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INDIA OFFICE,

WHITEHALL,

LONDON, S.W. 1.

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Acris 8920; L.O. Est. No.
Secretary, London.

Sir,

With reference to Mr. Batterbee's inquiry in September regarding a paper-pulp concession in India stated to have been given to Messrs. Thomas & Sons, I am directed to forward for information copy of a letter received from the Government of India on the subject.

13th October
enclosures
original.

I am, Sir,

Your obedient servant,

E. Turner

Secretary,

Commerce & Revenue Department,

The Under Secretary of State,
Colonial Office.

GOVERNMENT OF BENGAL

Revenue Department

Forests.

No. 276

From the Hon'ble Mr. W. C. M. PIN, M.A., I.C.S.,
Secretary to Government of Bengal.

To The SECRETARY to the GOVERNMENT of INDIA,
Department of Revenue and Agriculture.

Calcutta, the 8th January 1920

Sir,

I am directed to refer to Sir Edward MacLagan's circular No. 3F.-30-1, dated the 18th January 1913, in which it was laid down that forest contracts extending over a period of years, or over considerable areas, and connected with proposed new industries promising to be of commercial importance, should be submitted to the Government of India before being formally ratified by Local Governments. In accordance with that circular, I am to submit for the approval of the Government of India, a draft agreement which the Governor in Council proposes to enter into with the India Paper Pulp Company, Limited (of which Messrs. Andrew Yule & Co., Ltd., of Calcutta, are the Managing Agents) for the extraction of bamboos from the Kasaling Reserve in the Chittagong Hill Tracts Forest Division for the manufacture of paper pulp.

2. The forests, in respect of which the agreement is proposed to be made cover an area of about 427 square miles of evergreen and bamboo forest. The draft agreement has been drawn up in consultation with the Solicitor to the Government of India,

on

GOVERNMENT OF BENGAL

Revenue Department

Forests.

No. 276

From the Hon'ble Mr. M. C. MCALPIN, M.A., I.C.S.,
Secretary to the Government of Bengal.To The SECRETARY to the GOVERNMENT of INDIA,
Department of Revenue and Agriculture.

Calcutta, the 8th January 1920.

Sir,

I am directed to refer to Sir Edward MacLagan's Circular No. 27.-30-1, dated the 18th January 1913, in which it was laid down that forest contracts extending over a period of years, or over considerable areas, and connected with proposed new industries promising to be of commercial importance, should be submitted to the Government of India before being formally ratified by Local Governments. In accordance with that circular, I am to submit, for the approval of the Government of India, a draft agreement which the Governor in Council proposes to enter into with the India Paper Pulp Company, Limited (of which Messrs. Andrew Yule & Co., Ltd., of Calcutta, are the Managing Agents) for the extraction of bamboo from the Khasi Reserve in the Chittagong Hill Tracts Forest Division for the manufacture of paper pulp.

2. The forests, in respect of which the agreement is proposed to be made cover an area of about 427 square miles of evergreen and bamboo forest. The draft agreement has been drawn up in consultation with the Solicitor to the Government of India,

on the lines of the agreement entered into with Messrs. Davenport & Co. of Calcutta, for the extraction of timber from the Buxa Forest Division, and the manufacture of tea chests and three-ply wood, which was approved by the Government of India in Mr. Gilliat's letter No. 206-72-2, dated the 11th April 1918, subject to certain remarks contained therein. The period of the agreement now under consideration is 21 years, and the firm is given the option of a renewal for a further period upon such terms as may be settled by mutual agreement. The firm is required to begin work not later than 1st January 1921 and to erect and supply on or before that date all necessary machinery and plant. No royalty will be charged for the first two years commencing from the 1st January 1920.

3. The Governor in Council has examined the proposal in the light of the Resolution No. 1456-216 A., dated the 10th April 1916, of the Government of India, Department of Commerce and Industry. Under the resolution concessions involving monopolies of production and supply should be granted only for a strictly limited period, and after giving public information of what is intended; but this general principle is not intended to prevent forest contracts, provided that they are not granted for unduly long periods and that, so far as possible, due publicity is given in inviting applications for such contracts.

4. The proposal for the grant of the lease was therefore duly published for public information. Four objections were received. The main ground of objection was that the reserve at present provides bamboos for the local needs of both Chittagong and the Chittagong Hill Tracts. The Governor in Council is, however, satisfied that the scheme is an important one both from the industrial and the forest point of view. It will ensure the economic exploitation

of the vast bamboo resources of the reserve, where wasteful methods of extraction at present prevail; and it will result in a substantial increase of revenue. At the same time His Excellency in Council is of opinion that it is essential in order that local interests may be adequately protected, to provide facilities for the extraction of bamboos for local needs. Provision has accordingly been made in clause 5 of the agreement that should the Conservator of Forests, Bengal, find that the bamboos required by the inhabitants of the neighbourhood cannot be fully satisfied by other sources of supply, he shall have power to arrange for the removal of a number sufficient for the purpose out of the Kasalong Reserve. Provision has also been made to exempt *daleo*, (*Teinostachyum Dallesii*) which is almost exclusively used for floating purposes, from the license. As regards the question of export of bamboos to Chittagong, the Governor in Council is of opinion that there must be some interference with the trade by the dislocation of the supply from Kasalong; but he is satisfied that the interference with trade will only last for a short time until the demand becomes adjusted to the other available sources of supply.

5. His Excellency in Council considers that the terms of the draft agreement are reasonable and that the scheme is a real advance in forest exploitation in Bengal. I am, therefore, to request that the Government of India may be moved to approve the draft agreement, and that orders may be communicated at an early date.

I have etc.,

M. C. McAlpin,

Secretary to the Government of Bengal.

An AGREEMENT dated the _____ one thousand nine hundred and twenty made BETWEEN THE SECRETARY OF STATE FOR INDIA IN COUNCIL (hereinafter called "the Secretary of State") of the one part and the India Paper Pulp Company, Limited, having its registered Office at 8 Clive Row, Calcutta, (hereinafter called the Lessees which expression where the context so admits or implies shall include its successors and assigns) of the other part.

1. The Secretary of State hereby grants to the lessees liberty to enter upon the Masalong Reserve forest situated in the Chittagong Hill Tracts Forest Division, and to cut and remove therefrom bamboos of all kinds with the exception of *Teinostachyum Dalloca* commonly called Daloo, such bamboos to be crushed and prepared at a factory or factories at Chittagong, the site of which shall hereafter be determined by mutual agreement between the Conservator of Forests, Bengal and the lessees.

2. Government may cut and remove all bamboos that may be required by Government for civil or military purposes or for the requirements of the Public Works or Forest Department, and the lessees shall not in any way interfere with the servants of Government engaged in the work of cutting and removing such bamboos.

3. The lessees shall work through the area regularly and systematically in such manner and on such rotation which shall not be less than three years as shall be approved by the Conservator of Forests, Bengal, and shall remove all burls and tops as well as the central portions of the culms of the bamboo.

4. The lessees shall not hinder or prevent any person or persons holding permits duly issued by the Forest Department authorising them to cut *Teinostachyum Dalloca* Bamboos in the area subject to this agreement.

5. The Conservator of Forests, Bengal, if in his opinion the

the requirements for bamboos of the inhabitants of the area served by the Kassalong and the Karnafuli rivers from Mainimarkh to Sengkhong Mukh cannot be fully satisfied by other sources of supply, shall have the power to arrange for the removal of a number sufficient for this purpose out of the Kassalong Reserve, and the lessees shall give the holder of permits given under this clause full facilities for the cutting and removal of bamboos.

In the event of Daloo bamboos flowering during the period of this license the Conservator of Forests, Bengal, shall have power to arrange for the removal of such number of bamboos of any other species as may be in his opinion required for the purpose of floating timber provided that this quantity shall not exceed the average amount of Daloo bamboo extracted by local consumers during the previous five years.

6. The lessees shall not cut or remove any timber from the said Reserve except as provided in clause 12 hereof.

7. The lessees shall pay royalty at the following rates:

Nil for two years commencing from 1st January 1920,

From 1st January 1922 to 31st December 1931 Re.1 per ton

of crushed and baled bamboo leaving crushing mills,

and Re.2 per ton for the remaining years of the license

provided that in the event of the said royalty

payable under this clause being less in any year

from 1922 to 1931 inclusive than Rs.10,000 the

lessees shall pay such sums as will with the royalty

paid on bamboos actually crushed and baled during

such year, make up the sum of Rs.10,000 and so

during the years for 1932 to 1941 inclusive, except

that minimum royalty shall be Rs.15,000. In the

event of the flowering of any species of bamboo

in the said reserve in any year the provisions of

this proviso shall not apply.

8. The lessees shall commence work before 1st January 1922 and shall on or before that date erect and supply all necessary machinery and plant to the satisfaction of the Conservator of Forests, Bengal, and in the event of the re-planting so to do

do the Secretary of State may without prejudice to any other right or remedy hereunder forthwith by notice in writing to the lessee determine this agreement.

9. The lessees shall collect the bamboos cut from the reserve at such checking station outside the boundaries of the reserve as the said Conservator of Forests shall approve, where the bamboos will be enumerated and the number and species entered in a challan by a Forest Officer in the presence of an officer of the lessees. If they shall so require on production of this challan, free passing down of the rafts by the checking stations on the way will be sanctioned. At the crushing mill the rafts will be checked with the challan by a Forest Officer in the presence of an officer of the lessees. The royalty on any bamboos lost in transit or not forthcoming at the final checking station shall be forthwith paid by the lessees on demand at the prevailing scheduled rate. In the event of the lessees bringing to the mill bamboos not extracted by them but purchased in the open market they shall be entitled to claim rebate of royalty at the prevailing schedule rates on such bamboos. The lessees shall not before payment of the royalty mentioned in paragraph 7 sell any bamboos otherwise dispose of them, except by using them in the crushing mill.

10. The lessees shall provide every person employed by them in cutting, collection and transport of bamboo with a suitable badge for the purpose of identification.

11. The lessees shall abide by and observe the forest rules in force for the time being in the said reserve, and should there be any neglect of the said rules by the lessees or by any of their employes the Divisional Forest Officer shall have power in case of urgent necessity at once to suspend during such time as he shall think fit, the work of the lessees or their employes in any such locality.

12. The lessees shall be entitled to procure from the said ³³⁰ reserve such building stone, timber and other forest produce as they may require for the purposes of this concession on payment of half the royalty in force for the time being as embodied in the published schedule of rates of the Chittagong Hill Tracts Division. All trees required by the lessees shall be first approved and marked by Forest Officer, and the lessees shall not fell any tree which is not so marked.

13. The lessees shall be allowed the free use of water from any streams within the Reserved Forests with the previous consent in writing of the Conservator of Forests, Bengal, provided that the use thereof shall not, in the opinion of the Conservator, at any time be prejudicial to any pre-established rights of any village, or of any persons and provided that the water habitually used by such persons shall not be polluted and that due precautions be taken by the lessees to the satisfaction of the said Conservator to prevent any water in any way being polluted by their machinery or by the crushing of the bamboos and provided that the lessees shall make all such dams, tanks, water-channels and the like as shall in the opinion of the Divisional Forest Officer be necessary for the carrying out of their work in a secure and proper manner, and so as to minimize the risk of their causing landslip, floods, or soil erosion, and that if in the opinion of the Divisional Forest Officer all proper precautions are not at any time being taken to effect any or all of the said purposes, the Divisional Forest Officer may prohibit the use of such water by the lessees until such precautions have been taken.

Provided that nothing contained in this clause shall permit the lessees to do any act specified in sub-section (b) of section 76 of the Bengal Embankment Act, 1895 (Bengal Act II of 1892), without the previous permission of the Superintendent of the Chittagong Hill Tracts.

14. The lessees shall not erect any building nor clear sites for buildings or other purposes inside the Reserved Forest
without

without the previous consent in writing of the Conservator of Forests. For all such ground as shall be made available for clearing for building and other purposes, ground rent at the rate of Rs.5 per acre per year shall be paid in advance.

15. Subject as hereinafter mentioned this agreement shall continue in force for a period of 21 years from 1st January 1920 to 31st December 1941.

16. The lessees may terminate this agreement at any time before the expiry of the said period by giving notice to that effect in writing to the said Conservator on or before the first day of the year previous to the year in which they desire so to terminate this agreement.

17. In the event of the lessees failing to comply with any of the terms of this agreement as to which the opinion of the said Conservator shall be absolutely final and conclusive, or in the event of the lessees becoming insolvent or going into liquidation (except for purposes of reconstruction), it shall be lawful for the Secretary of State by notice in writing to the lessees under the hand of the Secretary to the Government of Bengal in the Revenue Department and notwithstanding any previous breach, to terminate this agreement at any time without prejudice to any other right or remedy of the Secretary of State hereunder.

18. In the event of this agreement being terminated under clause 15 or on the expiry of this agreement on the 31st December 1941, the lessees shall be entitled to remove within the next succeeding six months all machinery and other stores, tools and plant and pulp or other forest produce on which royalty has been paid in full.

The lessees shall also be entitled to remove within the same period such timber and forest produce obtained under clause 2 of this agreement at half the scheduled rates on payment of the balance required to make up with the sums already paid, the full scheduled rates then in force. On the expiry of the said

period of six months it shall be lawful for the Secretary of State to appropriate such machinery, stores, tools and plant buildings, timber and firewood, as may remain in the said area without payment of any compensation to the lessees and such machinery and other things shall become the property of the Secretary of State.

19. In the event of this agreement being terminated under clause 17 it shall be lawful for the Secretary of State to appropriate such machinery, stores and plant buildings, pulp and other forest produce as may, in his opinion, be necessary to cover all loss and damage incurred by him and to dispose of the same as his own property.

20. In the event of the lessees wishing to continue working for a further period after the lapse of the twenty-one years specified in clause 15 above, they shall be given preference to do so under such terms as may then be determined by mutual agreement of both parties.

21. The rights of the lessees under this agreement may be assigned by the lessees to any company registered in India, the capital of which is offered for subscription in India, provided always that the company is not a foreign-controlled company as defined in the Government of India's Notification No. 11917, dated the 6th October 1917, and provided also that such assignment shall be registered with the Conservator of Forests, Bengal.

22. In the event of any dispute arising with regard to the terms of these presents or the construction of meaning thereof or of any part thereof, or as to the performance of any act thereby required to be done, or as to any other matter or thing in connection therewith where not otherwise provided for, the decision of the Governor of Bengal in Council upon the matter of such dispute shall be final and binding upon the parties hereto.

copy of a letter No. 2183-I/21-1, dated Fort St. George, the 28th September 1921, from the Secretary to the Government of Madras, Development Department, to the Secretary to the Government of India, Department of Revenue and Agriculture.

733

In continuation of my telegram No. 2183-I, dated the 28th September 1921 regarding concessions to Messrs. Thomas Nelson and Sons, in connection with the establishment of a bamboo pulp factory in India, I am directed to forward a copy of G.O. No. 2421 Revenue dated the 20th August 1914 which shows the concessions asked for by the firm in the matter and those which Government were prepared to offer. But the offer was not utilised by the Company, apparently owing to the outbreak of the war. In 1916, Mr. G.M. Brown, a partner in the firm wrote to His Excellency Lord Pentland, then Governor of this Presidency, that the firm had to rule out the west coast as a possible field for their factory because of reported scarcity of water and of the report they had received that the bamboos in the locality had flowered and died over wide areas since 1914. He added that if there was any chance of the Government considering some grant to enable them to proceed with the establishment of a plant in India immediately, they would be very glad to consider the matter most carefully. The local officers were however of the opinion that there were ways of overcoming the difficulties pointed out; and the information collected by them was sent by Lord Pentland to one of the partners of the firm. The request for money grant was not considered and nothing further has been heard in the matter since.

GOVERNMENT OF INDIA
DEPARTMENT OF REVENUE AND AGRICULTURE.

(Forests.)

SIMLA, 13th October 1921.

His Majesty's Under Secretary of State for India,

Paper-pulp concession to Messrs
Thomas Nelson and Sons.

Sir,

With reference to the telegram from the Secretary of State
No. 4895, dated the 19th September 1921, I am directed to say that no wood
pulp concession has been granted in India to Messrs. Thomas Nelson and
Sons. It is understood, however, that the firm in question held shares
in the India Paper Pulp Company which holds a concession in respect
of bamboo pulp. Copies of the agreement and of the Government of
Bengal's letter No. 276, dated the 6th January 1920 in respect of this
concession, are enclosed as is a copy of a letter No. 21831/21-1, dated
the 28th September 1921, and enclosure, from the Government of Madras
the subject of what was at one time a proposal for Messrs. Nelson
and Company to establish a bamboo ^{pulp} factory in Malabar.

I have etc.,

M. Hearn.

Under Secretary.

No. 185

GOVERNMENT OF INDIA
DEPARTMENT OF REVENUE AND AGRICULTURE.

(Forests.)

SIMLA, 13th October 1921.

His Majesty's Under Secretary of State for India.

Paper-pulp concession to Messrs
Thomas Nelson and Sons.

With reference to the telegram from the Secretary of State No. 4805, dated the 19th September 1921, I am directed to say that no wood pulp concession has been granted in India to Messrs. Thomas Nelson and Sons. It is understood, however, that the firm in question hold shares in the India Paper Pulp Company which holds a concession in respect of bamboo pulp. Copies of the agreement and of the Government of Bengal's letter No. 276, dated the 8th January 1920 in respect of this concession, are enclosed as is a copy of a letter No. 21831/21-1, dated the 28th September 1921, and enclosure, from the Government of Madras the subject of what was at one time a proposal for Messrs. Nelson and Sons Company to establish a bamboo ^{pulp} factory in Malabar.

I have etc.,

M. Hearn.

Under Secretary.

the offer made by tenderers in respect of rent and capital, see paragraph 3 below. (b) The Southern Mau Escarpment. The total area here is about 40 square miles parallel to the railway. I suggest that it should be offered in two blocks of about 20 square miles each, but that the two ~~can~~ be combined in one block if sufficient capital were offered.

