories and other large consumers, together with the circumstance that the above-named allowance of thirty gallons for each inhabitant is about double the personal allowance in London, there would appear to be no doubt but the total quantity named, 1,214,400 cubic feet, would be an ample supply for the daily use of Calcutta.

8. Having settled the required quantity, the manner of obtaining it is next to be considered. For this purpose the works near Pultha Ghât should contain two reservoirs of equal capacity, whereby one may at any time be emptied for cleansing without detriment to the supply ; each reservoir should contain sufficient for one week's consumption, so that whenever it might become necessary to stop the pumping from the source, for the repairs of the machinery or other causes, there would be an abundant repository of water to prevent the inhabitants of Calcutta experiencing any inconvenience ; a matter of great importance, as the manual labor by which the supply is now furnished would doubtless be done away with, and it would be impossible at a short notice again to call the requisite number of bheesties or water-carriers into existence : and if by any chance one of the reservoirs should be emptied at the time the pumping was stopped, there would still be one week's supply available, besides what might be in reserve at the works near Calcutta, hereafter to be described.

9. The reservoirs, in order to contain the greatest area of water with the least possible embankment, should be circular, and if each has a top water diameter of 1,000 feet, and a depth of water of 12 feet, the contents would be 8,738,428 cubic feet, being 237,628 in excess of one week's supply, as above estimated (8,500,800), such an excess being desirable on account of evaporation, waste and other causes.

10. The level of the highest part of the ground near to where I propose the reservoirs should be constructed, is 12 feet above that at Ballygatchea, in the suburbs of Calcutta, where the water would be delivered and purified, and from whence its distribution through the City would take place. If therefore the reservoirs be excavated, and placed below the present surface of the ground, the fall would be so much diminished that the friction of the aqueduct or pipes would injuriously retard the flowing of the water in its passage to Calcutta.

The natural difference of level (12 feet), is itself but small in a distance of $13\frac{1}{2}$ miles. It would therefore be advisable to construct the reservoirs above the present surface, by raising an embankment of earth obtained from side cutting; the height of the bottom of the reservoirs above the present level of the ground might be advantageously fixed at 12 feet, thereby producing a head that would be desirable for forcing the water along the aqueduct or pipes at Calcutta.

11. The construction of these reservoirs would be attended with no difficulty, but would require care to ensure their being secure and water-tight. In the drawing accompanying this Report is shown their position and form, (in the general plan), and their chief details more at large in the sectional sketch, figure I.: this however is not drawn to scale, in order that the parts may be sufficiently large to be easily distinguished; it represents a section through the centre of the two reservoirs, showing the clay puddle in the banks, by which they would be rendered water-tight, also the feed-pipes, delivering the water from the pumps, and the discharge-pipes (of which more will be said presently), whereby the water would pass off to the aqueduct and thence to Calcutta. The engine-house between the reservoirs and the river, containing an engine of 200 horse-power, to work the pumps for raising the requisite supply, is also shown, but as these parts of the works are well understood, no particulars thereof need be given in this place. In short the whole of the design as hereby set-forth and explained must be considered only as an outline plan; the final settlement of the details would have to be considered whenever it may be determined to carry it into execution.

12. The engine would raise the water through a suction-pipe from about the centre of the river, (as shown in the plan,) and discharge it into the reservoirs, and whenever the water in the river was unfit for the purpose, from being somewhat brackish, which could only happen for short intervals at the top of very high tides, (and that only through a small portion of the year, about the vernal equinox), the pumping might cease, and be recommenced as soon as the waters of the river should have fallen. I am doubtful if the water can ever be said to be brackish so high up the river, but if such should be the case, the remedy is very simple, as above explained, and during a large portion of the year the tidal waters do not reach there, and for a time are scarcely sensible in the river at Calcutta, when the freshes are passing from the upper country to the sea.

13. The discharge-pipes or valves, for drawing the water from the reservoirs for use, would pass through the bank to the aqueduct or pipes by which it would be conveyed to Calcutta. As the water in the reservoirs would be pumped direct from the river it would be more or less turbid, consequently a great deposition of mud would take place, and therefore to obtain the fluid in as pure a state as the circumstances of the case would admit of, it would be desirable to draw it off from near the surface, and this could be effected by placing the aperture of the discharge-pipe a little below the top water level; but if it were *fixed* in such a position, it is evident that no water would pass off except when it was higher than the end of the said pipe, and thereby the utility of the reservoir would be nullified; it would, in fact, be in precisely the position of the waste-pipe to a cistern, or the waste-weir of a canal pond. And as on account of the muddy deposit, the mouth of the discharge-pipe should not be *fixed* at or near to the bottom of the reservoir, it can be contrived so that the pipe entering the reservoir at its bed should be connected with an extension pipe, by means of a hinge or rule socket joint, the length of such extension pipe being sufficient to reach just above the surface of the water whenever it be sufficiently elevated, (and it be requisite to stop the discharge), then, by means of a float or buoy attached to the extension pipe, its mouth could be at all times kept at any desirable depth below the surface of the water, because the float would rise and fall with every change in the level of the fluid. By means of a crab fixed on the bank of the reservoir and a chain attached to the extension pipe, the latter could at any time be raised above the water level as before named, and thereby stop the discharge; this would occasionally be requisite for the examination and repairs of the pipe and the aqueduct hereafter to be described. By such simple means the water would always be drawn off from the surface, and whenever it became necessary to draw the reservoir, nothing more need be done than to stop the feed, the extension of the discharge-pipe would then drain off the whole or any portion of the water, the float or buoy lowering its aperture as the water fell, until the pipe be laid horizontally on the bottom of the reservoir, or stopped, by means of the chain and crab, at any angle that might be sufficient to reduce the water to the required level. To render this part of the plan clearly intelligible, it is drawn more at large in figures II. III. and IV. of the accompanying drawing. Fig. II. is a longitu-

dinal elevation and section of the extension pipe, showing its position in the reservoir, with its float and crab, &c. Fig. III. is an end view, and Fig. IV. a plan of the same.

14. Having now explained all that is necessary at present as to the works at the source near Pultha Ghât, the method of conducting the water from thence to Calcutta comes next under consideration. We have seen that the quantity of water to be distributed daily will amount to 1,214,400 cubic feet, and whether this be conveyed through pipes or by an open aqueduct, it will be necessary that the means be in duplicate, to admit of one set of pipes or aqueduct being disused for cleansing or repairs without stopping the supply.

15. Three ways present themselves for conveying the required quantity of water from the works at the source to those at the delivery: first, by an open conduit or canal; secondly, by close cast-iron pipes; and thirdly, by an aqueduct elevated above the surface of the ground. The first would require a conduit of not less than the following dimensions, 5 feet wide at top, 4 feet at bottom, and $3\frac{1}{2}$ feet deep, and this in duplicate. The second plan would require a pipe of not less than 3 feet 4 inches clear diameter, and that also in duplicate. The third plan would require two water channels, each of nearly the same dimensions as the conduit above-named, elevated upon arches the whole of the distance. By each of these plans a different head of water would be obtained from the reservoirs, if made as above described, but each would be suited to its purpose.

16. Whichever of the three plans might be adopted, their line of direction should be as straight as the circumstances of the locality will admit of, and fortunately in this instance it is very favorable. Quitting the reservoirs, the water could be conveyed direct to the angle at the northern end of the Barrackpore Road, where it turns nearly at right angles to the westward towards the cantonments; the water-course would here require a small angle for it to be continued along the eastern side of the continuous straight line of road to where the south Trigonometrical Tower stands, then by a similar angle it could be still kept alongside the same road to the spot of ground I have chosen for the site of the distribution works in the vicinity of Calcutta; this is situated at Ballygathea, on the north side of that portion of the Circular Canal lying between the Barrackpore (or Shaum Bazar) Bridge, and the Dum-Dum Bridge; this area is otherwise bounded by the Barrackpore

Road on the west, the Dum-Dum Road on the east, and on the north by a crooked lane connecting the above two roads. If the whole of this plot be found more than sufficient for the purpose, in the first instance, a portion of it need only be taken as it may be required. The site for these works is coloured red on the accompanying plan.

17. The plot of ground selected for the Water-works at Ballygatchea is very suitable on several accounts,—namely, its contiguity to the canal, whereby facilities would be given for craft to bring coal and other materials alongside to be landed direct on the premises, and thus save considerable land-carriage, and hence expenditure. The spot is also well suited for the diversion of the mains to the several districts of the City, as well as for overcoming the chief obstacle thereto, namely, the crossing of the Circular Canal; for the great main could be readily carried over the Barrackpore Bridge to a most suitable spot for the divergence of the lesser mains, (as will be presently explained); and lastly, it is but a little out of the direction of the long straight line of the Barrackpore Road, requiring but a gentle angle near the south Trigonometrical Tower for the water-course to be continued alongside the road thereto.

18. The first of the three plans, namely, the open conduit, I would recommend for adoption, for the following important reasons: It would, in the first place, be the least costly; in the next place it would give greater facilities for cleansing and repairs than would be given by the pipes, and would certainly cost less in its maintenance than the third plan; and lastly, a stream of clear water alongside the Barrackpore Road would be an agreeable object to the sight, and afford facilities for watering that magnificent highway. A plan of the conduit is given at Fig. V., together with the basin at the upper extremity for receiving the water from the reservoirs. Sluices or gates will require to be placed at both ends, and probably at intermediate distances of each conduit, that one of them might without inconvenience be at any time closed and emptied for cleansing, &c.; for although the greatest deposit from the water will take place in the two reservoirs at the source, yet doubtless no small deposition will occur during the passage of the water along the $13\frac{1}{2}$ miles of open conduit. A longitudinal section of this part of the work is shown in Fig. VI., where it is represented in connexion with the reservoirs by the discharge-pipes. A transverse section is given at Fig. VII., and the whole is likewise shown in the general

plan. The manner of drawing off the water from the reservoirs, by means of the discharge-pipes, has already been explained in para. 13, and all that remains to be noticed appertaining thereto are the slide valves near the exit of each pipe, for stopping the discharge from either reservoir at the lower end, which will occasionally be found necessary, as well as having the means of stopping it at the upper end, by elevating the extension end of the pipe in the reservoir; the details of these valves are given in section at large in Figs. VIII., IX. and X. As respects the comparative cost of the three plans, they would be about in the ratio of 1, 8, and 10, the open conduit the lowest, the Iron pipes the highest.