3. There would seem no reason why tenders should not immediately be invited by advertisement in Nairobi in respect of the ^{areas} ~~orders~~ above mentioned. The tender should state what rent the tenderers are prepared to offer, what capital they are prepared to expend and ^(which) in what period of time. Mr. Martin, with whom the matter has been fully discussed during his stay in this country, pressed strongly that no royalty should be charged, but that the Govt. should reserve to itself the right to impose export duty if later it was considered that the development of trade justified such a step. At the time when the discussion with Mr. Martin took place, I had not received the papers now enclosed as to the concession granted by the Govt. of India ^(to the 22nd Peter Pulp Company). It will be seen that the terms of that concession provide that the concessionaires shall pay no royalty for 2 years, but that they ~~should~~ ^{shall} pay thereafter for a space of 10 years 1 rupee per ton of dressed and baled bamboo, and 2 rupees per ton for the remaining years of the licence, with a provision that the total payment in any year shall not be less than a ^{stated} fixed sum. In view of this the matter seems to me to require further consideration, and I shall be glad of an expression

of your views by telegraph on the point. It is, of course, undesirable to throw any obstacles in the way of the establishment of the industry by imposing too onerous conditions, but on the other hand, it is important, especially in present financial circumstances, not to neglect any opportunity of obtaining revenue for the Colony.

4. I notice that in the terms of the Indian concession it is provided that in the event of the flowering of the bamboo, the provisions as to royalty shall not ~~be applied~~.

I am not aware whether this is a difficulty specially to be provided for in the case of Kenya, and I have not delayed this despatch by obtaining the views of my Technical Advisers with regard to it. I shall be glad, however, to be furnished with any observations that Mr. Battiscombe may have to offer on the point.

5. Otherwise, I approve of the terms following those recommended by Mr. Battiscombe in his Memorandum "C" enclosed in Colonel Notley's despatch. The terms should, of course, be clearly stated in the advertisement calling for tenders.

6. As soon as the advertisement

has been published in Nairobi copies of the advertisement and of forms of tender should be immediately forwarded to me, when I may communicate copies to any persons who have made enquiries on the subject in this country.

7. As regard the time within which tenderers should be required to tender, it is, of course, desirable to avoid delay, but tenderers will require some time in which to prepare their tenders, and persons in this country will of course not receive the forms of tender until some time after the advertisement has appeared in Nairobi. I suggest that the case would be met if it were required that tenders should be received in Nairobi within six months of the date of advertisement, but I shall be glad to receive your observations as to this.

8. The information contained in the Report enclosed in the Imperial Institute letter of the 4th November, should be placed at the disposal of bona fide applicants, and I propose that the same course should be followed in the case of applicants in this country.

I have, etc.

(Signed) WINSTON S. CHURCHILL

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I have, etc.

(Signed) VINCENZO S. CHURCHILL

Government of Madras.

REVENUE DEPARTMENT.

C & R
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1914.

Enclosures

Spare copies

G.O. No. 2421, 20th August 1914.

Bamboo Pulp Factory.

Finalize orders on Messrs. Nelson & Co.'s scheme for the establishment of a — on the West Coast.

GOVERNMENT OF MADRAS.

REVENUE DEPARTMENT.

Read—the following papers:—

I

G. O. MIs. No. 424, Revenue, dated 10th February 1914.

Read—the following paper:—

Reference from the Board of Revenue (Land Revenue), Forest No 63-GI/14-1, dated 20th January 1914.

The Honourable Mr. R. C. C. CABR, I.C.S.

Read—the following paper:—

Letter from P. A. JONES, Esq., C.I.B., Conservator of Forests, Western Circle.
To—the Secretary to the Commissioner of Land Revenue and Forests.
Dated—the 7th January 1914.
No.—H.O.C. 42 of 1914-3.

I have the honour to enclose copy of a letter received from Mr. T. Nelson (of Messrs. Nelson & Co., Edinburgh) on the subject of establishing a bamboo pulp factory on the West Coast.

Messrs. Nelson & Co. are willing to erect a factory on the Challar river, and ask Government to grant them certain concessions in the first few years of the enterprise.

The factory is to be capable of dealing with 20,000 tons of air dry bamboo annually, and its erection involves large capital expenditure. Messrs. T. Nelson & Co. are anxious to commence work as soon as possible and Mr. T. Nelson is desirous of taking home to his partners definite information regarding the concessions Government will grant. The following are the concessions asked for:—

(1) That Government shall sell to the company at a low price, or grant free for five years and then rent, about 3,000 acres of land suitable for bamboo growth.

(2) That Government shall give the company an option on a further area for bamboo plantations in the event of the enterprise proving a success.

(3) & (4) That Government shall deliver at a low price 10,000 tons of air dry bamboo in the first year and 20,000 tons annually thereafter until the company's plantations are in bearing.

(5) & (6) That Government shall grant a factory site with necessary water rights free of charge or if the company acquires a factory site Government shall grant the necessary water rights.

(7) That Government shall give official advice and assistance in regard to planting, etc.

(8) That the mill materials and machinery may be exempt from import duty;

(9) That the pulp exported may be exempt from export duty for a term of years.

The bamboo pulp paper may be specified in Government contracts for paper.

I have told Mr. Nelson that it is impossible to definitely settle all these points in the short time available (Mr. Nelson leaves Bombay on the 7th February), but I think it is desirable that as far as possible definite replies should be given in order that the company may be in a position to order machinery and commence work as early as possible.

Taking the points *seriatim*—

(1) If the land required for plantations is in reserved forests a suitable area might be found in the new Amarampalam reserve; Mr. Nelson would prefer land nearer the proposed factory site near Kanniparamba, either in Calicut or Ernad taluk; the Collector of Malabar will be able to state whether the land is available. The land might be granted free of assessment for five years and thereafter subject to ordinary assessment.

(2) This must depend on what suitable land is available either in Amarampalam reserve or nearer the proposed factory.

(3) & (4) I have informed Mr. Nelson that I cannot at present guarantee any fixed annual output of bamboos; I have called for reports from North and South Malabar and it will take some time to obtain reliable figures of stock; until these are available all that can be said is that Government will supply as many bamboos as possible from State forests at Rs. 3 per ton or cost price, whichever is greater, and will if possible supplement the supply by leasing and working private forests, such supplemental supply to be paid for on the same terms as the supply from State forests. I would limit the period of supply at cost price to five years, by which time the factory should be well established and Government should reap some benefit from the market created for their bamboos.

(5) & (6) I do not know whether the factory site is on private or Government land; if the latter, it might be granted free of charge for five years; there should be no difficulty about the grant of water rights.

(7) The advice of the local District Forest Officer can be made available.

(8), (9) & (10) These are outside my province.

2. I submit that every possible encouragement should be given to this enterprise which, if successful, will be followed by others and will not only bring in revenue, but also enable Government to reduce the annual stationery bill.

Both Burma and Ceylon have offered liberal terms in order to facilitate the introduction of the bamboo pulp industry, and the concessions asked for by Mr. Nelson are not excessive.

3. Definite replies can be given at once to the last six points, and sympathetic consideration of the first four points can be promised; this would probably give Mr. Nelson sufficient grounds for putting work in hand on his return to England and I request that the orders of Government may be obtained at as early a date as possible.

ENCLURE.

Letter from Mr. T. NELSON (of Messrs. Nelson & Co., Edinburgh)
To—the Conservator of Forests, Western Circle.
Dated—the 7th January 1914.

I am very much obliged for all the information you have been good enough to give me in connection with the enquiry which I am here to make as to the possibilities of making a starting paper pulp from bamboo.

I feel however that my mission here will not have been a complete one unless I have your partners' satisfaction (which I am able to state definitely) as to my own opinion (formed after careful investigation on the spot) as to the probable success or otherwise of the venture, but also what inducements the Government of Madras are prepared to offer for the establishment of this new industry in the Presidency.

Already definite offers have been made by the authorities of Burma and Cochin and it is in order that the Madras Government may consider what terms they are prepared to offer that I venture to write now, stating our exact position at the moment and our reasons for wishing that a decision should be come to on this matter if possible before I sail at the beginning of next month.

Since 1875, when Mr. Thomas Routledge experimented with the manufacture of paper from Trinidad bamboo, that fibre has been recognised as a very suitable one for paper-making. All attempts on any large scale to utilise it for that purpose have, however, proved failures up to the present time. A large mill started in the East has failed to give satisfactory results and one which was worked for some years in Trinidad has now been abandoned. In spite of these failures my firm are prepared to make a further experiment on a large scale, either in India or the West Indies.

I feel sure that the Madras Government will realise the importance of establishing a large paper-making industry and will be willing like others to offer special inducements to firms ready to invest capital in such an enterprise. In asking the Madras Government to consider what special inducements they can grant us, I would like to draw your attention to the following considerations:—

(1) Our plans involve the immediate expenditure of a very large sum to provide plant for an output of from 5,000 to 10,000 tons of pulp per annum and a rapid extension of the mill if the experiment proves a success.

(2) We intend to manufacture pulp of a high grade which (if our experiment succeeds) will establish the Madras product as superior to any other bamboo pulp made even experimentally up to this time.

(3) The previous experiments in bamboo pulp-making have been so disastrous that some special inducements are necessary before further capital will be attracted to the industry.

(4) Without entering too minutely into the methods by which we propose to make bamboo pulp, I may say that we are fully alive to the difficulties hitherto experienced in the manufacture, such as the removal of the increasing matter from the bamboo, the treatment of the nodes, the bleaching of the pulp easily, etc., that we have erected and worked a complete experimental plant in Scotland large enough to test the matter commercially and that we have succeeded in producing a paper of a satisfactory character.

I give these particulars to let you know that, in spite of previous failures in making bamboo pulp, the methods we propose to use are, as far as we can see, likely to establish the industry on a new footing. This view is confirmed by one of the largest firms of paper-makers in Scotland, who have conducted all our experiments and have become partners with us in our enterprise.

In order to indicate the sort of facilities we would require before erecting a mill in the Madras Presidency I suggest—

(1) That (if no more suitable ground is available) the Government should sell to us at a low price, say, 5,000 acres of land suitable for the growing of bamboo. This land would be systematically planted and a crop might, we think, be expected in from four to six years. Alternatively, that the Government should give us that ground free for five years and thereafter for a long period at a nominal rent.

(2) That the Government should give us an option on any land available for growing bamboo to provide for the extension of the scheme should it prove a success.

(3) That to provide a sufficient quantity of bamboo for the mill, till such time as our own plantations come into bearing, the Government should deliver to us at the mill during the first year's working 10,000 tons of air dry bamboo (on the equivalent thereof) and during each succeeding year 20,000 tons of air dry bamboo.

(4) That the price for such deliveries should be, say, Rs. 3 per ton for all bamboo cut on Government land in the Nilambur district and that any bamboo cut and above this first year brought to the Government elsewhere.

(5) That, if such is available, the Government should grant us free a suitable factory site with all necessary water rights.

(6) That, if no such site is available on Government land, the Government should grant us the necessary water rights at a factory site to be secured by us from private owners.

(7) That the Government should give us advice and assistance through its officials in regard to planting, etc.

(8) That all the materials imported for constructing the mill and for manufacturing the pulp should be duty free for a period of years.

(9) That no export duty should be levied on bamboo pulp or paper for a term of years.

(10) That, when suitable, "Indian Bamboo Pulp" might be specified in Government contracts for paper.

If the above suggestions can be considered and some definite decision come to before I leave India, I shall feel greatly obliged.

Reference—Forest No. 63-GI/14-1, dated 30th January 1914.

Submitted to Government.

2. The Board thinks that the proposals of Messrs. Nelson & Co., Edinburgh, deserve favourable consideration. No definite scheme can, however, be submitted till Mr. Nelson selects suitable localities for his proposed factory and bamboo plantation.

3. The Collector of Malabar will be requested to report on the points referred to in the Conservator's letter and its enclosure after seeing Mr. Nelson, if possible.

W. G. McFARLAND,
Secretary.

To the Secretary to Government, Revenue Department.
Collector of Malabar.

Order—Misc. No. 424, Revenue, dated 10th February 1914.

Recorded.

2. The further report called for in paragraph 3 of the Board's Reference read above is awaited.

(True Extract.)

A. BUTTERWORTH,
Ag. Secretary to Government.

II

Reference from the Board of Revenue (Land Revenue), Forest No. 63/14-3, dated 9th June 1914.

The Hon'ble Mr. R. C. C. CABR., I.C.S.

Send—the following papers:—

(i)

Letter—from C. A. IERAS, Esq., I.C.S., Collector of Malabar.
To—the Secretary to the Commissioner of Land Revenue and Forests.
Dated—Calicut, the 24th January 1914.
No.—D. Dis. 152/F.

In reply to Board's Reference No. 63-GI/14-1, dated the 30th instant, regarding Mr. Nelson's proposals for the establishment of a bamboo pulp factory on the West Coast, I have the honour to say that I have seen Mr. Nelson and discussed the whole matter with him. In fact he stayed with me for three days.

I understand that Mr. Nelson leaves for Scotland on the 7th February and this being so it is out of the question for me to attempt to submit any useful report on the points indicated by the Board before Mr. Nelson leaves Madras. The first four questions asked for by Mr. Nelson relate to the supply of bamboo and the grant of an area for a bamboo plantation. Mr. Nelson and Mr. Bourne went into the question very thoroughly at Nilambur and I understand that Mr. Bourne is writing a report on the subject for the Conservator. Mr. Nelson has arranged to meet Mr. Lodge at Madras on the 26th instant and they will then discuss together Mr. Bourne's report. Mr. Lodge will no doubt inform the Board of the results of this discussion and a decision will probably be arrived at at the conference as to the most suitable area for a plantation. When this area has been selected I shall be able to offer an opinion as to whether it can be sold or leased to Mr. Nelson.

3. Similarly as regards the factory site, I am quite undecided at present where this site is likely to be. One possible site is 24 miles up the Beypore river above the reach, or owing to the expense of conveying coal up this distance it may be found necessary to put the factory at Beypore or Beakal, provided always that a

suitable water-supply can be secured. In either case it will probably be impossible for Government to give the site, there being little or no Government land available. In any case the determining factor must be the water-supply.

4. Mr. Nelson's letter to Mr. Lodge was written when he knew nothing of local conditions. He tells me that he would now be quite satisfied with a general assurance that Government will endeavour to help him on the lines indicated in that letter and I have no doubt that Government will willingly give that assurance. In the meantime until Mr. Nelson has seen Mr. Lodge and has discussed with him the bamboo question I see little use in attempting to write any further report and with the Board's permission I propose to wait until I hear either from the Board or the Conservator what decision has been arrived at as regards the site required for the bamboo plantation and as regards the other matters which are awaiting settlement in consultation between Mr. Nelson and Mr. Lodge.

(ii)

Letter—from C. D. MCCARTHY, Esq., Conservator of Forests, Western Circle,
To—the Secretary to the Commissioner of Land Revenue and Forests.
Dated—the 4th May 1914.
No.—R.O.O./42.

I have the honour to submit with my remarks the report on bamboo supply for paper pulp prepared by Mr. Bourne which were called for in Board's Reference No. 63/14-2, dated 18th February 1914. A copy of Mr. Bourne's report has already been supplied direct to Mr. Nelson by Mr. Lodge in January.

2. I was obliged to hold back Mr. Bourne's proposals for discussion of its numerous details and the data—often varying—on which he bases his results. And especially because this is the first scheme of systematic working of Indian bamboos on a commercial scale that I know of; and because next to nothing is known about the growth of bamboos, their rate of increase, and the effects of cutting on the future regeneration, dryage, weight and deduction; whilst the variations in size and rate of increase for comparatively small changes of locality which is a peculiarity of the species, required close attention to detail. For example, it is found that 31 full-sized bamboos in the Nilambur district yield one ton of dry weight. Ten miles away at Amarampalam at the foot of the ghats where growth is more luxuriant 15 bamboos suffice for the same result. The number of clumps per acre and the number of culms per clump vary almost as much; and this is the same species in both cases. It was impossible to accept variations of this sort upon which the whole estimate of supply depends, without examination and personal consultation with the writer.

3. As will be seen, the conclusion I have come to is that Mr. Bourne's calculations of the standing stock available are too conservative. Under the circumstances this caution is commendable but it has been carried to excess and I am of opinion that his figures may safely be doubled. On the other hand, his estimates of the annual yield are based on a removal at each cutting of 75 per cent. of the bamboos of the area and on the assumption that the culms so removed will be replaced by new annual shoots within a period of five years. In this Mr. Bourne follows Mr. Pearson's calculation, that this species of bamboo on the West coast and in Burma will on the average throw up one new culm per annum for every 4 old ones. (That is to say, in four years it will a little more than double its numbers, and (allowing for a margin) that a five-year rotation will be a safe one. But this rate of growth refers to the naturally growing unexploited clump; and it does not follow by any means that it will be maintained if 75 per cent. of the clump is cut out at the start. It is in fact a matter of surmise, and rests on the issue between two opposing considerations. One of these is that the removal of congestion in the clump should tend to encourage growth of new culms, and the other that there must be some set back to growth from the sudden elimination of so much food for the material for the stems, which in this case lies underground. In my opinion the balance would run in favour of the latter. As was said before we have very little knowledge of the subject but

at the same time we cannot ignore what few facts we have. One of these is the case recorded in clump No. 2, Appendix III, of the report. Here 75 per cent. of the culms in the clump. If, as proposed in this report, the whole bamboo area were worked on a 75 per cent. rate of removal in this report, the whole bamboo area were in five years, and the result were to approximate to this example, the effect would obviously be the suspension of all yield for some years till the area was fit for cutting again, and would be disastrous from the point of view of a regular supply for a factory.

4. As a matter of fact, from enumerations which I carried out in North Salem last autumn in 8 or 10 different blocks, of the number of new annual culms to old, I am of opinion that the rate of increase varies with the age (i.e., the age) of the clump and taking the life period to be thirty years that the rate is probably greater during the second and diminishes considerably in the last decade. These figures showed variations from one new culm per annum for 6 old ones in young clumps containing 10 to 15 bamboos; to 1 for 10 or more in clumps of 40 bamboos and over. I may say seeding seemed to be going on promiscuously and not gregariously in that district; or more that way than the other.

5. If this is true, no fixed rotation can be suitable for all periods of the life of the bamboo. In fact, I do not think that regularity is attainable unless, as regards rotation or intensity of working: e.g., towards the seeding period almost every culm will be removed. However that may be, from the point at which we are starting the most rational system of working seems to be one of short rotations accompanied with light fellings, as this will entail the minimum of risk and also supply the fullest opportunities for observation. I mean to say, that if one were obliged to fix both the rotation and the intensity I should prefer to begin with one of 3 or 4 years with a 50 per cent. of extraction than one of five years with 75 per cent.

6. But we are here in a favourable position with no obligation at all to fix a rotation at starting. The exploitable area and the standing stock are so distinctly in excess of requirements that we can start with light fellings—say 50 per cent.—which will easily meet the stipulated demand of Messrs. Nelson & Sons and go on doing so until the area of first fellings has recovered its original density of growth. When that has happened the intervening period will prove itself the proper rotation for that intensity of working.

7. For example in the present case we have two areas of different rates of productivity. We should commence in each at 50 per cent. removals. After three years working it may be found that in one, the first fellings have recovered their original density of growth; whilst in the other four years to do so in the other. Or the periods may be four and five years, respectively, or something else. Any how the rotation for each must come out if it is three years or over, and it is not likely to be less. We are able to do this not only because we can easily cope with the demand but because one of the proposed conditions is that the first five years' supply is to be made at cost price; and consequently it is not to the interest of Government to turn out more, or to force the pace.

8. I have now to deal with the exploitable area, the estimates of stock and annual yield and the cost of extraction, transport and delivery at the proposed factory which will probably be at Baysore. It may first be mentioned that as a supplementary source of supply in case of emergency, Mr. Bourne expects that 10,000 tons per annum of dry bamboo can be supplied from certain remote areas in the Mangrath Range (chapter III of his report). Also that the District Forest officer, North Malabar, can arrange for the delivery of 3,000 tons per annum from the Kantho range. But this supply is not likely to be called upon in the near distances involved, but because the greater cost of delivery, on account of the longer distances involved, the resources of the Nilambur and Amarampalam ranges in South Malabar are ample for the occasion and easiest of supervision.

9. The supply stipulated for by Messrs. Nelson & Sons, is 10,000 tons dry bamboo in the first year after erection of their factory, which at earliest could not be before 1915-1916; and 20,000 tons per annum in each of the four succeeding years, or a total of 90,000 tons in the first five years. Confining consideration to the

Nilambur and Amarampalam ranges, in the first place, allowance, as regards present supply, has to be made for the fact that flowering commenced in 1911 on some portions and has since been gradually extending. Dead (flowered) clumps are useless for pulp after two monsoons as the fibre becomes rotten or too soft. For this reason 8,899 acres of bamboo forest in the Nilambur range is thrown out of work for the present but will be available about eight years hence when the present seedling clumps attain workable dimensions.

10. Of the balance, the exploitable areas, viz., those which have been inspected by Messrs. Bourne & Nelson put on the maps and computed (paragraph 2 of chapter I of report) amount to—

Nilambur range	acs.
Amarampalam range	2,574
	20,096
Total	22,669

The "yield" from this area is given in paragraph 5 of chapter II of the report as 171,471 tons but there are arithmetical errors and the correct figure is 172,996 tons. By "yield" is here meant the exploitable stock which could at once be removed from this area after leaving 25 per cent. of the culms standing on the ground. Therefore the total stock on the ground would be 230,660 tons.

11. This estimate is based on most conservative data which I have carefully examined and as examples of the extreme caution with which Mr. Bourne has dealt with the subject I append the following remarks:—

(1) In Pokote and Kanakuth Mr. Pearson—a specialist in bamboos who came down from the Dehra Dun College—calculated the "yield" from sample areas at 9.9 tons per acre after leaving 25 per cent. standing. On the same conditions Mr. Bourne adopts 8.4 tons. This affects 1,506 acres.

(2) In weighing a sample culm for computation of yield in new Amarampalam and Nellioutha Mr. Bourne took a one year old culm, whereas the average culm of, say, four or five years would be much heavier. Even so, he has allowed for a dryage of 50 per cent. of the green weight. But Mr. Pearson's experiments showed dryage to be 72/110 and at this rate the number of culms to 1 dry ton would work out at 154. * See Appendix II.

Green weight = 221.6 lbs.
Dry weight = 72/110 of 221.6 = 145 lb. Mr. Bourne has adopted 20. This affects 15.5 bamboos per ton.
(3) For the same area he has adopted 11.85 culms to the clump following the average of an actual enumeration of a sample area. But this area was in a portion of forest lately fully cut over for bamboo required for floating timber; whereas he tells me that only about 2,000 acres has been so worked and he estimates that the number of culms per clump for the remaining 15,000 acres would be about 30.

Nos. (2) and (3) of the above reservations affect the estimate of stock enormously.

12. In paragraph 5 of chapter II of the report Mr. Bourne proposes also to reduce the exploitable area containing (bamboos paragraph 2 of chapter I) by one-half as several blocks have not been inspected. * But on that page, he gives the name of the areas which were inspected, * shown on maps and computed, and these amount to over 15,000 acres out of the total of 22,669 acres; and consequently I have not adopted the reduction he suggests. This is of course a very important correction of mine affecting half the stock but I think it is fully justified.

13. There is, however, another factor not taken into consideration in Mr. Bourne's report which tends again to enormously increase the probable stock and output. The standing stock has been taken at about 330,000 tons. Of this only 90,000 tons will be removed in the five years 1915-1916 to 1920-1921. In that time the balance of 240,000 tons will be increasing at the rate of over 100 per cent. per four years. It is not worth while working out what all this will amount to, when it is obviously many times that of present requirements and I propose to leave the subject of stock and yield at this point, and pass on to the cost of extraction and delivery at factory.

14. In computing cost of delivery at factory there are two important considerations which affect expenditure and require explanation. At present bamboos are felled at about 15 feet from the ground. This is done to avoid the clearance of what is known as the "palisade", viz., the dense thorny ring of branches often 8 to 5 feet thick which surround the lower portion of the clump and prevent access to the culms. But of course this manner of felling entails considerable loss of material as the lower is the thickest and heaviest part of the culm. The removal of the palisade is a disagreeable, arduous and costly work and adds to the cost of the first working. If the second fellings occur within three to five years the palisade has not time to form again and the difference in cost of the two fellings on this account amounts to from Rs. 4 to Rs. 5 per 100 bamboos according as the daily wage is 6 annas or 8 annas per cooly. The other consideration is the fact that it costs just twice as much to drift down green as dry bamboos. Owing to the difference in weight only half the number of waterways available. Rafting is also the most expensive item in the cost of delivery and when the difference in cost between green and dry varies in some cases from Rs. 10 to Rs. 5 per ton it is obvious that only dry bamboos (six months dried is sufficient) can be dealt with—vide page 9 of Mr. Bourne's report. The cost of rafting varies also with the amount of water in the channels, so that different rates have been laid down for the dry and wet seasons of the year.

15. There are some arithmetical errors in the figures for the total cost of delivery at factory in Baysore given in paragraph 5 of chapter I of the report. After correction the following table shows the cost for 1 ton dry output for delivery at Baysore from different blocks of reserves, for the first and second cycles of working.

Total cost of felling, dragging and rafting one ton dry output to Baysore.

Locality and range	First working		Second and subsequent working	
	December to May	June to November	December to May	June to November
1 Nilambur (range) Amarampalam range	16 4 2	16 4 2	16 4 2	16 4 2
2 Karik and Merial reserves	7 4 3	7 4 3	7 4 3	7 4 3
3 New Amarampalam, Nellioutha and Kanakuth reserves	11 11 1	11 11 1	11 11 1	11 11 1

The standing stock (paragraph 9 supra) on these areas amounts to the following—

On No. 1	1088
On "2"	21,365
On "3"	9,412
	200,683
Total	230,660

As it is possible that at some future time the whole area may come under full working, and also because it is all within easy reach of the head quarters of the division and thus capable of being effectively superintended, I should propose that all the areas be worked in proportion to their capacity. That is to say that the 10,000 tons to be supplied in the first year should come from the three areas in the proportion of 1,000, 500 and 8,500 tons respectively and double these amounts in each of the next four years.

16. As was the case with the estimation of the yield, the cost of working has been kept well or too much on the safe side. For instance the cost of felling, which is quoted at from Rs 12-8-0 to Rs 16-10-8 per 100 bamboos according as the wages are 6 annas or 8 annas per diem was computed on the actual cost of cutting

two huge clumps containing 110 and 193 culms each (see Appendix V of the report). But the average clump contains only about 15 culms and the cost of cutting must be very much cheaper in small clumps. By how much it is impossible to say as at present, the felling is 15 feet from ground and we have no previous experience of cutting at ground level.

17. Again the cost of carting is quoted at 4 annas per cart per mile. Dragging with buffaloes would be easier and cheaper and could be done for less than 4 annas per mile for the same quantity. This would reduce the cost of extraction from areas Nos. 2 and 3 (paragraph 15) by about 4 annas per ton. But the drafting is the most expensive item and how far the estimate may be reduced I am unable to say.

18. Generally Mr. Bourne's rates in paragraph 15 supra, may be compared with those submitted by Mr. Boulkes for supply from Kannoth forests. His lengths of culms are shorter, and probably fifty bamboos represent one dry ton. At this rate his figures for delivery at Beyer's work out to Rs. 4 per ton only. I think this is probably an under-estimate and it is calculated for floatage during monsoon only. It is very difficult to strike a balance, but I believe that Re. 1 per ton can safely be deducted from the corrected rates in paragraph 8 for supply from No. 2 area, 12 annas per ton from No. 3 and 8 annas per ton from No. 1.

19. Adopting this margin for over-estimation and allowing for the rafting of three-fourths of the annual supply during the monsoon months, the following statement shows the total cost of supply of 10,000 tons at Beyer's factory in the first year

Locality	Supply in tons	Rate	Total charge
K	750	6 1 1	4,800 1 1
L	250	6 1 1	1,650 1 1
M	275	7 9 11	2,857 6 1
D	116	10 11 7	1,249 7 11
N	6,275	5 1 1	31,814 1 1
E	2,185	9 0 3	19,528 1 1
Total	10,000		52,099 1 1

Messrs. M. Beyer's works; D) in Dry season

20. The above estimate of charges depends on our being free to work the whole area. If however there is any force in the objection raised in paragraph 8 of Mr. Bourne's report on account of Jemmi rights, then the only area workable is No. 3. It can supply the whole requisition for the first five years, if necessary. But this is a matter I am not able to decide.

21. There remain the questions of establishment, the housing of labour and staff, and drying sheds. For a scheme of this size with an output of practically 20,000 tons per annum, employing on an average about 500 coolies per day for felling alone, the amount of extra permanent establishment required may be estimated at Rs. 300 per annum or Rs. 3,000 per annum. As to construction and maintenance of buildings and other contingencies, these remarks have already led to such length that details may be omitted, but it is computed that 5 per cent. on the other annual charges for the five years of the contract will cover expenses.

22. At this rate the total estimate of charges for the supply of 10,000 tons in the first year will be--

Delivery of bamboos, 10,000 tons	57,531 8 2
Permanent establishment	3,000 0 0
Contingencies at 5 per cent. of above	3,561 9 1
Total	74,093 8 2

In the second to fifth years, the annual charges will be--

Delivery of bamboos, 20,000 tons	1,15,363 0 4
Permanent establishment	3,000 0 0
Contingencies at 5 per cent. of above	5,945 2 0
Total	1,24,308 2 4

This may have to be increased but if so the allowance for contingencies will meet it.

I believe, however, that the actual expenditure will fall within these amounts. 23. In conclusion some remarks are necessary on the general conditions of the proposed contract. It is evident that for supply on this scale the forest area in working will have to be converted and treated for special bamboo production and its possibilities for other purposes will be deliberately sacrificed. Now if, in addition we are granting all the concessions asked for in Mr. Lodge's letter to the Board, R.O.C. No. 42 of 14-5, dated 28th January 1914 (including the supply to the firm for five years at cost price), the negotiations with the firm should safeguard Government from having this forest thrown back on its hands after that period in a condition which will be useless for any other purpose. This may happen through Messrs. Nelson & Sons making other arrangements by plantation lease or purchase from neighbouring private owners of which there is some talk in their letters.

24. There is not a doubt, exemplified by the case of past reckless timber exploitation in the same area, that when the factory is established the neighbouring land-owners will come forward with offers below our own rates and it will be difficult to prevent the firm from taking advantage of them. Consequently we shall be in a difficult position, with this private competition facing us, in coming to terms about the rates to follow the first five-year period of supply at cost price, if Messrs. Nelson & Sons are left with a free hand in the matter. Whatever terms are made it is advisable that they should provide as far as possible for the absorption of the full yield which our organisation is able to supply or if that is too much, for a preference over other sources of supply.

Reference - Forest No. 63, 14-3, dated 9th June 1914

Submitted to Government in continuation of Board's Reference No. 63/14 1, dated 29th January 1914, recorded in G.O. Ms. No. 424, dated 10th February 1914

2. Mr. Nelson of Messrs. Nelson & Co., Edinburgh, applied *inter alia* for the following concessions in connection with his proposed bamboo pulp factory

- (i) that Government should sell to the company at a low price a grant free for five years and then rent, about 3,000 acres of land suitable for bamboo growth;
- (ii) that Government should grant a factory site with necessary water rights free of charge, or if the company acquired a factory site Government should grant the necessary water rights; and
- (iii) that Government should deliver at a low price 10,000 tons of air-dry bamboo in the first year and 20,000 tons annually thereafter until the company's plantations were in bearing.

3. Item (iv) - Mr. Bourne's report and Mr. McCarthy's letter deal only with item (iii).

The total area suitable for exploitation of bamboo in the next ten years in the Nilambur and Anamthalam ranges is estimated at 22,669 acres of reserved and leased forests. The stock on the ground is estimated at 250,680 tons. Allowing for 25 per cent. of the culms in each clump remaining on the ground, Mr. Bourne states that there is sufficient bamboo to meet the stipulated demand of Messrs. Nelson & Co. for five years. The stock, Mr. McCarthy thinks, has been under-estimated; he however, advocates the removal of only 50 per cent. of the culms. The Board understands that it is not advisable to remove more than 50 per cent. of the culms in each clump at a time as otherwise the clumps will be so weakened that the next monsoon will cause much devastation. Even at this rate the stock on the ground is, in the Board's opinion, ample to meet the demand of Messrs. Nelson & Co., as they want only five years' supply or 90,000 tons in all.

Next as to the question of cost of supply Mr. McCarthy gives the following estimate of total charges to be incurred in the supply of the required quantity of bamboos at Beyyore:—

Year	Quantity to be supplied in 1000 per annum	Charges for clearing, planting, establishment and maintenance per annum
First year	10,000	74,793
Second to fifth year	30,000	1,45,800

The Board generally accept the figures which work out to about Rs. 7-6-0 per ton

4. The Board is anxious that every encouragement should be given to the industry and that it should be done as speedily as possible, and accordingly suggests that Government should communicate the above figures to Messrs. Nelson & Co., by cable and ascertain what they have to say.

5. With reference to paragraph 29 of Mr. McCarthy's report suggesting that a condition should be inserted to the effect that Messrs. Nelson & Co., should continue to take bamboo from Government after the expiry of the first five years, the Board observes that the idea of the company is to have their own bamboo plantation. Five years' falling Government forests will, in the Board's opinion, do good by increasing the percentage of timber-yielding trees—at present there are too many bamboos—and this the Board considers should be one object of the fellings.

W. G. McFARLAND,
Secretary.

To the Secretary to Government, Revenue Department, with two plans.

ENCLOSURE

PRELIMINARY REPORT ON THE POSSIBILITY OF WORKING THE NATURAL FORESTS OF SOUTH MALABAR FOR BAMBOOS.

CHAPTER I—GENERAL DESCRIPTION.

1. *General description*—As this report is a result of Mr. Pearson's note on the utilization of bamboo for the manufacture of paper-pulp, it is necessary to note at the commencement certain relevant facts.

Mr. Pearson's stay in the district was unfortunately limited to three days, one of which he saw the old teak plantations in Edacode, on the second of which he laid out two bamboo sample areas, one in Kanakuth, and the other in Pokote, and on the third of which he went to Nudangayam and back.

His visit was made in February 1910. In his report he has taken 3,050 acres in Nilambur range as the area of fully stocked bamboo forest and based his calculation of the yield for this area on the statistics obtained from the sample areas in Kanakuth and Pokote. In compiling this area from the areas given in the Nilambur teak plantations working plan maps he has overlooked the fact that some of these natural forest areas contain no bamboo at all while others are by no means fully stocked. In the last three years since Mr. Pearson's visit some of these areas have flowered. Further in his report he has shown 3,050 acres of private forests calculated as a reserved yield. No bamboo will be available from the private forests in the Nilambur valley, as every workable area is out over every year for bamboo to flood the timber of private owners. These forests have been so devastated of bamboo that increasing numbers of applications for the grant of bamboos from Government forests are received every year; and it is a very significant fact that the rubber plantations on the edges of the valley, situated at a considerable distance from the centre of the timber operations, have been able this year for the first time to sell their bamboos to timber contractors. Hitherto they have had to have recourse to fire to get rid of them.

Mr. Pearson in his report has taken Rs. 6 as the cost of cutting 100 bamboos, which would allow the present rate to allow for the increased cost of cutting the culms at the base, but was unable to give any actual statistics of the cost of felling. Lastly the size of the bamboo culms in the forests are the result of considerably greater dimensions than those of Kanakuth and Pokote.

A few statistics on these points have been collected and a conservative estimate of the yield and cost of extraction from the Government forests made.

2. Distribution and area—

Name of natural forest	Whether reserved or leased forest	Area in acres	Total
<i>Nilambur Range</i>			
Valachappally and Edacode	Leased forest	3,050	
Pokote	Do.	568	
Kanakuth	Do.	140	
Chalambam	Leased forest and reserved	923	
Panyangode	Leased forest	204	
Valluvasseri	Do.	551	
Kranthadam	Do.		1,373
<i>Anarampalam Range</i>			
New Anarampalam	Reserved forest	95,000	
Nellikanta	Leased forest and reserved	1,561	
Karungora	Reserved forest	1,783	
Karum	Leased forest	950	
Mural	Do.	1,255	
			197,663

(Of these blocks, Valachappally and Edacode, Pokote, Kanakuth, Chalambam, Panyangode, Valluvasseri, New Anarampalam and Nellikanta have actually been inspected by Mr. Nelson and myself with a view to noting the distribution of bamboo.)