19. Having explained the plan for bringing the water into the vicinity of Calcutta, it remains to consider the kind of establishment and extent of the works necessary for completely purifying and distributing it for use. The situation of these works I propose should be at Ballygatchea, as explained in para. 16. In the formation of this establishment, as in the upper one near Pultha Ghât, the works should be in duplicate, so far as may be necessary to prevent any stoppage of supply during repairs, or the cleansing of any part thereof. The water brought down by the aqueduct should be capable of being turned into either of the two basins, and from thence pumped into extensive filters, where it would be freed from its remaining impurities and rendered fit for use. After filtration the fluid would pass into one or more reservoirs, capable of containing at least one week's supply. From thence the water would be forced by steam power into mains leading through the City with a pressure that would deliver it into elevated cisterns in each house, and every bathing-room might have a water-cock. Shower-baths might be easily supplied; and a constant supply of the purest water for drinking and culinary purposes be always at hand; and the manual labour for the water supply, as at present practised, be wholly dispensed with.

20. It was under consideration, in the earlier part of this investigation, to have arranged for the forcing of the pure water into two large elevated reservoirs, each to contain one day's supply, thus to form a head that would deliver the water at any required elevation in the City not higher than the head itself. This method would perhaps have produced the most perfect system of distribution, as the water would be constantly on at full pressure in all parts of the City, and the supply could be drawn at all hours, night and day, by simply turning a cock,

and no cistern would be necessary in the dwellings, which cannot be dispensed with according to the plan above proposed, otherwise a great expense would constantly be incurred in keeping one of the engines at work night and day. Upon going into the necessary calculations to arrive at the probable cost, it was found to be so much the greater of the two, that I have preferred to recommend the method by domestic cisterns to the elevated reservoirs.

21. The steam power that would be required at this station would be greater than that at Pultha Ghât, and could not be less than three hundred horses. This great power would be more advantageously supplied by two engines of 150 horses each than by one of 300, as we should thereby prevent the possibility of the supply being at any time stopped from the failure of the machinery. No further details need now be given to make this part of the project intelligible; necessary minutiae will be fully considered when the machinery is ordered to be constructed (which must be done in England), if ever I shall be honored with instructions to carry this great and important work into practice. At this station also, workshops, with all requisite tools and other necessary departments of so great an establishment, will have to be erected and fitted up.

22. The leading main, through which the water would be forced from the final reservoirs, could be conducted from the works into the City across the Barrackpore Bridge, a convenient space intended for a footpath in the middle of the bridge between the two road-ways being well adapted for the purpose. By this means no extra expense would be incurred, and the main would always be accessible for examination and repairs in case of leakage; whereas if it were conducted down the slope of the Canal Banks, and under the Canal, examination would be extremely inconvenient, and all repairs would be attended with difficulty and expense. On the other hand, to carry the main over so wide a span by the simplest means that could be devised, would occasion no inconsiderable outlay. The whole of which difficulties and expense would be saved by the appropriation to that purpose of the central space of the present bridge as above described.

23. From the Barrackpore Bridge the main would be continued south-eastward along the road to the junction of Shaum Bazar Street with Cornwallis Street and the Circular Road; at this point the great main might terminate, and from hence several smaller mains might

branch off along the roads leading in various directions of the town. This point I will name, for the sake of distinction, "the Main Divergence." Cornwallis Street, with its continuation by Tuntunah Bazar, College Street, Wellington Street, Wellesley Street and Wood Street, or Camac Street, to the Lower Circular Road, forms nearly a straight line of good width, the whole length of Calcutta, and not far from the middle of its breadth; along this line, therefore, I propose that the main pipes, or at least one of them, be laid; this might with propriety be called "the Central Main," the length thereof from the "main divergence" to the Lower Circular Road is 4 miles, 3 furlongs and 150 yards.

A second main, of equal bore, should leave the "main divergence" and pass along the Shaum Bazar Street, Chitpore Road, Cossitollah Street, and along the Chowringhee Road to the Lower Circular Road, at the south-east extremity of the Midan. The length of this main would be 4 miles, 6 furlongs and 83 yards, forming a second line of main from one end of Calcutta to the other, and might be called the "Western Main."

A third, which might be called the "Eastern Main," should be laid from the "main divergence" as before, along the Upper Circular and Lower Circular Roads, and receive the southern extremity of the central and western mains. The length of this main to its junction with the extremity of the western, or second described main at the south-end of Chowringhee Road, would be 5 miles, 1 furlong and 50 yards.

From these three great mains (which are denoted by red lines on the plan), the whole of the City, together with Fort William, Cooly Bazar and the suburbs to the east and south of the Circular and Lower Circular Roads, &c., could be supplied by means of pipes of smaller bore, ramifying in all directions. And if it should be found expedient or necessary to divide the distribution into districts, one or two only to be supplied at a time, though three great mains would render such a plan easily practicable, by having a four-way cock or other contrivance at the "main divergence," and thereby turn the water on to each district alternately for the allotted number of hours daily; or this division might be effected at any of the great cross thoroughfares, as Durrumtollah, Loll Bazar, &c.

24. For the supply of the City, as contained within the following limits, namely; the Circular Road on the east, Lower Circular Road and

Tolly's Nullah on the south, and the River Hooghly on the west, the length of the mains of various bores required for the distribution of the water would be approximately as follows; but from the impossibility of getting the dimensions of the whole of the streets and lanes until the completion of the large and detailed survey, ordered by the Hon'ble Sir Herbert Maddock, these dimensions will fall somewhat short of the real amount :

	Miles.	Fgs.	Yds.
From Barrackpore Bridge to the main divergence,	0	1	180
Central Main,	4	3	150
Western Main,	4	6	83
Eastern Main,	5	1	50
Roads and Streets,	70	4	19
Lanes,	57	0	0
Total, ...	142	1	42

25. The mains of various bores will be laid through the streets and lanes at the expense of the proprietors of the Water-works, but the service pipes, cocks, and cisterns, wherever the latter may be wanted for the delivery and receipt of the water in the houses, is usually paid for by the owners of the several premises. This is the practice in England, and no house of the least pretensions would find an occupier unless a supply of water was already laid on; of course the original outlay for this object is considered in the landlord's rent, and the tenant, in all cases, pays the water-rate to the parties who supply the water, so that, in the long run, the whole cost falls, as it should do, upon the consumer. In Calcutta the greater number of the landlords are Natives of the country, and would not so readily appreciate the advantages of such a refinement of civilization as the having a supply of pure water always at command on the premises; I therefore anticipate some difficulty or opposition at first to the introduction of the system, chiefly on the ground of the cost of laying on the water, as they would probably argue that they should get no increased rental on that account, and therefore would desire to throw the outlay upon the tenant. On the other hand, it is hardly to be expected that the occupiers would willingly accede to such a course, especially in so constantly a changing community as that of Calcutta; where after incurring the necessary outlay, the tenant would, probably in a few months, remove to a distant place, and the

in-coming party might either refuse to repay the outlay or only consent to take it at a reduced price. This subject would probably be a source of hindrance to the introduction of an improvement of the highest importance to the health of the inhabitants, if it were not met with firmness. I would therefore suggest that not only the use of the water, or the payment of the water-rate be made compulsory, but that the landlord be compelled to defray the expense of laying on the water, unless the plan to be next suggested should be deemed the more desirable course.

This difficulty, (if it should ultimately prove one,) might be overcome if the proprietors of the Water-works executed the work in question and charged an increased rate (on that account) for the supply; the result would be obviously the same to the consumer, whether he paid it in this form or in that of an additional rental to his landlord, and to the water proprietors it would simply be a question of capital, which might or might not be inconvenient to be raised in the first instance, for it would require for this purpose a sum of about £247,500, or, in round numbers, £250,000, over and above the necessary outlay for the establishment of the works for the distribution of the water through the mains. An inconvenience would also in this case arise from the circumstance that the property of the Water Company, in the form of pipes, cocks, and cisterns, would be partly inaccessible to them, being in private houses, and therefore less under their control, rendering them liable to occasional losses, unless the landlord be held responsible for their security.

26. I presume that the water would be laid on to the pucca buildings only, the inhabitants of the huts would obtain their supply from the stand-pipes or fountains in the streets; and as so many of these people are very poor, a very small sum only could be charged to them, and a vast number would be wholly exempted from payments of any kind. At present they obtain their supply of water from the numerous tanks, (and holes called tanks,) scattered through the City for nothing except the labor of fetching, but the filthy and unwholesome water they mostly thus obtain, must be favorable to the continuance and spread of disease, and as many of these tanks contain much decaying vegetable matter, they must give off injurious exhalations, to the detriment of the health of those who are otherwise supplied with better water for their use; in short, many of these tanks deserve no better name than that of

Pest-pits. It would therefore be desirable to do them all away, except perhaps a few of the largest and best situated, which could be supplied with good water from the Works, and if surrounded with neatly-preserved plantations would be ornamental as well as useful. The washing of clothes in these tanks should in all cases be prohibited, as the water would be intended for drinking and culinary purposes; the natives might carry away the water for the purposes of washing, or suitable places for this purpose might otherwise be provided.

27. The stand-pipes in the various streets could be contrived for the attachment of a hose, which, with the pressure of water in the pipes, would afford the means of effectually watering the streets, extinguishing fires, &c., and at suitable places, such as at the gardens of Government House, or in the halls of the house itself, the centre of Tank Square, the Fort, &c. &c., elegant fountains might be constructed, which if not particularly useful, would at least be ornamental.

28. We now come to the consideration of the cost of this important work. This is naturally divided into three parts,—*first*, the outlay necessary to convey the water to Ballygatchea, and purifying it for use; *secondly*, the cost of the mains and service pipes to convey the water through the streets; and *thirdly*, the annual outlay or working expenses. They are as follows:

Works at Pultha Ghât and Ballygatchea, and Aque-duct, the whole 13½ miles,	£	159,861
Mains and Pipes through the City, 142 miles, 1 furlong, 42 yards,... ..	,,	510,336
		<hr/>
Total outlay in the first instance,	,,	670,197
		<hr/>
Annual expenditure,	,,	55,480
		<hr/> <hr/>

29. The next point for consideration is the amount of income to be expected, and the way this is arrived at is by the consideration of what is at present paid by the house-holders for water. No house can do without employing one bheesty, and the larger houses have two or three and sometimes more. The lowest wages these men receive is 4 rupees per mensem, but mostly they have 5; considering the matter in this

way, I arrive at the conclusion that an income of £116,100 per annum ought to be realized without difficulty, thus :

6,000, two and three-storied houses, averaged at per mensem 8 rupees,	Rs.	48,000
9,000, one-storied houses, average 4 rupees,	,,	36,000
51,000, huts, average each 4 annas,	,,	12,750
		<hr/>
Rupees per mensem,		<u>96,750</u>

or, in round numbers, £9,675 per month, amounting to £ 116,100 per annum, as before stated.

30. Taking the numbers as above given, we have—

Working expenses,	£	55,480
Interest on a capital of £670,197 at £9 per cent., .. .	,,	60,317
		<hr/>
	£	<u>115,797</u>

Showing that, upon the above data, the project would yield a profit of at least £ 9 per cent. per annum.

31. The only remaining subject for consideration is that of the charge to be made by the Water Company, in addition to the above, in consideration of their defraying the expenses of laying on the water to each house. This, as stated in para. 25, will amount to the sum total of £250,000, and provides for the necessary leaden pipes, water cisterns, ball, and common cocks; the cistern to contain two days' supply being indispensable, because I propose supplying each district of the City but a given number of hours daily, to obviate the necessity of keeping the pressure constantly on the Engines, and therefore no house could dispense with a cistern, or it would occasionally be without water. A great saving to the Water Company would be effected by this method of storing the fluid for use, which again would tell in favor of the consumers, as they would otherwise have to pay the said additional working expenses.

To provide for the interest of £250,000 at the rate of 9 per cent., each of the 15,000 houses would have to pay upon an average 15 rupees per annum, or about 1 rupee 4 annas per mensem, in addition to the before-named sum for the water. The premises would of course in reality be charged the interest upon the exact sum expended, and this

would vary with their extent ; but reckoning it by the average charge per house is sufficient for present purposes.

32. The introduction of a system of water supply into Calcutta would doubtless meet with great opposition from the Natives, naturally averse as they are to any kind of innovation or change, and besides, in this instance, it would have the effect of throwing a class of people (the bheesties or water carriers) out of employment ; and therefore I feel persuaded that nothing short of the law rendering the adoption of the system compulsory, will enable it to be carried out with success, by which no injustice would be done, as the good of the whole community is intended. The European inhabitants would hail its introduction as a great boon, and the Natives themselves, after the first shock to their prejudices has been overcome, will rejoice in it also.

I have, &c.,

(Signed) F. W. SIMMS, C. E.

CALCUTTA,
The 27th February, 1847. }

FIG. VI.

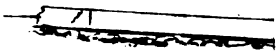


FIG. V.



16.

APPENDIX.

D

No. 1.

General Abstract of Census of Population and Houses in Calcutta, taken in 1831, by Captain Steel.

	NAMES OF THALUKAH.	Pucca Houses.	Tiled Huts.	Straw Huts.	Residing in the Division.		Employed in the Division, residing in another.		Employed in the Division, residing out of Town.		
					Ryots.	Proprietors.	Ryots.	Servants.	Ryots.	Servants.	
1	Shaum Bazar,	313	365	1,535	2,498	1,646	348	223	249	640	605
2	Bang Bazar,	626	129	1,690	883	713	670	332	224	47	118
3	Shampooer,	725	1,196	4,952	10,516	2,824	607	208	44	2,538	1,087
4	Churruckdangah,	335	614	743	2,367	1,482	389	320	228	244	209
5	Jorasanko,	348	593	321	2,648	405	507	353	40	0	0
6	Symiah,	1,526	296	3,208	1,926	720	704	296	88	24	80
7	Sukeas' Street,	632	360	2,266	3,899	2,627	681	850	0	13	0
8	Puttuldangah,	1,184	443	2,379	6,103	1,650	427	1,270	89	822	132
9	Tuntuneah,	228	671	1,592	2,975	2,734	331	162	29	2,699	345
10	Machooa Bazar,	208	1,591	333	1,103	2,992	248	8,423	182	554	16
11	Colocotollah,	346	505	152	1,251	709	285	244	137	425	74
12	Chunnam Gully,	135	570	86	1,848	228	423	67	91	627	126
13	Mirzapore,	489	433	2,379	5,094	1,620	412	1,230	69	812	123
14	Moocheeparrah,	273	260	1,132	7,789	1,596	299	1,241	127	154	169
15	Loll Bazar,	223	237	30	3,460	211	946	603	281	320	517
16	Shibollah,	277	429	30	626	286	577	166	391	152	637
17	Gooreah Tullah,	465	517	919	1,169	1,982	887	71	222	400	644
18	Fuddopooker,	1,174	415	1,290	2,375	292	848	354	315	150	130
19	Chandney Choke,	338	806	278	1,379	82	436	524	286	919	1,254
20	Tohtullah,	602	649	1,038	4,769	2,031	1,840	177	200	185	676
21	Jaun Bazar,	104	428	651	4,991	105	1,991	4,102	1,404	2,364	812
22											
23	Colingah,	626	879	3,025	4,177	1,789	1,616	267	495	198	255
24	Chowringhee,	152	163	397	169	338	528	22	11	12	9

NAMES OF THANNARS.	Pucca Houses.	Tiled Huts.	Straw Huts.	Residing in the Division.		Employed in the Division.		Employed in the Division, residing in another.		Employed in the Division, residing out of Town.		
				Ryots.	Proprietors.	Servants.	Ryots.	Servants.	Ryots.	Servants.	Ryots.	Servants.
25 Short's Bazar,	68	265	957	639	649	418	0	211	26	127		
26 Bamun Bustee,	88	15	543	390	344	1,753	0	433	0	249		
27 Coomartolee,	329	741	1,101	980	340	60	313	56	728	381		
28 Hautkolah,	655	945	1,269	1,191	1,441	228	132	12	2,155	1,644		
29 Jorabagan,	692	2,175	699	2,608	2,001	1,333	4,101	610	2,223	784		
30 Cubberdangah,	378	512	122	610	365	147	152	258	460	960		
31 Susteetollah,	458	699	102	2,505	679	1,100	63	562	70	129		
32 Burra Bazar,	483	443	17	5,902	1,763	3,433	666	665	169	37		
33												
34 Amratollah,	293	190	8	855	273	105	216	327	545	1,307		
35 Clive Street,	180	16	50	214	48	125	184	464	169	883		
36 Loll Diggee,	249	77	19	365	283	843	375	1,278	22	364		
37												
38 Larkins' Lane,	159	119	26	587	194	724	43	1,172	30	2,034		
39 Chandpaul,	91	7	5	225	2	0	2	1,768	6	1,558		
40 Coolie Bazar,	31	766	19,000	186	580	580	0	0	580	580		
	15,303	19,419	35,354	90,267	32,777	28,366	22,651	13,020	21,782	15,455		
Total Houses, ...	.....	70,076		Total Inhabitants,		1,87,081					
By this result I would say that no calculation had been made of women and children, not servants, and I think it would be fairer to calculate by 10, 6 and 4 as follows:	10	6	4									
	1,53,030	1,16,514	1,41,416	Making the total 4,10,960, which is much nearer the old calculation.								

No. 1—Continued.

In the year 1800, according to the Report of the Police Committee furnished to Lord Mornington, the population was, 5,00,000

And in 1814, according to the late Chief Justice Sir E. Hyde East, Knt., it was calculated at 7,00,000

In 1821, four assessors were employed, by whose calculation the population amounted to as follows :

	Christians.	Mahomedans.	Hindoos.	Chinese.	
U. N. Division,...	5	6,602	64,582	0	} 1,79,917
L. N. ,, ...	5,816	16,865	25,570	244	
U. S. ,, ...	4,476	7,510	18,153	170	
	2,841	17,185	9,898	0	

But the Magistrates in their

Report calculated the upper-roomed houses,

$$5,430 \times 16 = 86,880$$

Lower-roomed houses,

$$8,800 \times 8 = 70,400$$

Tiled huts, 15,792 ÷

$$4 \times 5\frac{1}{2} = 21,714$$

Straw ,, 35,497 ÷

$$4 \times 5\frac{1}{2} = 51,558$$

Total, ... 2,30,552

And the influx of population daily at one lac, (1,00,000,) and the resident population at 2,05,600.

CALCUTTA, 1st January 1857.	1st DIVISION.				2nd DIVISION.			
	Males.		Females.		Males.		Females.	
	+	-	+	-	+	-	+	-
	20	20	20	20	20	20	20	20
English,	1	1	2	2	172	66	80	59
Eurasians,	8	0	1	0	534	289	347	122
Portuguese,	1	0	0	0	837	377	695	345
French,	0	0	0	0	41	16	20	13
Chinamen,	0	0	0	0	62	16	20	9
Armenians,	0	0	0	0	283	174	86	78
Jews,	0	0	0	0	106	76	49	70
Mahomedans,	610	182	241	99	2,765	1,148	1,723	724
Mahomedans,	2,926	1,152	1,375	670	7,668	1,996	3,182	1,020
Hindoos,	2,658	671	1,104	587	5,932	771	1,078	301
Hindoos,	31,301	12,791	23,653	9,190	12,638	3,599	8,107	2,294
Moguls,	0	0	0	0	224	83	106	69
Parsees,	0	0	0	0	7	3	4	2
Arabs,	0	0	0	0	185	87	44	35
Mugs,	0	0	0	0	0	0	0	0
Madrassesees,	0	0	0	0	0	0	0	0
Native Christians, ...	19	11	10	9	0	0	0	0
Low Castes,	2,711	744	1,652	525	2,003	568	1,040	405
Total, ...	40,235	15,552	28,038	11,082	33,457	9,269	16,581	5,546
Males and Females, ...	57,787		39,120		42,726		22,127	
Total Population,	94,907				64,853			
Pucca Houses,	5,080				4,672			
Tiled Huts,	8,390				4,970			
Straw ditto,	15,974				5,665			
Total Houses,	29,444				15,307			
Police Force,	473				434			

3RD DIVISION.				4TH DIVISION.				TOTAL POPULATION.			
Males.		Females.		Males.		Females.		Males.		Females.	
+	-	+	-	+	-	+	-	+	-	+	-
20	20	20	20	20	20	20	20	20	20	20	20
558	217	209	114	557	381	370	349	1,288	665	661	524
1,038	391	541	167	324	366	261	357	1,904	1,046	1,150	646
219	56	123	66	81	144	103	134	1,138	577	921	545
13	11	6	0	16	4	12	8	70	31	38	21
132	33	66	24	0	0	0	0	194	49	86	33
6	0	4	2	2	0	1	0	291	174	91	80
3	0	2	1	0	0	0	0	109	76	51	71
1,880	378	491	79	1,827	505	705	320	7,082	2,213	3,160	1,222
2,038	340	606	128	9,510	4,009	5,583	2,864	22,142	7,497	10,746	4,682
1,225	98	133	36	1,402	432	630	275	11,217	1,972	2,945	1,199
4,476	820	1,952	287	4,707	1,624	2,107	772	53,122	18,834	35,819	12,543
6	1	2	1	12	6	8	9	242	90	116	79
22	0	2	0	0	0	0	0	29	3	6	2
0	0	0	0	0	0	0	0	185	87	44	35
400	50	205	28	0	0	0	0	400	50	205	28
0	0	0	0	19	11	17	8	19	11	17	8
0	0	0	0	0	0	0	0	19	11	10	9
1,003	285	394	85	3,507	1,253	2,053	856	9,229	2,850	5,139	1,871
13,009	2,690	4,736	1,018	21,964	8,735	11,850	5,952	108,675	36,236	61,205	23,598
15,699		5,754		30,699		17,802		1,44,911		84,803	
21,453				48,501				2,29,714			
3,295				1,576				14,623			
4,131				2,813				20,304			
1,141				7,787				30,567			
8,567				12,176				65,494			
218				233				1,358			

(Signed) F. W. BIRCH,
Superintendent of Police.