The approximate approximate area at present under bamboo was put on the maps and computed.

3. A probable area exploitable in the next ten years

Serial number	Name of block	Reserved or leased forest	Area under bamboo in acres	Deficit for area of forest	Net area	Total
<i>Nilambur Range</i>						
1	Valachappally and Edacode	Leased forest	300		2,750	3,050
2	Pokote	Do.	500		600	600
3	Kanakuth	Do.	60		60	60
4	Panyangode	Do.	150		150	150
5	Valluvasseri	Do.	204		204	204
6	Kranthadam	Do.	151		151	151
<i>Anarampalam Range</i>						
7	New Anarampalam	Reserved forest	14,300	3	14,000	14,000
8	Nellikanta	Leased forest and reserved	1,500		1,500	1,500
9	Karungora	Reserved forest	1,783	54	1,700	1,700
10	Karum	Leased forest	300		300	300
11	Mural	Do.	1,255		1,255	1,255
						30,990
						32,060

3. *Legal position*—In serial numbers 1 to 6, 8, 10 and 11, being leased forests Government have by their agreements to pay cultivation (percentage or stump fee) on all bamboo extracted from these forests according to the custom of the country in vogue at any time. The custom in vogue hitherto amounts to payment of 50 per cent of the net profits realized. It is shown in paragraph 5 of this chapter that the cost of extraction will be higher than estimated by Mr. Pearson and if Government agree to work the bamboos and supply a paper-pulp mill at a set price per ton, the forest tenants will complain. It is shown, however, in chapter I, paragraph 6, that the scientific felling proposed is likely to maintain or even increase the yield in the second rotation.

4. *Composition and condition*—All these natural forests contain bamboo, though the density, age and dimensions of growth vary to a considerable extent in different localities.

The principal species occurring naturally throughout the area is *Bambusa nana* and *Bambusa nana* species flowers generally copiously in some locality though it may flower periodically. The records of flowering in South Malabar are not very complete, but it has been reported to have flowered previously in 1894, 1906 and 1906. H. P. S. (India) Forest, page 6, 1906, 1906 (Nilambur Plantation Working Plan, page 10) and from present reports in Edacode in 1911, in Chalambam in 1911 and 1912, in New Anarampalam, Nellikanta and Karungora in 1912, 1913 and 1914, in Kanakuth, Pokote and in a small area partly in Edacode and

partly in Valachappally which will be called by the purposes of this report "Valachappally and Edacode" the bamboo may be considered to be fully stocked throughout the area given. A few *Terminalia*, *Ligustrum* and *Dalbergia latifolia* are found forest-up with long stems holes by the bamboo growth. In the New Amarampalam reserve the bamboo occurs less densely on the average, some areas being pure bamboo, which has killed out everything else, in others timber predominates, though almost throughout bamboo clumps are found.

In Nelliuttu the bamboo is on an average still less dense than in New Amarampalam, though the north-east quarter of the reserve is more fully stocked or at least denser than any other forests in the division. Kirampora reserve, Karim, Miriat, Bramhadan, Valluvasheri and Panayampala, though not now specially inspected for the distribution of bamboo, contain considerable quantities. While not being so fully stocked as Kanakuth, etc. the bamboo in these areas is as dense and in some cases much denser than the average density of stocking in Nelliuttu reserve.

In Edacode, the oldest of the flowered areas, an enumeration was made (see appendix II) to ascertain the minimum stocking of bamboo what it shall come into bearing. The size of the culms varies principally between the forests in the Amarampalam range (nearest the granite) and those in Nilambur range.

The culms of New Amarampalam, Nelliuttu and Kirampora are classed together, while the culms from all the other areas may be considered to be on the average, the same as the culms in Pokote and Kanakoth, dimensions of which were taken by Mr. Pearson.

The method of felling bamboos in the past must be mentioned. It has been the custom to cut our bamboos some 15-15' above the ground for two reasons: (1) to avoid the thorny palisade and to obtain cheapness in extraction, and (2) it was found by experiment that the bamboos cut at the base, though sufficiently buoyant to float by themselves, were insufficiently buoyant to float the teak saplings, which from the conditions of the market it was necessary to float green.

The result is to increase the palisade, in most cases the centre of the clump becoming so dense as to prevent any new culms being sent up except on the edges of the clump. This must affect the reproductive power of the clump from the root stock. It is noted in the Nilambur Teak Plantation Working Plan, page 43, that as a result of the flowering of many bamboos in 1881 from 1888 onwards a number of the giant bamboo of Burma, *Cephalostachyum pergracile*, were introduced along the banks of the rivers. No record is forthcoming as to how they were introduced but probably from seed. In 1895 Mr. P. M. Leachington reported that they had formed splendid clumps, though the culms were of no great size. In 1904 the same officer reported that the clumps were decidedly disappointing and that the actual culms were still very small and appeared to be brittle. There is some doubt as to the identity of this species, the giant bamboo of Burma is *Dendrocalamus giganteus*, *Cephalostachyum pergracile* as will be seen from appendix IV, grows no bigger in its natural habitat than it has here. Further this bamboo has a dense covering of stiff black hairs on the internodes which I find very irritating and so do the coolies. It probably is *Cephalostachyum pergracile*, misnamed the giant bamboo of Burma and in that case it grows even better here than in Burma. The only doubt remaining is that *Cephalostachyum pergracile* is said to have dense rigid, green pubescent branches from the lowest nodes, while the specimens here are practically clean. This bamboo has very succulent leaves and the culms are frequently broken by elephants, all the clumps in those areas in which Government elephants are put out to graze have been completely browsed down. The possibility of introducing this bamboo on a plantation scale is dealt with in chapter IV.

5. *Form factors, reducing coefficients, etc.*, used in the calculation of the yield.—These have been worked out in detail in appendices I and II. In chapter II the yield in the year of measurement is adopted, allowing to leave about 25 per cent. of the culms per clump standing—

- (1) Yield from Kanakuth, Pokote and Valachappally and Edacode—
225 culms per acre.
8.4 tons per acre dry.

- (2) Yield from New Amarampalam reserve—
Green clumps alone—
184 culms per acre.
9 tons per acre dry.
Fully stocked—
236 culms per acre.
14.75 tons per acre dry.

- (3) Yield from Nelliuttu and Kirampora reserves—
Green clumps alone—
148 culms per acre.
Fully stocked—
7.25 tons per acre dry.
184 culms per acre.
9.25 tons per acre dry.

- (4) Yield from Karim, Miriat, Bramhadan, Valluvasheri and Panayampala—
81 culms per acre.
2.6 tons per acre.

N.B.—These figures are calculated on the density of green clumps in Nelliuttu, e.g. 14.5 clumps per acre and the average number of culms per clump to be left and the dimensions of the average culm from Mr. Pearson's figures in Pokote and Kanakoth.

- (5) Future yield from Edacode, Valachappally and Chintambori—
114 culms per acre.
3.8 tons per acre.

- (6) Of the bamboos from New Amarampalam, Nelliuttu and Kirampora reserves—
30 dry culms will yield 1 ton.

- (7) Of the bamboos from Pokote, Kanakoth, etc.—
31 dry culms will yield 1 ton.

6. *Rate of growth.*—See appendix III.

7. *Supply of labour.*—Owing to the rubber estates on the edges of the valley, which, by the inducements they offer, attract a day for an ordinary cooly, and 2 for the better type, the Government coolies, coolie lines, free, and permanent work, have attracted most of local labour, in addition to imported labour brought in by cooly catchers and owing to the general hard work labour is scarce. Government pay at present is 4-6 a day per cooly in Nilambur and 4-5 a day in Amarampalam range.

The scientific felling of *Bambusa arundinacea* clumps at the base needs skilful labour and is a trying and distasteful work to the coolies.

Consequently to offer an inducement to labour, it is proposed to pay for felling *Bambusa arundinacea*—

	Cooly per day
In Nilambur range	4
In Amarampalam range	5
For felling <i>Cephalostachyum pergracile</i> —	
In Nilambur range	5
In Amarampalam range	6

These rates are allowed for in calculating the rate of extraction in appendix V.

Cooly lines are proposed to be built in Amarampalam range, as without them it will be impossible to count on a continuous supply of labour for the out-of-the-way and feverish forests of that range.

It is also probable that cooly-catching maistries would have to be employed to import labour.

8. *Method of extraction and transport to mill etc.*—Rates.—Figures have been worked out in detail in appendix V. It has there been shown that the floating charges of these big bamboos green is very high per 100 bamboos, though in the case of the biggest culms from Amarampalam range, of which 20 are equivalent to 1 ton, see paragraph 5 of this chapter, the cost per ton is proportionately reduced. It will be a simple matter to have six months' supply felled and dragged and stored under shelter in river side depots, always on hand, so that the figures of floating the bamboos dry have been adopted. Long low temporary sheds would be erected at river side depots, for storing purposes.

Summary of cost.

Locality and range.	Cost of felling 100 bamboos.		Cost of cutting 100 bamboos.	Cost of rafting 100 bamboos from rafting place to					
	I	II		December to May	June to November	December to May	June to November		
	Rs.	P.	Rs.	P.	Rs.	P.	Rs.	P.	
Nilambur	12	0	0	1	0	0	1	0	0
Amarampalam, Karim and Miriat.	12	0	0	1	0	0	1	0	0
New Amarampalam, Kirampora and Karampora.	10	0	0	1	0	0	1	0	0

* Corrected figures.

Total cost of felling, curing and floating 100 bundles

I Rotation		II Rotation		I Rotation		II Rotation	
December to May	June to November	December to May	June to November	December to May	June to November	December to May	June to November
Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
22 2 4	17 5 9	18 2 9	18 9 9	23 9 9	17 10 3	19 3 3	13 15 11
25 13 0	26 5 9	31 9 7	31 2 4	37 15 9	32 12 11	31 8 9	29 3 9
47 8 0	38 8 0	49 17 7	47 19 7	60 11 3	54 9 3	50 3 9	32 14 9

Total cost of felling, curing and floating 1 ton dry culms

I Rotation		II Rotation		I Rotation		II Rotation	
December to May	June to November	December to May	June to November	December to May	June to November	December to May	June to November
Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
5 3 0	5 5 8	5 10 0	5 2 8	11 7 7	5 9 1	3 14 7	4 3 2
11 7 0	3 7 0	9 15 0	6 9 0	11 11 7	9 9 11	10 1 4	9 15 9
18 0 0	9 2 0	14 7 4	11 9 0	22 9 3	18 11 4	21 1 4	18 7 7

*The figures in these columns have been prepared after allowing for arithmetical errors. Others have not been corrected as only delivery at Bhopore is required—(Initialed—G.D.M.)

The improvement of the floating channels and the alignment and construction of main drag roads in those areas to be worked would reduce the cost of extraction considerably.

CHAPTER II.—PROPOSED OUTLINE OF WORKING.

1. *Objects of management.*—It is understood that the minimum supply in tons of dry bamboo which would be required to start a paper-pulp mill on financial lines would be approximately 10,000 tons in the first year and 20,000 tons every year thereafter, with the prospect always in view of being able after the first five years to extend up to twice or even more than twice that amount. To boom this new industry which the more financially it is successful, the bigger the markets it will introduce to the extensive bamboo forests of this country, it is essential to produce the raw material at the lowest cost per ton possible.

It is therefore the object of Government to ascertain the highest sustained annual yield in tons of dry bamboo per annum exploitable within an expenditure financially favourable to a private firm.

The indigenous bamboo having flowered during the last three years, the primary object to be ascertained is the possible yield in the next five years, it having been found in experience that if flowered culms after exposure to more than one season are useless for paper-pulp manufacture.

2. *Method of treatment and nature of the fallings.*—It is seen from Appendix III that failure to leave-standing the number of culms necessary to provide sufficient cellulose for the supply of assimilation products to the root system, results in the early delivery of the latter from the effects of the falling. In working on a large scale, for want of adequate supervision, it would be impossible to leave-standing any fixed proportion of the number of the culms in the clump. So it is proposed to leave some number of culms, say 3-5 per cent, according to the size and that they should be one year old culms, or in any case, which there were not three or four year old culms that a sufficient number of old culms should be retained to bring the total in every case to three or more. The culms should be felled within one foot of the ground. All bamboo for departmental timber floating operations should be felled on the same principles as when no definite information is received that the mill will be started. The bottom ends will be cut off and stored under cover and will augment the supply in the first year of working. It is believed that if these bamboos are preserved from the pest they can be kept for several seasons and still be fit for paper-pulping.

It has been shown in Appendix III that after the first falling the thereby culms are considerably reduced and no longer forms such a formidable obstacle in attacking a clump.

3. *Rotation.*—It has been shown in Appendix III that it would not be at present safe to fall over bamboo areas on less than a five-year rotation. It may be possible subsequently to reduce the rotation to four years.

A rotation of five years is adopted for the first cycle.

4. *Density of the working area.*—Not annual census.—It is not within the scope of this report to detail the annual census. A much more detailed enumeration of the density of bamboo in each block is necessary before areas in any block can be apportioned to the annual census with the object of maintaining uniformity in distribution in the different regions, in the fully stocked and only partly stocked areas, in the most and least accessible areas, etc.

5. *Determination of the yield.*—Determination of the total yield available in the Government forests 1914-15—

Range	Name of block	Bamboo area in acres	Number of culms to be cut per acre	Number of culms to be left per acre	Yield of dry culms in tons per acre	Total yield dry in tons	Total yield dry, range and distribution in tons
Mandla	Vallabhapalli	468	250			1,172	
	Manasa	206	250		8 4	2,743	
	Kanabhat	668	250			5,611	
	Chalchapani	204	250	21	2 6	123	
	Chalchapani	281	250	21	2 6	1,012	
Anantnagar	New Anantnagar	14,000	All culms put on to cut in 1914	164	7 25	1,000	10,000
	Kanabhat	1,681	All culms put on to cut in 1914	164	7 25	14,101	
Mandla	Kanabhat	1,700	250	164	7 25	12,816	
	Manasa	500	250	61	7 25	2,470	
		1,700	250	61	7 25	4,680	
							167,671
							173,671

In this preliminary estimate, as some of the areas are of such an enormous extent and as several blocks have not been inspected especially to ascertain the stocking of bamboo, it is safer to assume that one-half of such areas contain no bamboo at all. In the fully stocked areas of Kanabhat, Pokota and Vallabhapalli and Manasa it is known that the whole area is stocked with bamboo, so that in these cases the full area may be retained.

The yield received as above is—

Range	Name of block	Bamboo area in acres	Number of culms to be cut per acre	Number of culms to be left per acre	Yield of dry culms in tons per acre	Total yield dry in tons	Total yield dry, range and distribution in tons
Mandla	Vallabhapalli	468	250			1,172	
	Manasa	206	250		8 4	2,743	
	Kanabhat	668	250			5,611	
	Chalchapani	204	250	21	2 6	123	
	Chalchapani	281	250	21	2 6	1,012	
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Mandla	Kanabhat	1,700	250	164	7 25	12,816	
	Manasa	500	250	61	7 25	2,470	
		1,700	250	61	7 25	4,680	
							173,671

This stock of 22,823 tons, equivalent to more or less 2,080,000 bamboos has to be realized in five years, 10,514 tons in the first year and 29,538 tons in each of the four years thereafter. To obtain uniformity of distribution the areas are grouped together according to their yield in tons per acre. One-sixth of the area of each of such groups is felled in the first year of working and two-fifths in each of the four years thereafter. It is calculated that the first year

of falling would be in 1915-16. No allowance is made for the new culms likely to be put on in the month of 1914 and 1915, for it is assumed that the percentage of flowering operations. The increment in each of these years would be set out for departmental floating operations.

Name of blocks in group	Area of group in acres	One eighth of area of group to be killed in 1914	Total yield in tons dry in 1914	Equivalent in number of culms	Percentage of culms which will be killed in 1915, 1916, etc.	Total yield in tons dry in 1915, 1916, etc.	Equivalent in number of culms	Total in tons dry in 1914-1916	Equivalent in number of culms
Vajachappali and Edabode	1,600	197	18,900	204	2,800	88,000			
Palode									
Misalsith									
Panayangode									
Valluvankar	1,801	219	645	18,000	720	1,000	10,000		
Bambadam									
Karim									
Mogal	7,000	778	7,000	140,000	1,400	14,000	140,000		
New Amaranjalam									
Nallikata	1,650-0	195	1,800	97,000	370	3,220	11,100		
Karampya									
Total	15,007-0	1,845	10,214	221,723	2,645	100,280	150,443	90,693	3,449,471

For the calculation of the yield in the second rotation it can be shown, on the assumption that in one year's growth, one culm is put on for every four standing culms at the commencement of the growth, that after five years growth from the date of felling a stump will contain exactly the same number of culms as in the year of felling, so that from the same area exactly the same yield is expected. Hundred thousand tons however will be required and the balance will be obtained at the end of the second rotation from those areas which flowered in 1911 and have been enumerated, see appendix II.

Additional yield expected at the end of the second rotation.

Block	Bamboo area in acres	Number of culms to be killed per acre	Yield of dry culms in tons per acre	Total yield in tons
Number of Culms per acre	1,500	150	20	10,700

For the calculation of the yield in the third rotation, all the areas which have flowered may be considered to be again fully stocked, see previous chapter, paragraph 4, and appendix II, enumeration of flowered clumps.

Yield in the third rotation.

Group	Name of block	Bamboo area in acres	Number of culms to be killed per acre	Yield in dry culms in tons per acre	Total yield in tons	Total yield dry culms and culms - new in tons
Wimbar	Vajachappali and Edabode	1,600	204	50	1,170	1,170
	Palode					
	Misalsith					
	Panayangode					
	Valluvankar	1,801	219	20	3,600	3,600
	Bambadam					
Amaranjalam	New Amaranjalam	7,000	300	1470	10,500	10,500
	Nallikata	1,650	195	20	1,770	1,770
	Karampya					
	Mogal	475	51	20	1,300	1,300
Total	14,927-0				147,340	

or approximately 28,000 tons dry per annum.