FROM

F. W. SIMMS, Esquire,
*Consulting Engineer to the Government of India,
and Director of the Railway Department,*

TO

F. J. HALLIDAY, Esquire,
Secretary to the Government of Bengal.

DATED, 20TH MARCH, 1847.

SIR,

I beg to forward some additional observations upon the proposed Water-works for Calcutta, in continuation of my Report on the same subject, dated the 27th ultimo.

I have the honor to be, &c.,
(Signed) F. W. SIMMS, C. E.

CALCUTTA,
The 20th March, 1847. }

CALCUTTA WATER-WORKS.

FROM

F. W. SIMMS, Esquire,
*Consulting Engineer to the Government of India,
and Director of the Railway Department,*

TO

F. J. HALLIDAY, Esquire,
Secretary to the Government of Bengal.

DATED, 20TH MARCH, 1847.

SIR,

In continuation of my Report upon the Water-works for Calcutta, of the 27th ultimo, I beg to communicate the following particulars, by way of answering the objections which His Honor the Deputy Governor of Bengal considered might probably be advanced against the project:

1st. As respects my proposition paras. 19 and 20, of delivering the water "into elevated cisterns in each house," as the most economical method of distribution. This may at first appear an objectionable plan, upon the supposition that the water would remain stagnant for some time, and when that is the case, it soon turns bad in this climate, and

abounds with the larvæ of insects. In explanation I would state that the cisterns need not be larger than sufficient to contain one day's supply only, because the water would be turned on in each district of the City for a given number of hours daily. It would be self-supplying, and can be made to scour itself out as often as may be deemed desirable, and if it be covered with a proper lid, no insects could get access to the fluid to deposit their eggs, &c., and the continual drawing off and re-filling of the cistern would almost be a continuous stream, and therefore the water could not become stagnant, but would be kept both pure and wholesome. If, however, the use of domestic cisterns should be found, or deemed to be objectionable, their use can be wholly dispensed with, by keeping the pressure constantly on the engine, the only objection thereto being the additional expense of doing so.

2nd. The next suggestion related to the possibility that the Native Hindoo population might take a prejudice against the water and refuse to use it, on the ground that it would be polluted by passing through iron pipes. I have made the probability of this a subject of inquiry, and the following are the results: In the first place the water of the Ganges, with which I propose to supply the City, is in itself considered by those people so holy as to purify everything in contact with it, therefore there can be but little doubt that it would (after the first shock to the prejudices of the orthodox Hindoos is got over) be acknowledged to produce that sanitary effect upon the pipes, especially as access to the water contained therein will be impossible, and hence it will escape the chances of pollution, either by accident or design. The Natives, with the exception of the high caste and orthodox Hindoos, now use the water from the present aqueduct, which is open and exposed to pollution in a variety of ways, by the insertion and the washing of things considered unclean. The water also passes through an iron pipe when pumped up from the river by the engine at Chandpaul Ghât. The Hindoo population will not take water from a mussack, or from the hands of a Mussulman, or Christian, consequently they do not employ a bheesty, but obtain their water from people of their own caste, who procure it from the aqueducts or tanks, and for the orthodox Hindoos, direct from the sacred river itself; by these people it is conveyed bhanga-fashion in earthen vessels, and those families of this class who are too poor to employ carriers of their own caste, obtain it by their females, each carrying an earthen vessel (called a *gurryer*), on their hips to and from the river.

3rd. I have learned that the orthodox Hindoos object to the aqueduct water for two reasons, not only from its being exposed to pollution, as above-named, but also because the engine, by which it is raised at Chandpaul Ghâut, is greased with tallow, which they believe to be that of their sacred animals. These being their main objections, it is evident that but little difficulty need be anticipated on this ground, as the use of animal fat and leather could be dispensed with in the new machinery, and if the superintendence of those parts of the Works be entrusted to high caste Brahmins, the great bulk of the people, even the most orthodox, would at once be reconciled to the use of the water: some few, however, will be found, who, rigidly adhering to the principles of caste, will object, for no other reason than its being an European project, and has not received the sanction of the Shastres. Time will, doubtless, speedily remove these prejudices, when they find that they can obtain close to, or in their houses, the sacred fluid of the Ganges, drawn there from above the pollutions of the City; upon the whole, I am constrained to conclude, that no real or insurmountable difficulty exists to the introduction of a complete system of water supply into Calcutta, in the prejudices of the highest castes and most orthodox Hindoos. The Mussulmen and Hindoos of low caste, and those of the high caste who have got rid of their prejudices by education, will at once gladly avail themselves of so great a boon.

4th. Next as to making a charge for the water, to defray the expenses of the Water-works and to realize a remuneration for the enterprize, I have been endeavouring to ascertain the number of bheesties or water-carriers in Calcutta, with a view to determine the present cost of water to the inhabitants; this I find is no easy matter to do, if it be possible to do it at all: they continually vary in numbers with the demand for such services, and this chiefly depends upon the season of the year. In the cold season less water is used in houses than at other times, and during the rainy season very little is required for watering the roads as compared with the cold and hot (or dry) months. The bheesties are invariably Mussulmen, and are mostly from Purneah and the adjoining Districts, also from Burdwan and the Eastern Provinces, the additional numbers of these men that are required and obtained in Calcutta, chiefly for watering roads during the dry months, are agriculturists, who leaving their families occupied at home, resort to the City about the close of the Paddy harvest, and taking to the trade of a bheesty remain there until the rains commence in the following June, and then,

when no longer required in that capacity, their services are called for in the sowing of Paddy and other Agricultural pursuits.

5th. Amongst the native population of the City, there is a class of bheesties who hawk water about the streets for sale (I am told that they are called "*acha pannee wallas*,") in the same way that water was formerly and is sometimes now sold in England. These men carry a small metal drinking vessel, with which they make a tinkling sound to give notice of their whereabouts. They profess to carry water from Lall Diggie, or other tanks reputed pure, but too frequently cheat the public by drawing their supply from the dirty water of the open aqueduct, or other still more unclean sources. The price they obtain for a draught of their beverage is one or two cowries, and that for the whole contents of their mussack (about 8 gallons) varies according to the distance it is professedly carried, for a mile and a half, one anna, and for shorter distances ranging from one anna to half a pice. Now assuming the average price for 8 gallons to be one pice, or say one-third of a penny, and the whole quantity purchased by the inhabitants of each hut is no more than half a mussack, or 4 gallons daily, (the other portion of their supply being obtained from the present impure sources gratis,) which will be a low estimate of the quantity of good water used by a family, their monthly expenditure for this article would amount to five pence or about $3\frac{1}{2}$ annas, the probability being that it would cost them much more. If this statement is correct, and it is deduced from the best information I can obtain, it is quite clear that the average sum of 4 annas per month, which I have proposed as a water rate, in para. 29 of my Report, will be unhesitatingly paid by the Native population for pure Ganges water. Many of the very poor will be unable to pay anything, but very many others much more than the sum named ; it is therefore not unreasonable to expect that the above average of 4 annas will be realized.

6th. The last point I have to notice is the cost of the Works, supposing that the water be not distributed through the City in pipes, as proposed in my Report, but through an open aqueduct, somewhat similar to the existing one, for the inhabitants to help themselves gratuitously. This would approximately amount to the sum of £176,409.

7th. The object to be gained is the distribution of pure water, but by this latter plan it would be in a great measure nullified by the water being exposed to pollution in a thousand different ways, and although it would leave the Works at Ballygatchea in a pure state, would soon have its condition altered by the Natives washing themselves and their dirty

clothes therein at every few yards' interval, and which it would be impossible to prevent, therefore the water, as far as purity is concerned, would be but a small improvement upon that now distributed from Chandpaul Ghât, and the Hindoo population would be in no way benefitted by the necessarily large outlay, for there is no reason to suppose that they would use such water any more than they now do that from the aqueduct.

I believe that the preceding remarks will clear up all the doubtful points, which His Honor the Deputy Governor suggested might probably be raised in opposition to the project of the Water-works.

I have the honor to be, &c.,

(Signed) F. W. SIMMS, C. E.

CALCUTTA, }
The 20th March 1847. }

No. 688.

FROM

The Under Secretary to the Government of Bengal,

TO

The Secretary to the Sudder Board of Revenue.

DATED FORT WILLIAM, THE 7TH APRIL, 1847.

SIR,

Judicial. I am directed by the Hon'ble the Deputy Governor of Bengal to forward the accompanying copies of two Reports from Mr. F. W. Simms, Civil Engineer, dated the 27th February and 20th ultimo, submitting the outline of a plan for supplying the City of Calcutta with Water from the River Hooghly; and to request that the Sudder Board will furnish Government, as speedily as possible, with an estimate of the value of the land required for the purposes indicated by Mr. Simms.

I have the honor to be, &c.,

(Signed) A. R. YOUNG,

Under Secy. to the Govt. of Bengal.

No. 178.

FROM

The Officiating Secretary to the Sudder Board of Revenue,

TO

F. J. HALLIDAY, ESQUIRE,

Secretary to the Government of Bengal

in the Revenue Department.

DATED FORT WILLIAM, THE 31ST MAY, 1847.

SIR,

Miscellaneous Depart. In obedience to the orders conveyed in Under
Present Secretary Mr. Young's letter of the 7th ultimo,
J. Lewis }
and } No. 688, I am directed by the Sudder Board
E. M. Gordon, } Esquire. of Revenue to submit an estimate of the value
of the land required for Mr. Simms' proposed Water-works.

2nd. In a letter dated 7th instant, Mr. Simms gives the land as follows :

At Pultha Ghât, 90 acres.

3rd. From the reservoir to the end of the Barrackpore Road $4\frac{1}{2}$ miles long and 30 feet wide.

4th. At Ballygatchea the whole area, with the buildings thereon, described in paragraph 16 of his Report, comprising about 44 acres.

5th. From the annexed Statement it will be seen that the whole quantity of land amounts in Bengal measurement to beegahs 516-7-7, that the estimated value of the piece at Pultha Ghât (beegahs 337-10-0) is Rs. 7,215-10-0, of the strip from the reservoir (beegahs 49-10) Rs. 1,058-2, of the parcel at Ballygatchea (beegahs 129-7-7-3s) Rs. 1,03,500, and of the buildings*

* 29 Brick-buildings and trees on this parcel Rs. 16,406, giving a total valuation of Rs. 1,28,179-12-0, in addition to which a remission of revenue to the amount of Rs. 577-15-6 per annum will have to be made.

6th. The valuation of the piece at Pultha Ghât and from the reservoir, has been estimated on the data obtained under Regulation I. of 1824, in the case of the lands taken for the formation of the Oolabarriah Road and Canal, which are at no great distance from the present lands. The Board had no nearer means of estimating the value without again applying the above Regulation, and it is probable that the estimate is below the mark.

7th. The estimate of the Ballygatchea parcel is more to be relied upon. Mr. Byrne found, from the deeds of sale of 26 proprietors produced at the late Mr. Crow's office when this land was settled, the average value to be Rs. 36-10-9 per cottah; he therefore assumed Rs. 40 per cottah as a fair rate of compensation. The buildings and trees were also carefully valued, and the Commissioner is of opinion that the whole estimate is not too high.

8th. The ground required on the east side of the Barrackpore Road, Mr. Simms expects will fall within the limits of the land appertaining to the Road. A valuation of that land was therefore not necessary, and the quantity was not given.

I have the honor to be, &c.,

(Signed) G. PLOWDEN,

Offg. Secretary.

Sudder Board of Revenue.

Assumed value of Land required for the proposed works for supplying Calcutta with Water.

Quantity of Land required, as per Mr. Simms' Report.	Area in Beegahs.	Kotihill produce at 2-8 per Beegah.	Probable Sudder summah to be re-mitted.	Expense of collection at 10 per cent.	Probable Zemindar profit.	Annuity value of Zemindar's profit at 20 years' purchase.	Value of Trees, Buildings, &c.	REMARKS.	
Reservoir at Pultha } Ghat, 90 acres, ... }	337 10 0	801 9 0	400 12 6	40 0 0	360 12 6	7,215 11 0	Unknown	These calculations are based upon the Oolabar-riah Canal case, but the value of the land would probably be greater.	
From Reservoir to end of Barrack-pore Road, 4½ miles long by 30 feet wide,	49 10 0	117 9 0	58 12 6	5 14 0	52 14 6	1,058 2 0	Unknown		
Land at Ballygatchea,	129 7 7	.....	118 6 6	.....	.....	1,03,500 0 0	16,406 0 0	These are the results of actual inquiry by the Officiating Deputy Collector of Calcutta.
	516 7 7	.....	577 15 6	.....	.....	1,11,773 12 0	16,406 0 0 1,11,773 12 0	
Company's Rupees, ...							1,28,179 12 0		

SUDDER BOARD OF REVENUE,
FORT WILLIAM,
The 31st May, 1847.

(Signed) G. PLOWDEN,
Officiating Secretary.

To

J. P. GRANT, Esquire,
Secretary to the Government of Bengal,
&c. &c. &c.

SIR,

I have the honor to request you to do me the favor of submitting to His Honor the Deputy Governor of Bengal the accompanying plan for supplying Calcutta with an improved system of drainage and pure Water.

You will perceive that the system of drainage differs, so far as I am aware, from any hitherto proposed. I have tried to adapt it to this Town from a system proposed for the Borough of Southwark; thinking that, if there be no engineering difficulties in the way, it may be found effective for the similar low level locality with which we have to deal here. And the Salt Water Lake has been chosen for the outlet of the drainage, not only as the best for the purpose, but to prevent, as much as possible, corrupting the waters of the river.

I have the honor to be, &c.,
(Signed) J. T. PEARSON,
Presidency Surgeon.

CALCUTTA, }
19th December, 1850. }

MEMORANDUM
ON THE
SUPPLY OF PURE WATER
AND
A BETTER SYSTEM OF DRAINAGE
TO THE
TOWN OF CALCUTTA.

On several occasions I have drawn the attention of the Board of Commissioners for the Improvement of Calcutta to the necessity of forming a plan for the supply of pure Water, and remedying the present defective system of Drainage; and upon the last, I proposed that the Board should request Mr. Simms and two competent Officers to form themselves into a Committee to draw up a plan for the purpose, which the Board could then submit to the Government for approval. Mr. Simms agreed to this at the time, but afterwards declined to serve on a Committee, offering, instead, to form a plan himself, which the Board agreed to; but probably from the press of business Mr. Simms did not do so. Under these circumstances, and despairing of anything being done otherwise, I now venture to address myself to the Hon'ble the Deputy Governor of Bengal, in the hope of a measure so beneficial meeting with attention.

The importance of good Drainage and pure Water to the inhabitants of a large town need not be dwelt upon. It has always been admitted, and recent investigations have proved it in a very conclusive manner. A report, published in the *London Medical Gazette* for January last, shows the rate of mortality from Cholera, in London, to be in direct proportion to the purity of the Water supplied to the inhabitants. In

that City and its suburbs, some of the Water Companies take their water from the River Thames, others from the Sea, the Amwell and Ravensbourne. The Water thus supplied differs in quality according to the situations from whence it is taken up, being comparatively pure the higher its source. From this Report I have constructed the following Table. It shows the effects of the purity of the Water upon only one disease, but from that a very fair inference may be deduced of all; and the important fact elicited that the average mortality of London might be reduced fifty per cent or more, merely by giving good instead of bad Water to the people, and that disease and suffering would be reduced in equal proportions :

Name of Company.	Districts supplied.	Rate of Mortality from Cholera.	Whence the Water is taken, and Remarks.
Grand Junction Company,	Paddington, Hanover Square, May Fair, greater part of St. James' Westminster,	{ 10 in 10,000 inhabitants; the average, lowest 6, and highest 16 in 10,000,	{ Above the point where the matter from the Sewers carried by the tides in the Thames at Kew.
West Middlesex Company,	Marylebone, Hampstead,	{ Average, 17 in 10,000; at Hampstead, 8 in 10,000, ...	{ Lower in the Thames; at Hammersmith; but still above the influence of the tides.
Chelsea Water Company,	St. George's Hanover Square; Chelsea, Westminster, ...	{ Average, 56 in 10,000,	{ Thames and Battersea. The water is derived from the Thames below the Chelsea Hospital, and within the influence of the tides, which carry matter from the Sewers above the suction pipe; which pipe extends to the centre of the stream.
Southwark Company,	Wandsworth; St. Claude; Bermondsey,	{ Average, 156 in 10,000. In Wandsworth, 111; in St. Claude 103; in Bermondsey, 194 in 10,000,	{ From Thames at Battersea, still lower down than the Chelsea Water Company, and the suction pipe appears to be near the side of the river, from which two circumstances the greater mortality probably owing.

Name of Company.	Districts supplied.	Rate of Mortality from Cholera.	Whence the Water is taken, and Remarks.
Lambeth and Southwark Water Company, ...	Parts of Lambeth, St. Saviour; St. George Southwark; Newington; Camberwell,	Average, 131 in 10,000. In Lambeth, 115; St. Saviour, 166; St. George Southwark, 168; Newington, 145 and Camberwell, 102 in 10,000,	From the Thames between Waterloo and Hungerford Suspension Bridges.
East London Water Company,	Poplar; Stepney; Bethnal Green; St. George in the East; Whitechapel, ...	Average, 69 in 10,000. In Stepney, 49; In Bethnal Green, 95 in 10,000,	From the River Lea.
Southwark and East Kent Water Company, ..	Rotherhithe, ...	208 in 10,000, ...	From the Thames, also the Ravensbourne; and partly from the ditches and wells, into some of which the water from drains and cesspools soaks.
New River Water Company, ...	Islington; Shore-ditch; St. Luke; Clerkenwell; London City; West London; East London; Holborn; St. Giles; Strand; St. Martin in the Fields,	Average, 48 in 10,000. In Clerkenwell, least, 19 in 10,000; greatest, in West London on the edge of the Thames, where it was 96 in 10,000, ...	From the Amwell and Lea.

To this is added the remark, that "this Table affords the means of investigating the effects of elevation of soil (which is a good index of the natural drainage) of density of population, and of poverty. And that the mortality was greatest in those districts which have their Water so low as Battersea and Hungerford Bridge; and least in those which have it from the Thames so high as Hammersmith and Kew. "The districts of the New River occupy an intermediate station."

Thus it appears, the lower the situation where the Water is taken, the greater is the impurity, and the greater the mortality. But bad as is the Water of London, that of Calcutta is in some respects even worse. The River Hooghly supplies the greater part used in Calcutta, and it is corrupted, not only by the impure matters produced by a dense popula-

tion, but by the dead bodies of men and animals thrown into it for many miles above and below the town ; and undergoes a kind of stagnation, by the flux and reflux of the tides, over and around the sources from whence the Water is taken. The remainder is, *perhaps*, worse than that from the river, being taken from the tanks and puddles, which are filled by the periodical rains ; and which is used, so long as it lasts, by the surrounding population. It is true, that some few tanks receive a supply, when low, of impure Water from the Hooghly, but the majority receive none but from the sources above-mentioned, and what falls about Christmas, Easter, and occasional storms in the hot weather. In these tanks the people bathe ; vegetables and animals, generated in all the fertility of the tropics, live, die, and decay in them ; the filth of drains and tatties runs into them, either directly in many instances, or carried there by the occasional showers ; no regulation prevents people afflicted with the most loathsome diseases from bathing in them, that is in the great majority of them ; and thus the water becomes more and more filthy as they dry up, though it is still used for cooking, washing, and to drink. After a few months the state of it is inconceivable. Then comes disease, fever, bowel complaints, and cholera ; and Calcutta is said to have an unhealthy climate ; while the truth lies in the habits of the people, and the neglect of supplying them with the great necessary of life.

If from the supply of Water we turn to the state of the Drainage of the town, we find matters, if possible, still worse. But as this part of the subject has been fully detailed in the Report of the Sub-Committee of the Municipal Commissioners, published in 1848, it need not be dwelt upon here.

Among other things, the Board of Commissioners for the Improvement of Calcutta was directed to provide a supply of pure Water to the town, and amend the state of the Drainage ; but adequate funds not having been provided, they are unable to do so. All they can do is to represent the subject to Government, and suggest a plan, together with the means of carrying it into effect.