Owing to the expected steady advance of the region of flowering across the valley from west-east since 1911, and to the fact that the only localities flowering in 1914 are on the eastern eastern boundary, it is hoped that no further flowering will occur after this year, so that the above figures of yield may not be affected.

6. Estimate for working approximately 10,000 tons of dry bamboo in 1915-16—Bamboos operations—

(1) Mithalur Range.

REVENUE for felling, dragging, carting, rafting and storing bamboos at Baypore or Chalappuram in 1915-16.

Item No.	Description	Quantity	Rate	Per	Amount	Remarks
1	Felling bamboo	60,000	Rs. 4. 00	100	Rs. 2,400	
2	Dragging and rafting bamboo to the rafting place	100	10 00	100	10,000	
3	Cost of rafting bamboo to Chalappuram				1,000 00	
4	Cost of rafting bamboo to Baypore				1,700 00	
5	Wagon's wage	482 ratta	2 00	100 ratta	964 00	
6	Transporting loads with oxen				11 00	
7	Transport of all cartage from Baypore to Chalappuram in Mithalur including cartage and carting in the Mithalur Range office	7 ratta	2 00	100	14 00	Two-thirds of the original cartage cost should be recoverable.
					114 00	
					430 00	
	Total to Baypore				6,800 00	
	Total to Chalappuram				1,100 00	

Estimated minimum number of culms required 20,000.

(2) Amaranjalam Range.

REVENUE for felling, dragging, carting, rafting and storing bamboos at Baypore or Chalappuram in 1915-16.

Item No.	Description	Quantity	Rate	Per	Amount	Remarks
1	Felling bamboo Karim, Mogal, New Amaranjalam, etc.	10,000	Rs. 4. 00	100	Rs. 40,000	
2	Dragging and rafting bamboo to the rafting place - Karim, Mogal, New Amaranjalam, etc.	100	10 00	100	10,000	
3	Cost of rafting bamboo to Chalappuram, Karim, Mogal, New Amaranjalam, etc.				1,000 00	
4	Cost of rafting bamboo to Baypore, Karim, Mogal, New Amaranjalam, etc.				1,700 00	
5	Wagon's wage	1,000 ratta	2 00	100 ratta	2,000 00	
6	Transporting loads with oxen				11 00	
7	Transport of all cartage from Baypore to Chalappuram in Mithalur including cartage and carting in the Mithalur Range office and further transport to Chalappuram in Mithalur	7 ratta	2 00	100	14 00	Two-thirds of the original cartage cost should be recoverable.
					114 00	
					280 00	
	Total to Baypore				54,000 00	
	Total to Chalappuram				60,410 00	

Estimated minimum number of culms required 96,000.

CHAPTER III.—PROPOSALS FOR PLANTING OF BAMBOO IN THE VALLEY.

It was stated in chapter I that no bamboo would be available from private forests in the valley and this must be accepted as a fact, for every bamboo is required for floating timber. Even when all the valuable timber has been removed the bamboo could be sold in the market, for as a commencement Government would be receiving some 50,000 bamboos from the market every year, being about the number necessary for floating the teak and which would be delivered to the paper pulp mill. However the foot hills of the Kasaulis, the silent and Attorney Valleys in Munnar and valleys are densely stocked with bamboo. It has been shown that Government can from their forests in the valley maintain the estimated annual yield necessary for the demand, but in the event of unforeseen circumstances it may be advisable to have additional areas on lease under working. The map shows two densely stocked areas A and B, the difference in the two areas being that while extraction from the former leads to the Bekkasi Puzha, a substantial tributary of the Kadalmudi River, connected near its mouth by a navigable backwater with Beyyore, extraction from the latter lies to the Kumbalangi and the Ponnani River and thence by sea to Beyyore. The cost of extraction from the latter must necessarily be high.

Area A is partly registered in the name of the Kuthiravath Nayar, partly as Government poramboke.

Area B is partly registered in the name of the Kuthiravath Nayar, and partly in the name of M.R. By. Palat Ramam Menon, though there are in both cases several additional claimants so that it would be the safest policy to acquire the land. These foot hills are death traps in the monsoon so that they must be worked from August-May and the stored bamboo floated at the floods.

Assuming that the areas are so densely stocked with bamboo as Kumbalangi, etc., to maintain a sustained annual yield of 10,000 tons, an area of 5,000 acres would be required. The cost of extraction is estimated for area A as follows, the labour charges in Nilambur range being adopted, and allowance only made for floating dry bamboos on the floods.

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Assuming that the areas are so densely stocked with bamboo as Kumbalangi, etc., to maintain a sustained annual yield of 10,000 tons, an area of 5,000 acres would be required. The cost of extraction is estimated for area A as follows, the labour charges in Nilambur range being adopted, and allowance only made for floating dry bamboos on the floods.

Range and locality.	Cost of felling 100 bamboos.		Digging and carting 100 bamboos over one mile at 10 mampas per cart and 1/2 c. per mile.	No. of bamboos per half.	Cost of cartage required at various points.	Cost of tying and carting at 1/2 c. per mile.
	I Retention.	II Retention.				
Munnar hills	Rs. 12.0	P. 4.0	Rs. 10.0	100	Rs. 1.0	P. 10.0

Average distance Area falling since top of hill to Beyyore in miles.	Cost of floating 1 half of 100 bamboos to Beyyore.	Total cost floating and carting 100 bamboos to Beyyore.	Total cost of felling, digging, carting and floating in Beyyore.		
			100 Retention.	200 Retention.	300 Retention.
Rs.	Rs. 12.0	P. 4.0	Rs. 10.0	Rs. 1.0	P. 10.0

The calculated cost of extraction to Ponnani is 12 annas less per 100 bamboos in both the I and II retentions and 4 annas less per ton dry return. The bamboo would then have to be shipped 55 miles to the coast to Beyyore.

CHAPTER IV.—SPECIAL OUTLINES FOR THE PROTECTION OF BAMBOO PLANTATIONS WITH *Diphysa longicauda Fagraeae*.

It has been shown in appendix IV that numerous possibilities lie before a plantation of *Cyrtosperma* from Fagraeae. Grown from seed in 1886 it had formed splendid clumps by 1895, and that if seed were obtained from Burma and sown over a suitable site, presumably moist as it prefers river banks, within 7 or 8 years it could be brought under working. It is suggested that a very similar bamboo in Trinidad is raised by ploughing in lime or guano, about 1/2 inch and laying grass cut below on the seed and grass covering them will make the seeds produce a full grown stem or more in one year's growth and from this a yield of 40 tons per acre is produced. There seems no reason why this bamboo should not do the same.

The difficulty lies in the formation; at level 30 mampas per acre would be found containing on an average 14 percent 177 1/2 cwt. of average length of best average number of holes per stem 25. Land and to seed 10 acres, 102 per acre would be needed. From the 90 clumps, 1000 cwt. would be available. This would plant up at least 70 acres. If 50 per cent of these were some produced on full sized culm in one year's growth, 87,500 culms would be available which would plant up 350 acres. On the same assumption the yield from this area in the second year's growth would plant up 10,500 acres.

Working could therefore commence after three years' growth.

Other work required.—A plantation of this kind would, if situated in elephant country, need rigid protection in the form of a 6' x 6' trench all round the endangered circumference, with an elaborate system of pits. Such a trench an intertie work at the rate of Rs. 14-4-0 per 1,000 c. ft. would cost Rs. 2,708-10-3 a mile or allowing for 2,000 c. ft. of solid rock blasting Rs. 2,944-3-3 per mile. Some bamboo could be planted outside the trench amongst the pits as a bait for the wild elephants.

A cost of extraction.—It is shown in appendix V that the cost of extraction is extraordinarily low.

R. BOURKE,
District Forest Officer, South Malabar.

NILAMBUR,
20th January 1914.

APPENDIX A
(Fully stocked areas)

In appendix VI of Mr. Pearson's note he gives the statistics obtained from sample areas laid out in Kankath and Hobott and trees which he calculated his figures of yield on pages 101 and 102 of his note. They are reproduced here for easy reference.

SAMPLE plots in Nilambur Range taken in February 1910.

Locality.	Area of plot in acres.	Number of clumps marked.	Number of stem produced per clump.	Number of old stems contained.	Number of culms on one stem.	Average height of culm in feet.	Average weight of culm in lbs.	Total weight dry in the plot.	Weight of dry culms in the plot.	Weight of dry culms per acre.	Weight of dry culms per acre in the field.	Yield of dry culms per acre in the field.
Kankath	1.1	48	115	217	180	83	10,285	7,200	8,200	1,000	15,944	15,944
Hobott	1.1	48	121	246	180	83	10,285	7,200	8,200	1,000	15,944	15,944
Average per acre	1.1	48	108	231	180	83	10,285	7,200	8,200	1,000	15,944	15,944

These sample areas were taken by him as fully stocked bamboo areas. Unfortunately they were not demarcated and the exact location could not now be located.

A sample area was laid out on an average plot of 10 acres as a check on Mr. Pearson's figures and only 60 culms were counted. It is thought advisable to reduce Mr. Pearson's figures to 30 culms per acre and the average per acre based on this figure works out as follows:

Area of plot in acres.	Number of clumps marked.	Number of stem produced per clump.	Number of old stems contained.	Number of culms on one stem.	Average height of culm in feet.	Average weight of culm in lbs.	Total weight dry in the plot.	Weight of dry culms in the plot.	Weight of dry culms per acre.	Weight of dry culms per acre in the field.	Yield of dry culms per acre in the field.
10	48	112	222	180	80	10,000	7,000	8,000	1,000	15,000	15,000

It is necessary to point out that Mr. Pearson in calculating the yield per acre of dry culms in his figures 35,944 lbs. above, that his calculation is of the yield in the year of measurement, based on his figures on culm falling. He has however shown that the retention of culms over old is as 1 in 4 or 25 per cent. (page 90 of his note) so that his figure is the correct calculation of the yield in the year subsequent to measurement if 25 per cent of the culms per clump are left standing. Further he has not taken into consideration the average number of stems per acre, but based the figure on the number of culms in the clumps. Under average per acre 25,944 lbs. should be 25,000 lbs. in the calculation based on the figure of 40 clumps per acre, column 12 represents the yield of dry culms per acre in pounds, culm felled in the year of measurement; column 14 represents the yield of dry culms per acre in pounds in the year of measurement if 25 per cent of the culms per clump are left standing. From the same figures 25,944 lbs. is the yield of dry culms, culm cut in the year of measurement, if 25 per cent of the culms in a clump are left standing, or 25 tons per acre.

APPENDIX II

(Partly stocked areas.)

LINNAEUS survey in *Nes Ameropaine* reserve starting from the Pannapoye, a short distance south-west of the Kiamapoye marsh in a north-west to south-east straight line. Two chains broad.

Parcels and acres.	Number of chains.	Number of established green stumps.	Number of felled stumps of 1912.	Number of felled stumps of 1913.	Number of felled stumps of 1914.	Number of green stumps alive per acre.	Total number of stumps per acre.
1 acre	1		10				
2	2						
3	3						
4	4						
5	5						
6	6						
7	7						
8	8						
9	9						
10	10						
11	11						
12	12						
13	13						
14	14						
15	15						
16	16						
17	17						
18	18						
19	19						
20	20						
21	21						
22	22						
23	23						
24	24						
25	25						
26	26						
27	27						
28	28						
29	29						
30	30						
31	31						
32	32						
33	33						
34	34						
35	35						
36	36						
37	37						
38	38						
39	39						
40	40						
41	41						
42	42						
43	43						
44	44						
45	45						
46	46						
47	47						
48	48						
49	49						
50	50						
51	51						
52	52						
53	53						
54	54						
55	55						
56	56						
57	57						
58	58						
59	59						
60	60						
61	61						
62	62						
63	63						
64	64						
65	65						
66	66						
67	67						
68	68						
69	69						
70	70						
71	71						
72	72						
73	73						
74	74						
75	75						
76	76						
77	77						
78	78						
79	79						
80	80						
81	81						
82	82						
83	83						
84	84						
85	85						
86	86						
87	87						
88	88						
89	89						
90	90						
91	91						
92	92						
93	93						
94	94						
95	95						
96	96						
97	97						
98	98						
99	99						
100	100						
Average per acre	15.4	2.9	2.7	2.7	2.7	1.0	1.4

Chains 47-50 were killed out after having been from south-east to north-west.

LINNAEUS survey in *Nallicuba* reserve starting from the Pannapoye, a short distance south-west of Mochibana in an east to west straight line. Two chains broad.

Parcels and acres.	Number of chains.	Number of established green stumps.	Number of felled stumps of 1912.	Number of felled stumps of 1913.	Number of felled stumps of 1914.	Number of green stumps alive per acre.	Total number of stumps per acre.
1 acre	1						
2	2						
3	3						
4	4						
5	5						
6	6						
7	7						
8	8						
9	9						
10	10						
11	11						
12	12						
13	13						
14	14						
15	15						
16	16						
17	17						
18	18						
19	19						
20	20						
21	21						
22	22						
23	23						
24	24						
25	25						
26	26						
27	27						
28	28						
29	29						
30	30						
31	31						
32	32						
33	33						
34	34						
35	35						
36	36						
37	37						
38	38						
39	39						
40	40						
41	41						
42	42						
43	43						
44	44						
45	45						
46	46						
47	47						
48	48						
49	49						
50	50						
51	51						
52	52						
53	53						
54	54						
55	55						
56	56						
57	57						
58	58						
59	59						
60	60						
61	61						
62	62						
63	63						
64	64						
65	65						
66	66						
67	67						
68	68						
69	69						
70	70						
71	71						
72	72						
73	73						
74	74						
75	75						
76	76						
77	77						
78	78						
79	79						
80	80						
81	81						
82	82						
83	83						
84	84						
85	85						
86	86						
87	87						
88	88						
89	89						
90	90						
91	91						
92	92						
93	93						
94	94						
95	95						
96	96						
97	97						
98	98						
99	99						
100	100						
Average per acre	15.4	2.9	2.7	2.7	2.7	1.0	1.4

Furlongs and verge	Number of culms obtained	Number of green culms	Number of brown culms of 1912	Number of brown culms of 1913	Number of brown culms of 1914	Number of green culms per acre	Total number of culms per acre
.....	71	5	..	..	..	..	..
.....	72	4	..	..	..	..	..
.....	73	4	..	..	..	..	..
.....	74	5	..	..	..	..	..
.....	75	6	..	..	..	..	..
16 acres	16	16	..	..	..	..	..
.....	77	7	..	..	..	..	..
.....	78	7	..	..	..	..	..
.....	79	3	..	..	..	..	..
.....	80	7	..	..	..	..	..
1 mile and 16 acres	80	7	..	..	..	..	..
Average per acre		19.4			19	19.4	18.9

The continuation of this line to the reserve boundary passes through very dense bamboo, so that this is a very conservative estimate.

In order to find the average number of culms per clump, an area which had been cut over for departmental bamboo in 1913 was measured. Every culm in each clump was counted, in order to find the number of suitable culms after the next monsoon. Every clump big and small was taken into consideration. New Amarampalam reserve, Korampala beat.

Number of clumps enumerated	Number of culms per clump	Average number of culms per clump
1	18	
2	18	
3	3	
4	3	
5	4	
6	4	
7	18	
8	3	
9	12	
10	7	
11	20	
12	18	
13	7	
14	22	
15	12	
16	12	
17	30	
18	6	
19	15	
20	9	
21	14	
22	14	
23	10	
24	18	
25	6	
26	6	
27	6	
28	5	
29	5	
30	8	
31	8	
32	7	
33	7	
34	9	

11.85

This again is a conservative estimate as every clump had been cut over in the year. This figure may also be taken for Nellikutta. As big culms were only available at Silambar it was decided to fall an average bamboo from new Amarampalam or Nellikutta, survey is to W. number and there weight. For this purpose a one year culm, being of less weight than an

old culm of the same dimensions, was taken from a small clump on the hill near the Korampala reserve. The measurements derived may therefore be considered conservative as the growth in the valleys is greater. The measurements were as follows:-

Measurable length in feet	Mid-girth in inches	Base girth in inches	Greater girth in inches	Number of culms	Average diameter of culm in inches	Total weight green in lb.	Total weight dry in lb.
55	10	14	20	80	1.5	221.5	145.0

The dry weight measurement in the last column, as the culm could not be left for want of time to dry is calculated on the assumption that the green weight is to the dry weight of these bamboos as the green weight is to the dry weight of the bamboos measured by Mr. Pearson from Fokho. It is absolutely safe to 50 per cent. dryage loss of weight will be allowed or 110 lb. taken as the dry weight of one culm.

Calculations of the yield per acre for Nellikutta and New Amarampalam reserves are:-

Location	Average number of culms per acre	Average number of culms per acre when fully stocked	Average number of culms per acre when fully stocked	Weight of one culm dry in lb.	Yield when fully stocked of dry culms per acre in lb.	Yield from green culms per acre in lb.	Yield from green culms per acre in tons	Yield when fully stocked of dry culms per acre in tons
New Amarampalam	19.4	18.9	11.85	1.5	28.125	29.224	0	34.75
Nellikutta	17.5	18.0	11.85	1.5	26.718	24.323	7.44	6.29

LINEAR survey through Widaocde, a future bamboo area. Starting from the northernmost point in plantation 1893 line north in a straight line, one chain broad:- Three seasons' growth.