Several plans have been, from time to time, proposed to supply pure Water, but if there be not insuperable obstacles on the score of expense, that of Mr. Simms' is perhaps the best. It is not enough that the Water be filtered, though that may deprive it of organic impurities, but those of a gaseous nature cannot be separated by mechanical means ;

while chemical ones, to operate upon so large a quantity, are out of the question. It must be brought from the purest source at command, and that Mr. Simms' plan provides for. He proposes, if I understand his plan aright, to bring it from the river above Barrackpore, beyond the usual bounds of the brackish water brought by the tides, conveying it, either by pipes or by an aqueduct, to Cossipore Bridge, filtering it there, and, having provided a sufficient head, distribute it in pipes over the town, even to the tops of the highest houses; so as to supply Water for domestic use, for extinguishing fires, and playing abundantly in fountains.

Along with the supply of Water comes the Drainage, which, indeed, depends in great measure upon it. The drains run, and for the most part must run, towards the Salt-water Lake: but I believe the whole fall, from the Bridge at Cossipore to the Lake, is not more than 11 or 12 feet, which is not enough, and therefore an artificial one should be made. This may be done by running all the great pipes along the centres of the streets, opening into each other, and receiving branches from the houses they pass, and terminating in a reservoir at the lowest part of the town, somewhere about the bottom of Park Street. This reservoir may be dug deep enough to procure any fall desirable, and may be emptied by pumps worked by an engine.

The pipe should be brought from England. Those in use there, and found to be the best, are made of the composition called stone-ware. They are oval in form (O) like an egg, cut through its longest diameter, the small end placed downwards; they are clean, durable, and less expensive than iron pipes. They are made of any size, from an inch to several feet in diameter, and can be provided with an apparatus for flushing them out daily with water supplied from the Water-works.

This system of Drainage and supply of Water, would be no doubt expensive: probably not less than seventy lacks of rupees would be required. But it would not be more expensive than any other system equally efficient. I propose to borrow the money on bonds transferable, or saleable in the market like Government Securities; and, like them, the interest payable half-yearly: to ensure raising the money interest at six per cent would be probably sufficient.

To pay the interest of this, which might be called the Calcutta Improvement Loan, an assessment upon houses, godowns, and landed property of all descriptions, would be required; the rate to be paid by

the occupiers, as they would derive the immediate benefit. Some reduction might be made upon the two latter descriptions of property; but they occupy space, and the pipes must be carried past them; and moreover houses will probably be built hereafter upon their sites, and the property improved; on all which accounts they could not plead an entire exemption.

The amount of the assessment to pay the interest of the bonds, must depend upon the amount borrowed, and the sums derivable from other sources. The expenses of cleaning out and repairing drains, bridges, and other charges in the Scavenging department, would be saved, and the sums now paid for them available: also those for watering, including the engine at Chandpaul Ghât; and, as the drains would remove almost all the substances now carried away in the Conservancy carts, the expenses of those would be saved, and the money devoted to paying the interest on the bonds. In fact, little beyond the charges for making and repairing the roads and lighting, would remain of the present system. On the other hand the expense of the new would be greatly reduced, by requiring the proprietors of houses, &c., to pay for the laying down the pipes, both for Drainage and Watering of their property; the work being, for the sake of uniformity, done by the Board of Commissioners, who should be empowered to recover the amount, if requisite, in a Court of Law.

An increase of assessment, or rather a new assessment, might be objected to, by a few litigious individuals; but I believe it would be in general cheerfully submitted to, as the proposed plan would save the expenses of the present supply by bodily labour, which not only gives bad water and an unhealthy town, but is, in reality, more expensive.

I venture to suggest that the Government appoint a Committee, to consist of at least three persons, two of whom ought to be Engineer Officers conversant with the works required, to draw up and submit to Government a plan for supplying Calcutta with pure Water, and an improved system of Drainage; and for providing funds to execute the Works.

When the Committee shall have finished their labours, it will be necessary for an Act of the Legislative Council to be passed to carry it into effect; for no one who knows this people can expect useful work to be executed except upon compulsion, even though it be to supply

them with the greatest essentials of life, pure Air and pure Water, and health, their attendant blessing.

(Signed) J. T. PEARSON,
Presidency Surgeon.

CALCUTTA,
19th December, 1850. }

No. 200.

TO THE COMMISSIONERS FOR THE IMPROVEMENT OF
THE TOWN OF CALCUTTA.

GENTLEMEN,

Judicial. I am directed by the Deputy Governor of Bengal to forward the accompanying copy of a letter, dated the 19th Ultimo, from Dr. J. T. Pearson, enclosing a Minute on the subject of supplying pure Water, and introducing a better system of Drainage in the Town of Calcutta, and to request that your Board will favor His Honor with your views on the subject.

I have the honor to be, &c.,
(Signed) J. W. DALRYMPLE,
Under Secy. to the Govt. of Bengal.

FORT WILLIAM,
The 30th January, 1851. }

PUBLIC DEPARTMENT.

No. 6 of 1852.

OUR GOVERNOR OF THE PRESIDENCY OF FORT WILLIAM IN BENGAL.

We transmit for your information, and for such notice as you may think them to merit, two letters, of the dates noted in the margin, which were addressed to us by Captain C. B. Young, shortly before his return to his duty at your Presidency, on the subject of the supply of Water to Calcutta, and the reduction of Mr. Simms' Map of that City.

10th February 1852.
13th Ditto ditto.

We are, &c.,
(Signed) J. SHEPHERD,
„ W. WIGRAM AND 11 OTHERS.

LONDON,
The 24th March 1852. }

FROM

BREVET CAPTAIN C. B. YOUNG,
Bengal Engineers,

To

J. C. MELVILL, ESQUIRE,
Secy. H. E. I. Company.

6, SOUTHWICK STREET,
LONDON, 10TH FEBRUARY, 1852.

SIR,

Among the subjects to which I have directed my attention during my furlough in England, has been the supply of Water to the City of Calcutta, and before returning to my duty in India, I deem it right to submit to the Honorable the Court of Directors, the result of my inquiries and observations on the subject.

This I beg now to do in the shape of a memorandum drawn up by myself and Mr. Hawkesly, a Civil Engineer of some eminence, on this subject, in which we conclude that a Water system, such as might be confidently recommended for Calcutta, might be established for £1,60,000-0-0.

The Local Government desired Mr. Simms, then consulting Civil Engineer, about four years ago, to furnish an estimate for this purpose, and the system he recommended amounted in cash to £5,70,000.

I beg also to append copy of a letter to me from Mr. Hawkesly, in which he proposes that the funds requisite for the undertaking should be raised by a Joint Stock Company in England, an idea which, I should say, originated entirely with himself: but believing, as I do, that it is as desirable a plan as any for furthering this important object, I have assured Mr. Hawkesly, that I consider two points to be absolutely necessary to its success, *viz.*—*first*, the substantial support of Government, and *secondly*, the superintendence of the whole work by a Government Officer.

Never having had personal opportunity of ascertaining exactly all the details which are necessary to a precise estimate, but having drawn these chiefly from Mr. Simms' Report before referred to, I have informed Mr. Hawkesly that the first thing necessary to be done in case the Government felt disposed to lend their support, would be to draw out, in India, more detailed estimates and also plans to correspond. This done, Mr. Hawkesly is ready to revise them according to

his experience and the prices of this country, as well as to organize, as I understand, a Company to raise funds for carrying them out ; while for my own part, I shall be at all times ready in India to lend my aid in furtherance of an object already fully recognized by the Local Government, and evidently fraught with much benefit to the Town of Calcutta.

I have, &c.,
(Signed) C. B. YOUNG,
Brevet Captain, Bengal Engineers.

FROM

T. HAWKESLY, ESQUIRE,
Civil Engineer,

TO

BREVET CAPTAIN C. B. YOUNG,
Bengal Engineers.

DATED LONDON, THE 8TH FEBRUARY 1852.

MY DEAR SIR,

Herewith you have my notes upon the proposed Water supply of Calcutta.

There would, I conceive, be no difficulty whatever in raising funds by means of an English Company, if the Local Government would give the project their support, take shares to a limited amount, and provide the services of a resident Engineer Officer, and providing the East India Company would further the object so far as to give it their commendation and countenance.

The work is of such easy construction, and of such light expense, that I have no doubt the undertaking would prove highly remunerative to those who might choose to invest capital in it.

I am, &c.,
(Signed) T. HAWKESLY.

I will, (as you suggest,) with much pleasure do what is necessary to be done in this country as an Engineer, in conjunction with yourself in India, and will place the matter in a proper position before the English capitalists, if there should appear any prospect of the undertaking being carried into effect.

(Signed) T. H.

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**NOTES ON THE PROPOSED SUPPLY OF WATER TO
CALCUTTA.**

The supply of Water to London, as at present existing, is ascertained to amount to 20 gallons per head, and is expected to increase to 25 gallons per head, and there to remain tolerably stationary.

Considering the many purposes to which Water is applied in England beyond the purposes to which it is or is likely to be applied in India, although for some purposes Water is more abundantly used in hot climates than in temperate climates, it is probable that the English experience would suffice for application to the circumstances of Calcutta.

The provincial experience of England is 18 gallons per head per day. The mean may be fairly taken at 20 gallons per head per day.

The European quarter of Calcutta may be estimated to contain—

Europeans, 	}	11,000
Eurasians, 		
Mahomedans,	}	90,000
Hindoos, 		
		1,01,000

for immediate supply after the rate of 20 gallons per head per diem.

	<i>Gallons.</i>
Say 100,000 × 20 	2,000,000
Government and public purposes,	1,000,000
Total, per diem,	3,000,000

According to which quantity all the works capable of being from time to time enlarged and extended when and as occasion may require, should be proportioned; but on the other hand, all works which from their nature do not admit of such extension and enlargement, should, in conformity with established practice, be made capable of affording one and a half times to twice the foregoing amount of supply.

The only source available for the supply of Calcutta is the River Hooghly, and inasmuch as the influence of Salt Water is perceptible nearly as high up the river as Pultha, a distance of 13½ miles above the City, this is the nearest point at which Fresh Water can at all seasons be obtained.

The bank of the river at Pultha is about 15 feet above the surface of the river, at low water, and thence the ground descends gradually towards Calcutta, with a nearly uniform fall of (say) 4 inches per mile.

Moreover the City itself is placed on a practically horizontal plane, corresponding in height with the bank of the river.

Under these circumstances, it appears best to raise the Water from the river at Pultha by means of small steam-engines into tanks, and thence to allow it to flow in a continuous stream along a suitable conduit to other receivers, to be made at some place near the City, where larger engines may be erected to distribute the supply under high pressure to the portion of the City now under consideration.

In this way the cost of an expensive iron main may be saved and much friction avoided.

A situation advantageous to this latter purpose (the engine station,) presents itself at Ballygatchea, immediately without the Mahratta Ditch of the City, where the necessary filter-beds and pure Water tanks may also be erected.

Five Engines. To raise 3,000,000 gallons per day of 500 minutes in 2 tides of 250 minutes each, requires—
500/3,000,000

6,000 gallons per minute.

60,000

Tank say 20 feet above low water ;
33,000/1,200,000 in a minute.

40 Horse-Power.

—say, to provide against accident 3 engines of 20 Horse-Power each.

Then as to the conduit from Pultha to Calcutta, conduit say of 4 feet internal diameter.

$$0 = \frac{1}{4} \sqrt{\frac{4 \times 48}{1760}} = \frac{192}{1760} = \frac{1}{9}$$

$$= \frac{1}{4} \times \frac{1}{3} = \frac{1}{12} = \frac{1}{4}$$

$(\frac{48}{12})^2 \times \frac{1}{4} = \frac{2^2 \cdot 3^0}{3} = 58$ gallons per second.

$86,400 \times 58 = 5,110,200$ gallons per diem.

Hence with a diameter of 48 inches and a fall of 4 inches per mile, the conduit would run (approximately) 3 ft. 5 in. deep when delivering 3,000,000 gallons in 24 hours.

Distributary Engines. The Distributary Engines ought to be capable of raising 3,000,000 gallons 80 feet high in 8 hours, or say 500 minutes = 160 Horse-Power nearly, say 3 engines of 50 Horse-Power, each with one spare engine in case of accident.

Pipes. The population to be supplied is 1,00,000, properly distributed after the rate of 2,000 per mile of street.
1,00,000 population.

2,000 per mile = 50 miles.

Add public and principal main 10 miles.

60 miles of street pipes.

Estimate. On the above data (to be hereafter corrected), the cost of construction may be calculated as follows, viz. :

1. Engine power at Pultha :
Three Engines of 20 Horse Power with pumps, buildings, sluices, &c. &c., costing in England £105 per Horse-Power, say in India £210 per Horse-Power, ... £ 12,600
2. Three subsiding and regulating Tanks, each capable of holding 1 tide of Water = 1,500,000 × 3 = 4,500,000 gallons, say each 60 yards square and 3 yards deep 10,000 yards of surface, at 10s,... .. £ 5,000
3. Thirteen and a half miles of 48 inch conduit, 9 inches thick brick work,... .. 12s
cutting and filling, $\frac{2-6}{20}$ puddling, &c.,
13½ × 1760 × £1, £ 22,760
4. Four filter beds, each to filter 100,000 gallons per day, say each 40 yards square 40 × 40 × 4 = 6,400 at 15, £ 4,800
5. Two pure Water tanks to receive the filtered Water and to be arched over to protect it from solar influence, dust, &c., each to contain 1,000,000 gallons, say—
50 × 50 × 2 = 5,000 yards at 20, £ 5,000
6. Two hundred Horse-Power as before at £210, ... £ 42,000

7. 60 miles of pipes at £800,	£ 48,000
	<u>£ 1,40,160</u>
Including contingencies,	<u>£ 1,60,000</u>

Add value of Land, if not provided by Government.

(Signed) T. HAWKESLY.
,, C. B. YOUNG,
Brevet Captain, Bengal Engineers.

To

J. C. MELVILL, Esquire,
&c. &c. &c.

6, SOUTHWICK STREET,
LONDON, THE 13TH FEBRUARY, 1852.

SIR,

Since submitting my letter of the 10th instant, with estimate and communication from Mr. Hawkesly, Civil Engineer, on the subject of the Water supply to Calcutta, I have been informed that the map of that place lately drawn out by Mr. Simms, after careful survey, is on so very large and elaborate a scale that the Honorable the Court of Directors are doubtful of the expediency of incurring the very great expense which the engraving of it for publication would entail.

As the map would no doubt be of great value, from the care bestowed on its preparation, provided only it were of convenient and suitable dimensions, and as it would be particularly so with reference to the subject of my letter referred to, *viz.*, the supply of Water to the City of Calcutta, I beg respectfully to state that, should the Honorable the Court of Directors approve, I am willing to place my services at disposal for the purpose of reducing the map accurately, in such a manner and to such size as may be deemed advisable.

I have &c.,
(Signed) C. B. YOUNG,
Brevet Captain, Bengal Engineers.

No. 971.

To

THE SECRETARY TO THE COMMISSIONERS FOR THE IMPROVEMENT OF THE TOWN OF CALCUTTA.

SIR,

General. I am directed by the Most Noble the Governor of Bengal to transmit, for the consideration of the Municipal Committee, the accompanying copies of two Letters addressed to

(Vide Court's *Public Letter* to Bengal, No. 6 of 1852, dated 24th March.)

the Secretary at the India House by Captain C. B. Young, of the Bengal Engineers, dated respectively the 10th and 13th February last, received from the Honorable the Court of Directors, on the subject of the supply of Water to Calcutta and the reduction of Mr. Simms' map of this City.

I have &c.,

(Signed) J. W. DALRYMPLE,

Under-Secy. to the Govt. of Bengal.

FORT WILLIAM, }
The 28th June 1852. }

No. 729.

FROM

J. O. BECKETT, ESQUIRE,

Secretary to the Commissioners for the Improvement of the Town of Calcutta.

To

CECIL BEADON, ESQUIRE,

Secretary to the Government of Bengal.

DATED 4TH SEPTEMBER, 1852.

SIR,

With reference to the several communications as cited in the margin, enclosing certain reports from the

Bengal Government to Commissioners of Conservancy, No. 200, dated 30th January 1851.

Ditto ditto, No. 1136, dated 26th May 1852.

Ditto ditto, No. 971, dated 28th June 1852.

Ditto ditto, No. 1298, dated 7th June 1852.

late Dr. Pearson, Mr. F. W. Simms, late Consulting Engineer to Government, and Captain C. B. Young, Bengal Engineers, on the subject of supplying pure Water and introducing a better system of Drainage in the Town of Calcutta, I am instructed by the Commissioners for the Improvement of the Town of Calcutta to submit in reply the following

remarks thereon for the consideration of the Most Noble the Governor of Bengal.

The projects contemplated in the above reports provide for two very grand and inestimable benefits to the Town and its daily increasing population, *viz.*, an efficient and entirely new system of Drainage and a bountiful supply of pure and filtered Water, adapted for all domestic purposes, to be delivered in the houses of the chief residents, and at the doors of the humbler classes: provision is also made for the easy and effectual flushing and scouring of the drains and sewers, and other general, public, and street purposes.

The first of these objects, as urged on the attention of the Government in Dr. Pearson's Report, dated the 19th December 1850, is an improved Drainage, which he states has already been fully detailed in the report of the Sub-Committee of the Municipal Commissioners published in 1848. The plan proposed by this gentleman, which he observes in his letter covering the report, above quoted, differs from any hitherto proposed, seems to be something to the following effect; considering that the natural drainage of the Town to be towards the Salt-water Lake, and that the whole fall from the Cossipore Bridge to the Lake (not more than 11 to 12 feet) is insufficient, he deems an artificial fall necessary, and thinks it might be effected by running all the great pipes along the centre of the streets, opening into each other, and receiving branches from the houses they pass, and terminating in a reservoir at the bottom of Park Street, to be dug deep enough to procure the requisite fall, and to be emptied by pumps worked by an Engine.

The pipes to be obtained from England of stone-ware or porcelain, of an oval shape, which are stated to be clean, durable, and less expensive than iron pipes. The estimated expense for the Drainage, according to this plan, is supposed to be about twenty-three (23) lacs of Rupees.

On this part of Dr. Pearson's Report, I am desired to say the Commissioners have very lately, in their Eighth Half-yearly Report, dated the 1st February last, offered their opinions, and therein given such information on the subject of Drainage, and the plan as originally proposed by Col. Forbes, as laid in their power; it would therefore seem superfluous to enter into it again further in this place.

The supply of Water to the Town, alluded to by Dr. Pearson, is taken from Mr. Simms' plan for that purpose, a copy of whose report and specifications has only recently been furnished to this department. The

system proposed by the latter gentleman is to bring the Water from the purest source at command, *viz.*, from Pultah Ghât above Barrackpore, 18 miles from Calcutta, beyond the bounds of the brackish tides. It will be raised from the river at that point by means of steam-power, into reservoirs or tanks built at a sufficient elevation, from whence it will be conveyed through aqueducts along the direct course of the present Barrackpore Road to Ballygatcheea, in the vicinity of the suburbs, near the Barrackpore suspension bridge, where extensive works are to be erected for filtering purposes, and to distribute the supply, by larger steam-engines under high pressure and by a conduit over the bridge through several main channels over the city.

Mr. Simms distinctly shows how good Water is to be procured in abundance at the rate of 30 gallons per diem for each inhabitant of the town, and how it is to be distributed in pipes or channels even to the tops of the houses, for domestic use, for extinguishing fires, and playing abundantly in fountains. The estimated expense for this desirable object is thus simply stated by the late Consulting Engineer to Government :

Works at Pultah Ghât and Ballygatcheea and Aqueduct,	
the whole 13½ miles,	£ 159,861
Mains and pipes through the city, 142 miles, 1 f. 42 yds., ..	510,336
	<hr/>
Total outlay in first instance,	670,197

or in round numbers sixty-seven (67) lacs of Rupees, and the annual expenditure or working expenses for carrying on the operations, are estimated at £55,480, or at about five and a half (5½) lacs per annum.

Dr. Pearson observes that this system of Drainage and Water-supply would no doubt be expensive; probably not less than seventy (70) lacs of Rupees would be required, and he proposes to borrow the money on bonds to be called "The Calcutta Improvement Loan," bearing interest at 6 per cent, payable Half-yearly, and transferable or saleable in the market like Government securities. To secure payment of the interest on this loan he proposes a new assessment upon houses, godowns and land property of all descriptions, to be paid by the occupiers, and at a rate depending on the amount borrowed and the sums derivable from other sources. Amongst these are stated what he considers would be

a saving of the present municipal charges, *viz.*, the expense of cleansing and repairing of drains and bridges, watering and other charges in the Scavenging Department, watering the streets, and working the engine at Chandpal Ghât. He further proposes to reduce the amount of the loan, by requiring the proprietors of houses to pay for the laying down of the pipes both for draining and watering their property.