Furlongs and verge	Number of chains	Number of furlong culms	Number of furlong culms	Furlongs and verge	Number of chains	Number of furlong culms	Number of furlong culms per acre
.....	1	6	..	1 furlong and 3 acres	27	2	..
.....	2	6	..		29	2	..
.....	3	6	..		30	0	..
.....	4	6
.....	5	4	..	2 furlong and 1 acre	21	1	..
.....	6	4	..		23
.....	7	6	..		25
.....	8	6	..		26
.....	9	6	..	3 furlong and 1 acre	27
.....	10	6	..		28	1	..
.....	11	6	..		29	1	..
.....	12	6	..		30
.....	13	6	..	4 furlong and 1 acre	31
.....	14	6	..		32
.....	15	6	..		33
.....	16	6	..		34
.....	17	6	..	5 furlong and 1 acre	35
.....	18	6	..		36
.....	19	6	..		37
.....	20	6	..		38
.....	21	6	..	6 furlong and 1 acre	39
.....	22	6	..		40
.....	23	6	..		41
.....	24	6	..		42
.....	25	6	..	7 furlong and 1 acre	43
.....	26	6	..		44
.....	27	6	..		45
.....	28	6	..		46
.....	29	6	..	Average per acre	47
.....	30	6	..		48
.....	31	6	..		49
.....	32	6	..		50
.....	33	6	..	51	..	..
.....	34	6	..	52	..	..
.....	35	6	..	53	..	..
.....	36	6	..	54	..	..
.....	37	6	..	55	..	..
.....	38	6	..	56	..	..
.....	39	6	..	57	..	..
.....	40	6	..	58	..	..
.....	41	6	..	59	..	..
.....	42	6	..	60	..	..
.....	43	6	..	61	..	..
.....	44	6	..	62	..	..
.....	45	6	..	63	..	..
.....	46	6	..	64	..	..
.....	47	6	..	65	..	..
.....	48	6	..	66	..	..
.....	49	6	..	67	..	..
.....	50	6	..	68	..	..
.....	51	6	..	69	..	..
.....	52	6	..	70	..	..
.....	53	6	..	71	..	..
.....	54	6	..	72	..	..
.....	55	6	..	73	..	..
.....	56	6	..	74	..	..
.....	57	6	..	75	..	..
.....	58	6	..	76	..	..
.....	59	6	..	77	..	..
.....	60	6	..	78	..	..
.....	61	6	..	79	..	..
.....	62	6	..	80	..	..
.....	63	6	..	81	..	..
.....	64	6	..	82	..	..
.....	65	6	..	83	..	..
.....	66	6	..	84	..	..
.....	67	6	..	85	..	..
.....	68	6	..	86	..	..
.....	69	6	..	87	..	..
.....	70	6	..	88	..	..
.....	71	6	..	89	..	..
.....	72	6	..	90	..	..
.....	73	6	..	91	..	..
.....	74	6	..	92	..	..
.....	75	6	..	93	..	..
.....	76	6	..	94	..	..
.....	77	6	..	95	..	..
.....	78	6	..	96	..	..
.....	79	6	..	97	..	..
.....	80	6	..	98	..	..
.....	81	6	..	99	..	..
.....	82	6	..	100	..	..

The growth when mature may be calculated on Mr. Pearson's figures from Polow:

Locality.	Area one acre.	No. culms of culms in 1st year.	No. culms of culms in 2nd year.	Average number of culms in 1st year.	Height in feet.	Weight in lbs.	Total weight dry.	Yield of dry culms per acre in 1st year.	Yield of dry culms per acre in 2nd year.	
Elacode	18	81	107	Average culms.	99	75.2	109.9	75.1	3,380	3.8

APPENDIX III.

Rate of growth.

In May 1912, the Guards' Vernacular Training School felled one or two clumps in Kanakuth on scientific principles at the base. These being the only statistics available of the reproduction from the root stocks two additional clumps were suggested. The Beat Guard who attended the school stated that in every clump all the one year old culms were left standing. The number of culms cut could be easily denoted by the number of stumps remaining.

Number of clump.	Number of culms left standing in 1911.	Number of culms in 1912.	Number of culms in 1913.	Number of culms in 1914.	Number of culms in 1915.	Number of culms in 1916.	Number of culms in 1917.	Number of culms in 1918.
I	2	10	6	6	6	6	6	6
II	2	14	10	10	10	10	10	10
Total	4	24	16	16	16	16	16	16
Average per clump	1	6	4	4	4	4	4	4

Note 1.—In this table the yield of dry year culms is estimated on the basis of the yield of that year.

Note 2.—That the number of old culms in 1912 after two consecutive years of growth at the base on the number of culms left standing in 1911 appeared that no new culms were cut out in the first year after cutting.

Note 3.—The estimated number of one year old culms in 1912, 1913, 1914, will be cut out in the autumn of 1915 based on article 6th a conservative basis. Clump No. II was felled in the autumn of 1914.

These figures show that after four successive years of growth the average number of culms per clump cut out will have been replaced. This gives a margin of safety in the present conditions should be adapted. It was observed that by scientific felling the density of culms found the base of the clump is considerably reduced.

APPENDIX IV.

Cephaelis Ipecacuanha.

Two clumps were selected in Remair on the north bank of the Chaine poya, one big and one small. They were felled at the base, all the one year old culms being left in the big clump No. 1, while 50 per cent of the total number of culms in the small clump No. 2 were left standing.

One average stem from each clump was measured and weighed green and the dry weight calculated on a 50 per cent allowance for loss of weight in drying.

If this bamboo were introduced on a plantation, each clump would yield more than 3000 lbs. of culms per acre than the *Bambusa Arundinacea* as they are fully assumed to show for 10 years. These should get 40 clumps per acre, the density of fully stocked natural bamboo. On these two conservative assumptions of dryness and density, the following figures are held for pure bamboo.

Number of clump.	Number of culms left standing per clump.	Number of culms left standing per acre.	Ratio of culms left standing to 100.	Number of culms per acre.	Number of culms per acre.	Number of culms left per acre.	Yield of culms per acre per year.
I	2	20	20	20	20	20	20
II	2	100	100	100	100	100	100
Average per clump or acre	1	100	100	100	100	100	100

Number of clump.	Mid-girth of average culm in each clump in inches.	Best girth of culm in each clump in inches.	Number of culms in each clump.	Thickness of culm at base of average culm in inches.	Total weight of culms in clump in lbs.	Yield of culms per acre in lbs.	Yield of culms per acre in tons.
I	4	10	20	10	100	100	10
II	4	10	100	10	1000	1000	100
Average per clump or acre	4	10	100	10	1000	1000	100

These clumps can be at the same 50 years old.
107 dry culms are equivalent to one acre.

APPENDIX V.

Cost of extraction.

Bambusa Arundinacea.—In order to obtain statistics of the expenditure incurred in felling these clumps additionally at the base, two clumps in V. Varanheri with a large palisade were felled, and accurate data of the losses obtained.

It was found that it took 2 days to fell a dried or green stump as a full bamboo, so that 4 clumps that have never before been felled for bamboo, as many full bamboos would be obtained in the total number of dried and green stumps, half bamboos and full bamboos from these sample clumps.

The whole of this area is covered in the report for working bamboo has already been felled over from time to time, though the density is less than these sample clumps.

It will be most accurate then to assume that the number of coolies working on these sample clumps produced in output per coolie per day the same mean between the output per coolie per day of all bamboos and the total output per coolie per day in units in these sample clumps. Every clump in the area to be worked must be felled on scientific lines so that the total output per coolie per day will be the same.

Percentage of clump.	Number of culms left standing in 1911.	Number of culms left standing in 1912.	Number of culms left standing in 1913.	Number of culms left standing in 1914.	Total culms.	Number of culms for one day.
I	2	10	6	6	24	24
II	2	14	10	10	36	36
Average	1	12	8	8	30	30

In calculating the actual cost of extraction in the first and second seasons, it is assumed that in the second season there will be no dry or new stumps in the clump, but that every unit removed will be a full bamboo. No further allowance is made in the second season on account of the expected reduction in the palisade as the above assumption is a reduction factor in itself.

Cost of felling and stacking bamboos.

Sample slumps.	Output.		1 Season.		23 Seasons.	
	Number of felling gangs per day.	Total bamboos felled per day.	Cost per 1000 bamboos felled.	Cost per 1000 bamboos stacked.	Cost per 1000 bamboos felled and stacked.	Cost per 1000 bamboos felled and stacked.
Average	1.02	1.98	10 1/2	12 1/2	22 1/2	32 1/2

Cost of dragging or carting from the felling site to the rafting place.

Locality.	Average distance in miles.	Average number of bullocks per cart.	Rate per mile.	Cost of carting 1000 bamboos.
Channarayana Range.				
Karim Muddi	5	10	4	20 0 0
Average	5	10	4	20 0 0
New Ananthapuram Range.				
Kannayya Muttappa	11	8	4	39 2 0
Average	11	8	4	39 2 0
Shivara Range.				
Channarayana of Channarayana	1	10	4	4 0 0
Channarayana of Channarayana	1	10	4	4 0 0
Channarayana of Channarayana	1	10	4	4 0 0
Channarayana of Channarayana	1	10	4	4 0 0
Channarayana of Channarayana	1	10	4	4 0 0
Average	1	10	4	4 0 0

Cost of floating bamboos to the ghat. It was ascertained from Mr. Nelson that a sufficient quantity of good water was obtainable at Byrappa, everything pointed to Byrappa as the most suitable place for the construction of the dam. The cost of floating is therefore worked out from Byrappa to Channarayana and to Byrappa.

The floating charges are first estimated in Pongalur, where the single raft is projected and linked up into consignments.

Secondly from Pongalur to Channarayana and thirdly from Channarayana to Byrappa. In the above stages rafts can only be taken from Channarayana to Byrappa. During the six months, December-May inclusive, the water in the river is so low that only a reduced number of bamboos can be taken into a raft and that the usual floating charge of one raft is raised by 50 per cent. The same has been taken from the two sample slumps in Vallabhabari were tied into rafts for the collection of data.

Throughout except where otherwise stated, green bamboo has been assumed.

Locality.	Number of rafts constructed.	Total bamboos floated.	Average number per raft.	Cost per 1000 bamboos.	Total number of rafts in a day.
Single slump, Vallabhabari	1	100	10	10 0 0	1

Locality.	Number of rafts constructed.	Total bamboos floated.	Average number per raft.	Cost of floating per 1000 bamboos.		Total cost of floating per 1000 bamboos.
				From Pongalur to Channarayana.	From Channarayana to Byrappa.	
Channarayana Range, Karim Muddi, Kannayya Muttappa, Shivara Range, Channarayana of Channarayana, Channarayana of Channarayana, Channarayana of Channarayana, Channarayana of Channarayana.	1	100	10	10 0 0	10 0 0	20 0 0
	1	100	10	10 0 0	10 0 0	20 0 0
	1	100	10	10 0 0	10 0 0	20 0 0
	1	100	10	10 0 0	10 0 0	20 0 0
	1	100	10	10 0 0	10 0 0	20 0 0
	1	100	10	10 0 0	10 0 0	20 0 0
	1	100	10	10 0 0	10 0 0	20 0 0
	1	100	10	10 0 0	10 0 0	20 0 0
	1	100	10	10 0 0	10 0 0	20 0 0
	1	100	10	10 0 0	10 0 0	20 0 0
	1	100	10	10 0 0	10 0 0	20 0 0

It is estimated that if all bamboos cut are stored under shelter after felling for six months and then floated dry, it will be possible to float twice as many bamboos in a raft than if they were green. The cost of rafting per 100 and per ton dry cutstem would then be halved.

Locality and range.	Total cost of rafting 100 bamboos to Chalappuram.		Total cost of rafting 100 bamboos to Baysam.		Total cost of rafting 1 ton dry cutstem to Chalappuram.		Total cost of rafting 1 ton dry cutstem to Baysam.	
	Six months, June - Nov. 1913.	Six months, June - Nov. 1914.	Six months, June - Nov. 1913.	Six months, June - Nov. 1914.	Six months, June - Nov. 1913.	Six months, June - Nov. 1914.	Six months, June - Nov. 1913.	Six months, June - Nov. 1914.
Nilambur	2 2 6	2 0 0	2 2 6	2 0 0	2 2 6	2 0 0	2 2 6	2 0 0
Chalappuram and Marik.	12 10 0	5 14 3	10 7 6	6 5 0	4 14 0	1 10 0	3 10 0	1 14 0
New Amarampalam, Nelli-cutta and Karumpaya.	25 4 6	11 12 0	26 14 6	13 7 0	7 6 0	3 2 0	7 6 0	3 2 0

Dephalostachyum Pergracis.—In the case of the two clumps felled, date of felling, rafting, etc., were collected.

Three hundred and seventy-four clumps were felled and five half-bamboos or a total of 379 units by 19 coolies in one day, or 20 units per coolie per day.

Locality and range.	Cost of rafting 100 bamboos to Chalappuram.		Cost of rafting 100 bamboos to Baysam.		Cost of rafting 1 ton dry cutstem to Chalappuram.		Cost of rafting 1 ton dry cutstem to Baysam.	
	Six months, June - Nov. 1913.	Six months, June - Nov. 1914.	Six months, June - Nov. 1913.	Six months, June - Nov. 1914.	Six months, June - Nov. 1913.	Six months, June - Nov. 1914.	Six months, June - Nov. 1913.	Six months, June - Nov. 1914.
Nilambur	2 2 6	2 0 0	2 2 6	2 0 0	2 2 6	2 0 0	2 2 6	2 0 0
Chalappuram and Marik.	12 10 0	5 14 3	10 7 6	6 5 0	4 14 0	1 10 0	3 10 0	1 14 0
New Amarampalam, Nelli-cutta and Karumpaya.	25 4 6	11 12 0	26 14 6	13 7 0	7 6 0	3 2 0	7 6 0	3 2 0

Locality and range.	Total cost of rafting, cutting and mulling 100 bamboos to Chalappuram.		Total cost of rafting, cutting and mulling 100 bamboos to Baysam.	
	Six months, June - Nov. 1913.	Six months, June - Nov. 1914.	Six months, June - Nov. 1913.	Six months, June - Nov. 1914.
Nilambur	2 2 6	2 0 0	2 2 6	2 0 0
Chalappuram and Marik.	12 10 0	5 14 3	10 7 6	6 5 0
New Amarampalam, Nelli-cutta and Karumpaya.	25 4 6	11 12 0	26 14 6	13 7 0

Locality and range.	Average number of clumps cut per day.		Average number of units cut per day.		Average number of clumps cut per day.		Average number of units cut per day.	
	Six months, June - Nov. 1913.	Six months, June - Nov. 1914.	Six months, June - Nov. 1913.	Six months, June - Nov. 1914.	Six months, June - Nov. 1913.	Six months, June - Nov. 1914.	Six months, June - Nov. 1913.	Six months, June - Nov. 1914.
Nilambur	2 2 6	2 0 0	2 2 6	2 0 0	2 2 6	2 0 0	2 2 6	2 0 0
Chalappuram and Marik.	12 10 0	5 14 3	10 7 6	6 5 0	4 14 0	1 10 0	3 10 0	1 14 0
New Amarampalam, Nelli-cutta and Karumpaya.	25 4 6	11 12 0	26 14 6	13 7 0	7 6 0	3 2 0	7 6 0	3 2 0

Note.—The number of coolies and the weight of bamboos cut are given in the table, but the total cost of rafting, cutting and mulling 100 bamboos is given approximately. The cost of rafting of 1 ton dry cutstem is given.

No. 2421, Revenue, 20th August 1914.

Order No. 2421, Revenue, dated 20th August 1914.

With its Forest Reference No. 63-G/14-3, dated 20th January 1914, the

Forest No. 1211

Board of Revenue submitted a scheme formulated by Mr. T. Nelson of Messrs. Nelson & Co., Edinburgh for the establishment on the West Coast of a factory for the manufacture of paper pulp from bamboo. In furtherance of his scheme Mr. Nelson has asked for certain concessions, the more important of which are dealt with below.

2. Mr. Nelson requests that the Government should either themselves sell bamboos to his company at a low price, or grant, free of rent for five years and thereafter subject to rent, an extent of about 3,000 acres of land suitable for bamboo growth with an option on a further area for extension of bamboo plantations in the event of the enterprise proving a success. The Government cannot undertake to stipulate in a private firm any considerable extent of land below its proper value, and they are prepared to consider an application for temporary remission of assessment on the analogy of the concessions specified in the notes to clause 15 of Board's Standing Order No. 20.

3. As to the quantity of the supply of bamboos desired, Mr. Nelson asks that the Government should deliver to the company 10,000 tons air dry in the first year and 20,000 tons annually thereafter until the company's plantations are in bearing. The Board has submitted with its ~~own~~ remarks and those of the Conservator of Forests, Western Circle, a careful detailed report prepared by Mr. Bourne on the possibility of working for bamboo certain natural forests in South Malabar. The Government are inclined to agree with the Board in the view that the thinning of bamboo should benefit, rather than injure, the forests and for that reason they consider it unnecessary to stipulate that the company shall continue to buy bamboos from the Forest Department after the expiry of the proposed initial period of five years. As regards the rate at which bamboo should be sold to the company, the Government are prepared to supply at cost price for two years, but after that period they must stipulate for a profit of 12½ per cent. The cost price cannot be guaranteed but on the data available Mr. Nelson may be informed that it seems likely to work out to about Rs 7-8-0 per ton.

4. With reference to his request for the grant of water rights to the company's factory free of charge, the Government consider that while water power may be given, if locally available, there should be a fair payment for the supply taken.

5. Mr. Nelson next asks that all the materials imported for constructing the company's mill and manufacturing the pulp should be exempted from import duty and that for a term of years no export duty should be levied on bamboo pulp or paper. He should be informed that there is no export duty on paper pulp and that no concession in respect of import duty can be granted.

6. Mr. Nelson's last request is that bamboo pulp paper should be specified in Government contracts for paper. The Government can give no such promise until the price and the quality of the paper manufactured by the company are known. But Mr. Nelson may be assured of all reasonable official advice and assistance in the proposed enterprise.

7. The Board of Revenue will be requested to communicate to Mr. Nelson the substance of the foregoing remarks and to issue instructions to the Forest officers concerned to conduct careful experiments and observations as to the reproductive power of bamboo, the cost of its production, etc.

True Extract.)

L. HARRISON,
Ag. Secretary to Government.

To the Hon'ble Revenue and Forest Secretary
with two copies retained
Copy to the Board of Revenue, Revenue Buildings,
Madras.

Government of Madras.

REVENUE DEPARTMENT.

File

Enclosure

Regd

1914

Spare copies

G.O. No. 2421, 20th August 1914.

Bamboo Pulp Factory.

Printing order on Messrs. Nelson & Co.'s scheme for the establishment of a — on the West Coast.

GOVERNMENT OF MADRAS.
REVENUE DEPARTMENT.

Read—the following papers:—

I

G.O. Mis. No. 424, Revenue, dated 10th February 1914.

Read—the following paper:—

Reference from the Board of Revenue (Land Revenue), Forest No. 63-G1 (14-1,
dated 20th January 1914.

The Hon'ble Mr. R. C. C. CARR, I.O.S.

Read—the following paper:—

Letter—from F. A. LONG, Esq., C.I.E., Conservator of Forests, Western Circle.
To—the Secretary to the Commissioner of Land Revenue and Forests.
Dated—the 8th January 1914.
No.—R.O.C. 42 of 1914-3.

I have the honour to enclose copy of a letter received from Mr. T. Nelson (of Messrs. Nelson & Co., Edinburgh) on the subject of establishing a bamboo pulp factory on the West Coast.

Messrs. Nelson & Co. are willing to erect a factory on the Chaliar river, and ask Government to grant them certain concessions in the first few years of the enterprise.

The factory is to be capable of dealing with 20,000 tons of air dry bamboo annually, and its erection involves large capital expenditure; Messrs. T. Nelson & Co. are anxious to commence work as soon as possible and Mr. T. Nelson is desirous of taking home to his partners definite information regarding the concessions Government will grant. The following are the concessions asked for:—

- (1) That Government shall sell to the company at a low price, or grant free for five years and then rent, about 3,000 acres of land suitable for bamboo growth;
- (2) that Government shall give the company an option on a further area for extension of bamboo plantations in the event of the enterprise proving a success;
- (3) & (4) that Government shall deliver at a low price 10,000 tons of air dry bamboo in the first year and 20,000 tons annually thereafter until the company's plantations are in bearing;
- (5) & (6) that Government shall grant a factory site with necessary water rights free of charge or if the company requires a factory site Government shall grant the necessary water rights;
- (7) that Government shall give official advice and assistance in regard to planting, etc.;
- (8) that the mill materials and machinery may be exempt from import duty;
- (9) that the pulp exported may be exempt from export duty for a term of years; and
- (10) that "bamboo pulp paper" may be specified in Government contracts for paper when suitable

I have told Mr. Nelson that it is impossible to definitely settle all these points in the short time available (Mr. Nelson leaves Bombay on the 7th February), but I think it is desirable that as far as possible definite replies should be given in order that the company may be in a position to order machinery and commence work as early as possible.

Taking the points *seriatim*—

(1) If the land required for plantations in reserved forests a suitable area might be found in the now Amarampalam reserve; Mr. Nelson would prefer land nearer the proposed factory site near Kannaparauba, either in Calicut or Ernad taluk; the Collector of Malabar will be able to state whether the land is available. The land might be granted free of assessment for five years and thereafter subject to ordinary assessment.

(2) This must depend on what suitable land is available either in Amarampalam reserve or nearer the proposed factory.

(3) & (4) I have informed Mr. Nelson that I cannot at present guarantee any fixed annual output of bamboos; I have called for reports from North and South Malabar and it will take some time to obtain reliable figures of stock, until these are available all that can be said is that Government will supply as many bamboos as possible from State forests at Rs. 3 per ton or cost price, whichever is greater, and will if possible supplement the supply by leasing and working private forests, such supplemental supply to be paid for on the same terms as the supply from State forests. I would limit the period of supply at cost price to five years, by which time the factory should be well established and Government should reap some benefit from the market created for their bamboos.

(5) & (6) I do not know whether the factory site is on private or Government land; if the latter, it might be granted free of charge for five years; there should be no difficulty about the grant of water rights.

(7) The advice of the local District Forest Officer can be made available

(8), (9) & (10) These are outside my province.

2. I submit that every possible encouragement should be given to this enterprise which, if successful, will be followed by others and will not only bring in revenue, but also enable Government to reduce the annual stationery bill.

Both Burma and Cochin have offered liberal terms in order to facilitate the introduction of the bamboo pulp industry, and the concessions asked for by Mr. Nelson are not excessive.

3. Definite replies can be given at once to the last six points, and sympathetic consideration of the first four points can be promised; this would probably give Mr. Nelson sufficient grounds for putting work in hand on his return to England and I request that the orders of Government may be obtained at as early a date as possible.

ENCLOSURE

Letter—from Mr. T. Nelson (of Messrs. Nelson & Co., Edinburgh)
To—the Conservator of Forests, Western Circle
Dated—the 7th January 1914.

I am very much obliged for all the information you have been good enough to give me in connection with the enquiry which I see how to make as to the possibilities of manufacturing paper pulp from bamboo.

I feel however that my mission here will not have been accomplished either to my own or my partners' satisfaction unless on my return home I am able to state definitely not only my own opinion (formed after careful investigation on the spot) as to the probable success or otherwise of the venture, but also what inducements the Government of Madras are prepared to offer for the establishment of this new industry in the Presidency.

Already definite offers have been made by the authorities of Burma and Ceylon and it is in order that the Madras Government may consider what terms they are prepared to offer that I venture to write now, stating our exact position at the moment and our reasons for wishing that a decision should be come to on this matter if possible before I sail at the beginning of next month.

Since 1875, when Mr. Thomas Routledge experimented with the manufacture of paper from Trinidad bamboo, that fibre has been recognised as a very suitable one for paper-making. All attempts on any large scale to utilize it for that purpose have, however, proved failures up to the present time. A large mill started in the East has failed to give satisfactory results and one which was worked for some years in Trinidad has now been abandoned. In spite of these failures my firm are prepared to make a further experiment on a large scale either in India or the West Indies.

I feel sure that the Madras Government will realize the importance of establishing a large bamboo industry and will be willing like others to offer special inducements to firms ready to invest capital in such an enterprise. In asking the Madras Government to consider what special inducements they can grant us, I would like to draw your attention to the following considerations:—

- (1) Our plans involve the immediate expenditure of a very large sum to provide plant for an out-put of from 5,000 to 10,000 tons of pulp per annum and a rapid extension of the mill if the experiment proves a success.
- (2) We intend to manufacture pulp of a high grade which (if our experiment succeeds) will establish the Madras product as superior to any other bamboo pulp made even experimentally up to this time.
- (3) The previous experiments in bamboo pulp-making have been so disastrous that some special inducements are necessary before further capital will be attracted to the industry.
- (4) Without entering too minutely into the methods by which we propose to make bamboo pulp, I may say that we are fully alive to the difficulties hitherto experienced in the manufacture, such as the removal of the irritating matter from the bamboo, the treatment of the nodes, the bleaching of the pulp easily, etc., that we have erected and worked a complete experimental plant in Scotland large enough to test the matter commercially and that we have succeeded in producing a paper of a satisfactory character.

I give these particulars to let you know that, in spite of previous failures in making bamboo pulp, the methods we propose to use are, as far as we can see, likely to establish the industry on a new footing. This view is confirmed by one of the largest firms of paper-makers in Scotland, who have conducted all our experiments and have become partners with us in our enterprise.

In order to indicate the sort of facilities we would require before erecting a mill in the Madras Presidency I suggest—

- (1) That (if no more suitable ground is available) the Government should sell to us at a low price, say, 5,000 acres of land suitable for the growing of bamboo. This land would be systematically planned and a crop might, we think, be expected in from four to six years. Alternatively, that the Government should give us that ground free for five years and thereafter for a long period at a nominal rent.
- (2) That the Government should give us an option on any land available for growing bamboo to provide for the extension of the scheme should it prove a success.
- (3) That to provide a sufficient quantity of bamboo for the mill, till such time as our own plantations come into bearing, the Government should deliver to us at the mill during the first year's working 10,000 tons of air dry bamboo (or the equivalent thereof) and during each succeeding year 20,000 tons of air dry bamboo.
- (4) That the price for such deliveries should be, say, Rs. 3 per ton (for all bamboo) in Government land in the Nilambur district and that any bamboo over and above this that might be required to make up the necessary quantity should be charged to us at its net cost price to the Government.
- (5) That, if such is available, the Government should grant us free a suitable factory site with all necessary water rights.
- (6) That, if no such site is available on Government land, the Government should grant us the necessary water rights at a factory site to be secured by us from private owners.
- (7) That the Government should give us advice and assistance through its officials in regard to planting, etc.
- (8) That all the materials imported for constructing the mill and for manufacturing the pulp should be duty free for a period of years.
- (9) That no export duty should be levied on bamboo pulp or paper for a term of years.
- (10) That, when suitable, "Indian Bamboo Pulp" might be specified in Government contracts for paper.

If the above suggestions can be considered and some definite decision come to before I leave India I shall feel greatly obliged.

Reference—Forest No. 63-41-14-1, dated 20th January 1914.

Submitted to Government.

2 The Board think that the proposals of Messrs. Nelson & Co., Edinburgh, deserve favourable consideration. No definite scheme has, however, been submitted till Mr. Nelson selects suitable localities for his proposed factory and bamboo plantation.

3 The Collector of Malabar will be requested to report on the points referred to in the Conservator's letter and its enclosure after seeing Mr. Nelson, if possible.

W. A. McFARLAND,
Secretary.

To the Secretary to Government, Revenue Department
Collector of Malabar.

Order—Mis. No. 424, Revenue, dated 10th February 1914.

Recorded.

2 The further report called for in paragraph 3 of the Board's Reference read above is awaited.

(True Extract)

A. BETTS WORTH,
dg. Secretary to Government.

To the Secy. of Revenue, Land Revenue (Syrats)

II

Reference from the Board of Revenue (Land Revenue), Forest No. 63-41-3, dated 9th June 1914.

The Hon'ble Mr. R. C. CARR, I.C.S.

Read—the following papers—

Letter—from G. J. INNES, Esq., I.C.S., Collector of Malabar.
To—the Secretary to the Commission of Land Revenue and Forests.
Dated—Calicut, the 24th January 1914.
No—D. Dis. 163 P.

In reply to Board's Reference No. 63-41-14-1, dated the 20th instant, regarding Mr. Nelson's proposals for the establishment of a bamboo pulp factory on the West Coast, I have the honour to say that I have seen Mr. Nelson and discussed the whole matter with him. In fact he stayed with me for three days.

I understand that Mr. Nelson leaves for Scotland on the 7th February and this being so I set out the question for me to attempt to submit any useful report on the points indicated by the Board before Mr. Nelson leaves Madras. The first four concessions asked for by Mr. Nelson relate to the supply of bamboo and the grant of an area for a bamboo plantation. Mr. Nelson and Mr. Bourne went into this question very thoroughly at Nilambur and I understand that Mr. Bourne is writing a report on the subject for the Conservator. Mr. Nelson has arranged to meet Mr. Lodge at Madras on the 26th instant and they will then discuss together Mr. Bourne's report. Mr. Lodge will no doubt inform the Board of the results of this discussion and a decision will probably be arrived at at the conference as to the most suitable area for a plantation. When this area has been selected I shall be able to offer an opinion as to whether it can be sold or leased to Mr. Nelson.

3. Similarly as regards the factory site. It is quite undecided at present where this site is likely to be. One possible site is 24 miles up the Beypore river above this town; or owing to the expense of conveying coal up this distance it may be found necessary to put the factory at B-ypanor or Perok, provided always that a

suitable water supply can be secured. In some cases it will probably be impossible for Government to give the site, there being little or no Government land available. In any case the determining factor must be the water-supply.

4. Mr. Nelson's letter to Mr. Lodge was written when he knew nothing of local conditions. He tells me that he would not be quite satisfied with a general assurance that Government will endeavour to help him on the lines indicated in this letter and I have no doubt that Government will willingly give that assurance. In the meantime until Mr. Nelson has seen Mr. Lodge and has discussed with him the bamboo question I see little use in attempting to write any further report and with the Board's permission I propose to wait until I hear, either from the Board or the Conservator what decision has been arrived at as regards the site required for the bamboo plantation and as regards the other matters which are awaiting settlement in consultation between Mr. Nelson and Mr. Lodge.

Letter—from C. D. McClelland, Esq., Conservator of Forests, Western Circle,
To—the Secretary to the Commissioner of Land Revenue and Forests,
Dated—the 4th May 1914.
No.—K.O.C. 42.

I have the honour to submit with my remarks the report on bamboo supply for paper pulp prepared by Mr. Bourne which was called for in Board's Reference No. 63/14-2, dated 18th February 1914. A copy of Mr. Bourne's report has already been supplied direct to Mr. Nelson by Mr. Lodge in January.

2. I was obliged to hold back Mr. Bourne's proposals for discussion of its numerous details and the data—often varying—on which he bases his results. And especially because this is the first scheme of systematic working of Indian bamboos on a commercial scale that I know of, and because next to nothing is known about the growth of bamboos, their rate of increase, and the effects of cutting on the future supply of the clump. Practically all the data had to be collected for the occasion by enumeration, dryage, weighing and deduction, whilst the variations in size and rate of increase for comparatively small changes of locality which is a peculiarity of the species, required close attention to detail. For example, it is found that 31 full-sized bamboos in the Nilambur district yield one ton of dry weight. Ten miles away at Anamparam at the foot of the ghats where growth is more luxuriant 15 bamboos suffice for the same result. The number of culms per acre and the number of culms per clump vary almost as much, and this is the same species in both cases. It was impossible to accept variations of this sort upon which the whole estimate of supply depends, without examination and personal consultation with the writer.

3. As will be seen, the conclusion I have come to is that Mr. Bourne's calculations of the standing stock available are too conservative. Under the circumstances this caution is commendable but it has been carried to excess and I am of opinion that his figures may safely be doubled. On the other hand, his estimates of the annual yield are based on a removal at each cutting of 75 per cent. of the bamboo on the area and on the assumption that the culms so removed will be replaced by new annual shoots within a period of five years. In this Mr. Bourne follows Mr. Pearson's calculation, that this species of bamboo on the West coast and in Burma will on the average throw up one new culm per annum for every 4 old ones. That is to say, in four years it will a little more than double its numbers, and (allowing for a margin) that a five-year rotation will be a safe one. But this rate of growth refers to the naturally growing unexploited clump; and it does not follow by any means that it will be maintained if 75 per cent. of the clump is cut out at the start. It is in fact a matter of surprise, and rests on the issue between two opposing considerations. One of these is that the removal of congestion in the clump should lead to encourage growth of new culms, and the other that there must be some set back to growth from the sudden diminution of so much food forming material for the stems, which in this case lies underground. In my opinion the balance would be in favour of the latter. As was said before we have very little knowledge of the subject but

at the same time we cannot ignore what few facts we have. One of these is the case recorded in clump No. 2, Appendix III, of the report, where 75 per cent. of the clump of 20 bamboos was cut out four years ago, and at present there are only 8 culms in the clump. If, as proposed in this report, the whole bamboo area were worked on a 75 per cent. rate of removal in the expectation that it would renew itself in five years, and the result were to approximate to this example, the effect would obviously be the suspension of all yield for some years till the area was fit for cutting again, and would be disastrous from the point of view of a regular supply for a factory.

4. As a matter of fact, from enumerations which I carried out in North Salem last autumn in 8 or 10 different blocks, of the number of new annual culms to old, I am of opinion that the rate of increase varies with the size (i.e., the age) of the clump and taking the life period to be thirty years that the rate is probably greatest during the second and diminishes considerably in the last decade. These figures showed variations from one new culm per annum for 5 old ones in young clumps containing 10 to 15 bamboos; to 1 for 10 or more in clumps of 40 bamboos and over. I may say nothing seemed to be going on prodigiously fast and so gradually in that district; or more that way than the other.

5. If this is true, no fixed rotation can be suitable for all periods of the life of the bamboo. In fact I do not think that regularity is attainable either as regards rotation or intensity of working; e.g., towards the ending period almost every culm will be removed. However that may be, from the point at which we are starting the most rational system of working seems to be one of short rotations accompanied with light fellings, as this will entail the minimum of risk and also supply the fullest opportunities for observation. I mean to say, that if one were obliged to fix both the rotation and the intensity I should prefer to begin with one of 3 or 4 years with a 50 per cent. of extraction than one of five years with 75 per cent.

6. But we are here in a favourable position with no obligation at all to fix a rotation at starting. The exploitable area and the standing stock are so distinctly in excess of requirements, that we can start with light fellings—say 50 per cent.—which will easily meet the stipulated demand of Messrs. Nelson & Sons and go on doing so until the area of first fellings has recovered its original density of growth. When that has happened the intervening period will prove itself the proper rotation for that intensity of working.

7. For example in the present case we have two areas of different rates of productivity. We should commence in each at 50 per cent. removals. After three years' working it may be found that in one, the first fellings have recovered their original density of growth, whilst it takes four years to do so in the other. Or, the periods may be four and five years, respectively, of something else. Any how the right rotation for each must come out if it is three years or over, and it is not likely to be less. We are able to do this, not only because we can easily cope with the demand but because one of the proposed conditions is that the first five years' supply is to be made at cost price; and consequently it is not to the interest of Government to turn out more, or to force the pace.

8. I have now to deal with the exploitable area, the estimates of stock and annual yield and the cost of extraction, transport and delivery at the proposed factory which will probably be at Beypore. It may first be mentioned that as a supplementary source of supply in case of emergency, Mr. Bourne expects that 10,000 tons per annum of dry bamboo can be supplied from certain remote areas in the Mannarghat Range (chapter III of his report). Also that the District Forest officer, North Malabar, can arrange for the delivery of 3,000 tons per annum from the Kanott range. But this supply is not likely to be called upon in the near future (not only because of the greater cost of delivery or account of the longer distances involved, but because the resources of the Nilambur and Anamparam ranges in South Malabar are ample for the occasion and easiest of supervision).

9. The supply stipulated for by Messrs. Nelson & Sons, is 10,000 tons dry bamboo in the first year after erection of their factory, which at earliest could not be before 1915-1920, and 20,000 tons per annum in each of the four succeeding years, or a total of 90,000 tons in the first five years. Confiding consideration to the

Nilambur and Amarampalam ranges, in the first place, allowance, as regards present supply, has to be made for the fact that flowering commenced in 1911 on some portions and has since been gradually extending. Dead (flowered) clumps are useless for pulp after two monsoons as the fibre becomes rotten or too soft. For this reason 3,899 acres of bamboo forest in the Nilambur range is thrown out of work for the present but will be available about eight years hence when the present seedling clumps attain workable dimensions.

10. Of the balance, the exploitable areas, viz. those which have been inspected by Messrs. Bourne & Nelson put on the maps and computed (paragraph 2 of chapter I of report) amount to:—

	ACS.
Nilambur range	2,573
Amarampalam range	34,094
Total	36,667

The "yield" from this area is given in paragraph 5 of chapter II of the report as 171,474 tons but there are arithmetical errors and the correct figure is 172,904 tons. By "yield" is here meant the exploitable stock which could at once be removed from this area after leaving 25 per cent. of the culms standing on the ground. Therefore the total stock on the ground would be 230,669 tons.