In addition to the above plans, there is another for a Water-supply, from Captain C. B. Young, Bengal Engineers, differing in no essential point from Mr. Simms' proposal, excepting in the very important matter of cost, in which there is a very wide discrepancy between the two systems. Mr. Simms' Report gives no idea whatever of the means by which he arrived at the two items of expense (67 lacs) above quoted; he calls it a mere outline plan. Captain Young, on the other hand, goes into minute detail for each portion of the work, and arrives at an estimate of £160,000 or sixteen (16) lacs of rupees, or including ground at Pultah, Ballygatcheea, and on the road, 246 beegahs at 800 Rupees per beegah, 18 lacs of Rupees. While the difference in the first outlay in the two plans is as 67 to 18 lacs of Rupees, or in a ratio of nearly 4 to 1, so are the working annual expenses as 5,54,800 Rupees to 40,000 Rupees, or in the proportion of 16 to 1. The horse-power for the engines proposed by Mr. Simms is in the same extensive ratio to that of Captain Young, *viz.*, as 200 horse-power to 60 for Pultah Ghât, and as 300 to 150 horse-power for the filtering station at Ballygatcheea. Mr. Simms estimates for no less than 142 miles of pipes and mains, while Captain Young considers 60 miles of street-pipes sufficient. The necessary funds the latter Officer conceives could easily be raised by a Joint-Stock Company in England, provided the Government lent the project their support.

The amount of income expected from the introduction of such a system for the payment of the interest on the loan, and the working expenses, is differently estimated by the two Officers. Mr. Simms comes to the conclusion that an income of £116,000 per annum, (eleven lacs and sixty thousand Rupees,) ought to be realized without difficulty by levying a Water-rate on every house and native hut. Captain Young grounds his estimate on the mean of several calculations, and makes it (1,54,750) one lac, fifty-four thousand, seven hundred and fifty Rupees per annum, being in the ratio to the former calculation as 1 to 7½, and certainly much nearer the probable result.

With the above brief outline of the propositions under consideration, the Commissioners believe that before entering into any serious analyzation of such gigantic schemes, it would be better to understand the views of Government on the following primary and very important points.

First,—Is the Government prepared to enforce by laws the use by the native population of the drinking Water which any general scheme that may be determined on will supply, and to levy a rate on native huts as well as on pukka houses for that purpose ?

Secondly,—Is the Government prepared to advance $67 + 23 = 90$ lacs of rupees, or even the smaller sum of $18 + 23 = 41$ lacs, or to guarantee the rate and payment of dividends to any private Company that might be induced to subscribe the capital and undertake the work ?

Desirable as the supply of pure Water to the Town, and a better system of Drainage, undoubtedly is, and incalculable as the benefit to the Town would be, the Commissioners conceive both schemes to be perfectly out of the question, and the continued discussion of them fruitless, until the needful funds are in the first place either provided by the Government, or a guarantee given to Capitalists who might be induced to speculate in such a scheme. Whenever it may be the pleasure of the Government to take up and decide upon the financial part of the question, the suggestion contained in Dr. Pearson's minute for the appointment of properly qualified Engineers to consider and mature the details of a plan, and submit the same for the approval of Government with a view to a legislative enactment being passed to carry it into effect, would be attended with good results.

In the consideration of the subject of a Water-supply, there is one point which demands particular notice, *viz.*, the difficulties which may be anticipated from the religious feelings and prejudices of the Hindoo community, forming the bulk of the native population in this Town, against using any Water drawn by an engine and supplied by means of pipes or aqueducts. Although it was stated in the First Half-yearly Report by the Sub-Committee of the Conservancy Commissioners, two members of which were native gentlemen, that a considerable portion of the population, both European and native, are in the habit of using for culinary and other domestic purposes the Water of the tanks supplied by the present aqueducts, subjected to all sorts of abominations from

the river source whence it was taken, still the opinion of the native members of the present Board is very strongly opposed to the sentiments expressed in Mr. Simms's Second Report, as to the Water so conveyed being acceptable to the native community generally, after the first shock to the prejudices of the orthodox Hindoos is overcome. These gentlemen are unanimous in declaring their belief that the Hindoos will never use Water conveyed by such means, although they might obtain it even at their very doors. No Hindoo, they observe, whether rich or poor, orthodox or heterodox, will use the Water, but they will, as now, obtain it direct from the river by their own servants and females, notwithstanding it is impure and corrupt, and therefore they cannot, with any show of justice, be charged for water which they cannot against their religious scruples use, and for which they cannot be relieved of any part of their present expenses; neither will the absence of animal fat and leather, and the employment of high-caste brahmins to work the engines, as proposed by Mr. Simms, in any way lead the mass of the Hindoos to think better of the scheme. A few whom education and refinement have placed above the prejudices of caste and the influences of superstition may be inclined, they think, to use pure Water obtained by such means, but as their females are as superstitious and bigotted as the females of the most orthodox Hindoos, and as they have family idols for whom the fluid fresh from the sacred stream must be supplied, they will be under the necessity of using the Water they now do. The native Commissioners are decidedly of opinion that a very long time must elapse, and education must spread far and wide, before the Hindoos could be expected to use Water supplied by means of aqueducts or iron pipes, and they consider that any measure rendering the use of it by the Hindoo community compulsory against their religious feelings and prejudices would be an arbitrary one, and such as they cannot recommend to Government.

The Government Members of the Board, with every deference to the sentiments of their native colleagues, are inclined to think that simply on such grounds the introduction of such a scheme, for imparting health and cleanliness to such a Town as Calcutta, could not altogether be rejected. Time and habit, they believe, would soon have its due effect as regards the use of good and pure Water, accessible at all hours of the day and night, even with the Hindoo population, or at all events with so large a proportion of the native inhabitants generally as to

warrant its introduction. But looking to the other side of the question, viz., the expense, they are of opinion that with the great advantages already possessed as regards the extreme cheapness of manual labor and the conveniences of good tanks existing in almost all parts of the Town, the expenditure of so large a sum of money as 16 or 18 lacs of rupees for such a purpose cannot be deemed either necessary or practicable, when the more crying necessity of an improved Drainage is so imperatively called for, and so apparently unlikely to be realized.

Captain Young proposes to commence with an experiment on the European quarter of the Town, in the 4th Division, but any experiment of this sort involves the construction of the entire Works at Pultah and Ballygatcheca, together with the construction of the permanent conduit along the intervening road. If established at all, therefore, it would appear to be necessary to make it compulsory on all parties alike, or no fair returns equivalent to a dividend on the paid-up capital of 9 per cent could be expected.

Although the data on which Mr. Simms based his estimate, amounting to the enormous sum of 67 lacs of rupees, is not before the Board, it is to be supposed that that Engineer had good grounds for arriving at that sum; Captain Young's estimate, on the other hand, reaching only one quarter of this outlay, is supported by a Civil Engineer of some eminence at home, and provides for the same identical work, and apparently with every show of reason and probability on its side.

The Board, without venturing an opinion as to what the cost of the work, if properly carried out, will be, hope that Mr. Simms' estimate will be found far above the mark, as they cannot but consider that he has over-stated the work to be done. The length of street-pipes is calculated by this gentleman at 142 miles, whilst Captain Young thinks 60 miles will be sufficient. The latter may be below the actual quantity required, but Mr. Simms is supposed to have included small lanes, which might well be omitted in this large difference of 82 miles, it being only reasonable that the main thoroughfares and the houses of the chief inhabitants should be supplied, who would be expected to pay a fair equivalent for what they receive, while the unimportant lanes, from which no return could possibly be made, would entail an expenditure of many lacs of rupees. This, however, will properly come under revision and scrutiny by any Committee which the Government might appoint.

If the scheme for an independent joint-stock Company should find favor in the estimation of Government, perhaps the best mode of making the subject known would be to print the whole of the papers on the subject for the information of the English capitalists; provided the Government guarantees were given, Mr. Hawkesly, the Engineer in England, considers the capital might easily be procured there, and although both Mr. Simms and Captain Young over-state the sources of income likely to be derived by the introduction of their system, and consider many items of present expenditure as certain to be avoided, which the Commissioners cannot acquiesce in, still the employment of funds in establishing such a scheme would doubtless be in many ways advantageous to the Town, and as such, would of course meet the hearty co-operation and approval of the Municipal Board. They are, however, unanimously of opinion that no further assessment on the houses, as proposed by Dr. Pearson, could be made.

There can be no doubt that the Water-supply is intimately connected with a new system of Drainage: the great advantage, indeed necessity, of a good flow of Water at all seasons of the year for flushing and scouring the drains is self-evident, but filtered water from Pultah, brought down at high pressure and at an expense of 18 lacs of Rupees is not at all necessary for such a purpose, and therefore the views and aim of this Department is to obtain, first of all, that which is really daily and hourly pressing itself on the attention of the Commissioners, *viz.*, some improvement to the present defective state of the Drainage of this important Town, and an abatement of the noisome and pestilent effluvia arising on all sides from the drains, dangerous alike to the residents who are unfortunate enough to live over them, and to the passer-by, who is ever and anon reminded of their proximity by the gaping and unsightly appearance they present, as well as by their offensive odour.

The present appears a favorable opportunity added to the many of which the Municipal authorities have already availed themselves, to urge on the attention of the Government the extreme helplessness of their present position, with respect to funds, for carrying out of even the most trifling improvement. From several years of compulsory inactivity in this respect, the Town, it is to be feared, is retrograding instead of improving, while the increasing population demands increasing efforts to maintain the appearance, healthiness, and order of its in-

numerable thoroughfares. This formidable difficulty to the progress of all conservancy improvement or to the carrying out of any of the great undertakings contemplated by the Government in the Act, want of funds, has been felt and expressed forcibly in the First and every succeeding Half-yearly Report, from the constitution of the Board, under Act XVI. of 1847, up to the present time, and various suggestions as to the sources and means of income, which appeared appropriate for such ends, have been offered; a recapitulation of these here would be unnecessary, but I am directed to express a hope that the present inquiry may tend to provide the means of lessening the causes of disease and suffering in this Town, and that a longer time may not be allowed to elapse without the display of that paternal care and interest of the Government which may form the basis of a great and lasting improvement.

In Captain Young's Address to the Secretary to the Hon'ble Court of Directors, allusion is made to Mr. Simms' Survey of Calcutta, which being on so large and elaborate a scale, the Hon'ble Court have deemed it inexpedient to go to the expense which the engraving of such a publication would entail. A proposition is therefore made to reduce it to convenient and suitable dimensions. The Commissioners desire me to state that, so far as they are informed, no general reduced plan of the whole Town is as yet available to the public, or to themselves, for the important and constant necessities of Town improvement. The original block-plans are understood to be in the Surveyor General's Office, and have not yet been turned to any practical utility. The want of such a map is most urgently felt by nearly all classes of the community, and it appears most desirable that the results of such a survey should be put into a cheap and useful form for general circulation. The orders of Government on this head are, therefore, respectfully solicited.

I have the honor to be, &c.,

(Sd.) J. O. BECKETT,

Secy. to the Commissioners.





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