11. This estimate is based on most conservative data which I have carefully examined and as examples of the extreme caution with which Mr. Bourne has dealt with the subject I append the following remarks:—

(1) In Pokote and Kanakuth Mr. Pearson—a specialist in bamboos who came down from the Dehra Dun College—calculated the "yield" from sample areas at 9.9 tons per acre after leaving 25 per cent. standing. On the same conditions Mr. Bourne adopts 8.4 tons. This affects 1,506 acres.

(2) In weighing a sample culm for computation of yield in new Amarampalam and Nelliutha Mr. Bourne took a one year old culm, whereas the average size of, say, four or five years would be much heavier. Even so, he has allowed for a draage of 50 per cent. of the green weight. But Mr. Pearson's experiments showed draage to be 72/110 and at this rate the number of culms to 1 dry ton would work out at 154.

Mr. Bourne has adopted 20. This affects the calculations for over 17,000 acres.

(3) For the same area he has adopted 11.85 culms to the clump following the average of an actual enumeration of a sample area. But this area was in a portion of forest lately fully out over for bamboos required for floating timber; whereas he tells me that only about 2,000 acres has been so worked, and he estimates that the number of culms per clump for the remaining 15,000 acres would be about 20.

Nos. (2) and (3) of the above reservations affect the estimate of stock enormously.

12. In paragraph 5 of chapter II of the report Mr. Bourne proposes also to reduce the exploitable area containing bamboos (paragraph 2 of chapter I) by one-half as several blocks have not been inspected. But on next page, he gives the name of the areas which were inspected, "shown on maps and computed," and these amount to over 15,000 acres out of the total of 32,669 acres, and consequently I have not adopted the reduction he suggests. This is of course a very important correction of mine affecting half the stock but I think it is fully justified.

13. There is, however, another factor not taken into consideration in Mr. Bourne's report which tends again to enormously increase the probable stock and output. The standing stock has been taken at about 230,669 tons. Of this only 90,000 tons will be removed in the five years 1915-1916 to 1920-1921. In that time the balance of 140,669 tons will be increasing at the rate of over 100 per cent. per four years. It is not worth while working out what all this will amount to, when it is obviously many times that of present requirements and I propose to leave the subject of stock and yield at this point and pass on to the cost of extraction and delivery at factory.

14. In computing cost of delivery at factory there are two important considerations which affect expenditure and require explanation. At present bamboos are felled at about 16 feet from the ground. This is done to avoid the clearance of what is known as the "palisade" size, the dense thorny ring of branches often 5 to 5 feet thick which surrounds the lower portion of the clump and prevent access of the culms. But of course this manner of felling entails considerable loss of material as the lower is the thickest and heaviest part of the culm. The removal of the palisade is a disagreeable and costly work and adds to the cost of the first working. If the second fellings occur within three to five years the palisade has not time to form again and the difference in cost of the two fellings on this account amounts to from Rs. 4 to Rs. 6 per 100 bamboos according as the daily wage is 6 annas or 8 annas per cooly. The other consideration is the fact that it costs just twice as much to draft down green as dry bamboos. Owing to the difference in weight only half the number can be tied together in one rail—otherwise they strand in the comparatively shallow waterways available. Rafting is also the most expensive item in the cost of delivery and when the difference in cost between green and dry varies some 50 per cent. from Rs. 10 to Rs. 5 per ton it is obvious that only dry bamboos months draage is sufficient can be dealt with—see page 9 of Mr. Bourne's report. The cost of rafting varies also with the amount of water in the channels, so that different rates have been laid down for the dry and wet seasons of the year.

15. There are some arithmetical errors in the figures for the total cost of delivery at factory in Mysore given in paragraph 5 of chapter I of the report. After correction the following table shows the cost for 1 ton dry culm for delivery at Mysore from different blocks of reserves, for the first and second workings and for the dry and wet seasons:—

Total cost of felling, dragging and floating one ton dry culm to Mysore.

Locality and range.	First working.		Second and subsequent working.	
	December to May	June to November	December to May	June to November
1 Nilambur range, Amarampalam range	Rs. 4 7 7 5 2	Rs. 4 7 5 9 1	Rs. 4 7 5 14 7	Rs. 4 7 4 3 5
2 Kankas and Marial reserves	11 11 7	14 9 11	10 1 6	6 16 8
3 New Amarampalam, Nelliutha and Kanakuth reserves	9 13 2	6 13 5	8 11 4	5 14 7

The standing stock (paragraph 9 supra) on these areas amounts to the following:—

	TONS
On No. 1	29,545
On " 2	6,912
On " 3	200,669
Total	337,126

As it is possible that at some future time the whole area may come under full working and also because it is all within easy reach of the head-quarters of the division and thus capable of being effectively superintended, I should propose that all the areas to be worked in proportion to their capacity. That is to say that the 10,000 tons to be supplied in the first year should come from the three areas in the proportion of 1,000, 500 and 8,500 tons respectively, and double these amounts in each of the next four years.

16. As was the case with the estimation of the yield, the cost of working has been kept well or too much on the safe side. For instance the cost of felling, which is adopted at from Rs. 2.25-3 to Rs. 15-18.5 per 100 bamboos according as the wages are 6 annas or 8 annas per cooly was computed on the actual cost of cutting

two huge clumps containing 110 and 195 amins each (see Appendix V of the report). But the average clump contains only about 16 amins and the cost of cutting must be very much cheaper in small clumps. My how much it is impossible to say as at present the falling is 15 feet from ground and we have no previous experience of cutting at ground-level.

17. Again the cost of carting is quoted at 4 annas per cart per mile. Dragging with buffaloes would be easier and cheaper and could be done for less than 3 annas per mile for the same quantity. This would reduce the cost of extraction from areas Nos. 2 and 3 (paragraph 15) by about 4 annas per ton. But the drafting is the most expensive item and how far the estimates may be reduced I am unable to say.

18. Generally Mr. Bourne's rates in paragraph 15 *supra*, may be compared with those submitted by Mr. Fowler for supply from Kannoth forests. His lengths of culms are shorter, and probably fifty bamboos represent one dry ton. At this rate his figures for delivery at Bepore work out to Rs. 4 per ton only. (I think this is probably an under-estimate and it is calculated for floating during monsoon only.) It is very difficult to strike a balance, but I believe that Rs. 1 per ton can safely be deducted from the corrected rates in paragraph 8 for supply from No. 2 area, 12 annas per ton from No. 3 and 8 annas per ton from No. 1.

19. Adopting this margin for over-estimation and allowing for the raising of three-fourths of the annual supply during the monsoon months, the following statement shows the total cost of supply of 10,000 tons at Bepore factory in the first year—

Locality	Supply in tons	Rate	Total charges
M	750	8 4 2	6,000 12 6
N	250	6 11 2	1,650 2 6
M	275	7 4 12	2,047 6 0
N	325	10 11 7	3,265 7 11 11
N	9,775	5 1 2	49,314 7 3
N	1,125	7 6 2	7,912 5 2
Total	10,000		67,931 4 2

M = Monsoon period. N = Dry season.

20. The above estimate of charges depends on our being free to work the whole area. If however there is any force in the objection raised in paragraph 9 of Mr. Bourne's report on account of joint rights, then the only area workable is No. 3. It can supply the whole requirement for the first five years, if necessary. But this is a matter I am not able to decide.

21. There remain the questions of establishment, the housing of labour and staff, and drying sheds. For a scheme of this size with an output of practically 20,000

* 20,000 tons = about 500,000 bamboos or 3 bamboos per acre per diem = 166,556 poles per annum.

At 312 working days per annum about 530 poles per diem.

of buildings and other contingencies, these remarks have already run to such length that details may be omitted, but it is computed that 5 per cent. on the estimated charges for the five years of the contract will cover expenses.

22. At this rate the total estimate of charges for the supply of 10,000 tons in the first year will be—

Delivery of bamboo, 10,000 tons	67,931 4 2
Permanent establishment	3,200 0 0
Contingencies at 5 per cent. of above	3,381 2 2
Total	74,512 6 4

In the second to fifth years, the annual charges will be—

Delivery of bamboo, 20,000 tons	Rs.	As.	P.
Permanent establishment*	3,500	0	0
Contingencies at 5 per cent. of above	6,943	2	3
Total	114,806	2	3

* This may have to be increased but if it is the allowance for contingencies will meet it.

I believe, however, that the actual expenditure will fall within these amounts.

23. In conclusion some remarks are necessary on the general conditions of the proposed contract. It is evident that for supply on this scale the forest area in working will have to be converted and treated for special bamboo production and its possibilities for other purposes will be deliberately sacrificed. Now if, in addition, we are granting all the concessions asked for in Mr. Eodge's letter to the Board, N.O.C. No. 42 of 14-3, dated 8th January 1914 (including the supply to the firm for five years at cost price), the negotiations with the firm should safeguard Government by having this forest thrown back on its hands after that period in a condition which will be useless for any other purpose. This may happen through Messrs. Nelson & Sons making other arrangements by plantation, lease or purchase from neighbouring private owners of which there is some talk in their letters.

24. There is not a doubt, exemplified by the case of past reckless timber exploitation in the same areas, that when the factory is established the neighbouring land-owners will come forward with offers below our own rates and it will be difficult to prevent the firm from taking advantage of them. Consequently we shall be in a difficult position with this private competition facing us, in coming to terms about the rates to follow the first five-year period of supply at cost price, if Messrs. Nelson & Sons are left with a free hand in the matter. Whatever terms are made it is advisable that they should provide as far as possible for the absorption of the full yield which our organisation is able to supply or if that is too much, for a preference over other sources of supply.

Reference—*Supra*: No. 63,14-3, dated 9th June 1914.

Submitted to Government in continuation of Board's Reference No. 86/14-1, dated 20th January 1914, recorded in G.O. Misc No. 424, dated 10th February 1914.

2. Mr. Nelson of Messrs. Nelson & Co., Edinburgh, applied *inter alia* for the following concessions in connection with his proposed bamboo-pulp factory:

(i) that Government should sell to the company at a low price or grant free for five years and then rent, about 4,000 acres of land suitable for bamboo growth;

(ii) that Government should grant a factory site with necessary water-rights free of charge, or if the company acquired a factory site Government should grant the necessary water-rights; and

(iii) that Government should deliver at a low price 10,000 tons of good dry bamboo in the first year and 20,000 tons annually thereafter until the company's plantations were in bearing.

3. These (i)-(iii) items, Board's report and Mr. McCarthy's letter deal only with item (ii).

The total area suitable for exploitation of bamboo in the next ten years in the Nilgiris and Anamalai ranges is estimated at 22,659 acres of reserved and leased forests. The stock of the ground is estimated at 236,600 tons. Allowing for 25 per cent. of the culms in each clump remaining on the ground, Mr. Bourne states that there is sufficient bamboo to meet the stipulated demand of Messrs. Nelson & Co. for five years. The stock, Mr. McCarthy thinks, has been under-estimated, he however, advocates the removal of only 50 per cent. of the culms. The Board understands that it is not advisable to remove more than 50 per cent. of the culms in each clump, as this or otherwise the clumps will be so weakened that the next monsoon will cause much devastation. Even at this rate the stock on the ground is, in the Board's opinion, ample to meet the demand of Messrs. Nelson & Co. as they want only five years' supply of 20,000 tons in all.

Next as to the question of cost of supply Mr. McCarthy gives the following estimate of total charges to be incurred in the supply of the required quantity of bamboos at Bepore:—

Year.	Quantity to be supplied in tons. per annum.	Charges for delivery including establishment and contingencies. Rs. per annum.
First year	10,000	74,798
Second to fifth year	20,000	1,45,866

The Board generally accepts the figures which work out to about Rs. 7-6-0 per ton.

4. The Board is anxious that every encouragement should be given to the industry and that it should be done as speedily as possible, and accordingly suggests that Government should communicate the above figures to Messrs. Nelson & Co., by cable and ascertain what they have to say.

5. With reference to paragraph 23 of Mr. McCarthy's report suggesting that a condition should be inserted to the effect that Messrs. Nelson & Co., should continue to take bamboo from Government after the expiry of the first five years, the Board observes that the idea of the company is to have their own bamboo plantation. Five years' felling in Government forests will, in the Board's opinion, do good by increasing the percentage of timber-yielding trees at present, there are too many bamboos—and this the Board considers should be one object of the fellings.

W. G. MCFARLAND,
Secretary.

To the Secretary, Government, Revenue Department, with two copies.

ENCLOSURE

PRELIMINARY REPORT ON THE POSSIBILITY OF WORKING THE NATURAL FORESTS OF SOUTH MALABAR FOR BAMBOOS.

CHAPTER I.—GENERAL DESCRIPTION.

1. *General description.*—As this report is a result of Mr. Pearson's note on the utilization of bamboo for the manufacture of paper-pulp, it is necessary to note at the commencement certain relevant facts.

Mr. Pearson's stay in the district was unfortunately limited to three days, on one of which he saw the old bush plantations in Edacode, on the second of which he laid out two bamboo sample acres, one in Kanakuth, and the other in Pokote, and on the third of which he went to Nodargayam and back.

His visit was made in February 1910. In his report he has taken 3,060 acres in Nilambur range as the area of fully stocked bamboo forest and based his calculations on the yield for this area on the statistics obtained from the sample acres in Kanakuth and Pokote. In compiling this area from the areas given in the Nilambur total plantation working plan may be overlooked the fact that some of these natural forest areas contain no bamboo at all, while others are by no means fully stocked. In the last three years since Mr. Pearson's visit some of these areas have flowered. Further in his report he has shown 3,800 acres of private forests calculated at a reduced yield. No bamboo will be available from the private forests in the Nilambur valley, as every available area is cut over every year for bamboos to feed the timber of private owners. These forests have been so denuded of bamboos that increasing numbers of applications for the grant of bamboos from Government forests are received every year, and it is a very significant fact that the rubber plantations on the edges of the valley, situated at a considerable distance from the centre of the timber operations, have been able this year for the first time to sell their bamboos to timber contractors. Reports they have had to have recourse to fire to get rid of them.

Mr. Pearson in his report has taken Rs. 6 as the cost of cutting 100 bamboos, about double the present rate to allow for the increased cost of cutting the culms at the base, but was unable to give any actual statistics of the cost of felling. Lastly the size of the bamboo culms in the forests near the ghats are of considerably greater dimensions than those of Kanakuth and Pokote.

A few statistics on these points have been collected and a conservative estimate of the yield and cost of extraction from the Government forests made.

2. *Distribution and area.*

Name of natural forest.	Whether reserved or leased forest.	Area in acres.	Total
<i>Nilambur Range.</i>			
Valachappally and Edacode	Leased forest	3,060	
Pokote	Do.	866	
Kanakuth	Do.	698	
Chatambora	Leased forest and reserved	140	
Panayangode	Leased forest	282	
Valluvacheri	Do.	204	
Kranthadap	Do.	581	
			5,472
<i>Amarampalam Range.</i>			
New Amarampalam	Reserved forest	94,000	
Nellikuttam	Leased forest and reserved	1,661	
Karunappya	Reserved forest	1,780	
Karim	Leased forest	860	
Murta	Do.	1,766	
			104,119
			107,641

Of these blocks Valachappally and Edacode, Pokote, Kanakuth, Chatambora, Panayangode, Valluvacheri, New Amarampalam and Nellikuttam have actually been inspected by Mr. Nelson and myself with a view to noting the distribution of bamboo.

The exploitable approximate area at present under bamboo was put on the maps and computed.

Approximate area exploitable in the next ten years

Serial number.	Name of block.	Reserved or leased forest.	Area under bamboo in acres.	Defect for area in acres.	Net area.	Total.
<i>Nilambur Range.</i>						
1	Valachappally and Edacode	Leased forest	320		320	
2	Pokote	Do.	508		508	
3	Kanakuth	Do.	668		668	
4	Panayangode	Do.	298		282	
5	Valluvacheri	Do.	204		204	
6	Kranthadap	Do.	453		581	
						1,573
<i>Amarampalam Range.</i>						
7	New Amarampalam	Reserved forest	14,880	880	14,000	
8	Nellikuttam	Leased forest and reserved	1,661		1,681	
9	Karunappya	Reserved forest	1,780	80	1,700	
10	Karim	Leased forest	860		950	
11	Murta	Do.	1,766		1,766	
						22,096
						23,669

3. *Legal position.*—In serial numbers 1 to 6, 8, 10 and 11, being leased forests, Government have by their agreements to pay kuttikanam (concessions or stamp fee) on all bamboos extracted from these forests according to the custom of the country in vogue at any time. The custom now hitherto amounts to payment of 50 per cent. of the net profits realized. It is shown in paragraph 8 of this chapter that the cost of extraction will be higher than estimated by Mr. Pearson, and if Government agree to work the bamboos and supply a paper-pulp mill at a set price per ton, the forest jinnis will complain. It is shown, however, in chapter I, paragraph 6, that the scientific felling proposal is likely to maintain or even increase the yield in the second rotation.

4. *Composition and condition.*—All these natural forests contain bamboo, though the density, age and dimensions of growth vary to a considerable extent in different localities.

The principal species occurring naturally throughout the area is *Bambusa arundinacea*. This species flowers generally irregularly in any locality, though it may flower sporadically in some places. It has been reported to have flowered irregularly in 1804, 1806 and 1846 (Brandis's *Forest Trees*, page 671). In 1883 (Nilambur Plantations Working Plan, page 43) and from a more recent inspection in Edacode in 1910, in Chatambora in 1911 and 1912, in New Amarampalam, Nellikuttam and Karunappya in 1912, 1913 and 1914. In Kanakuth, Pokote and in a small area only at Edacode and

partly in Nilgahappilly which will be called for the purpose of this report. Valsahappilly and Edacode bamboo may be considered to be fully stocked throughout the areas given. A few specimens of *Isotriaena* and *Dactyloctenium* are found forced up with long clean culms by the bamboo growth. In the New Amarampalam reserve the bamboo occurs less densely on the average, some areas being pure bamboo, which has killed out everything else, in others timber predominates, though almost throughout bamboo clumps are found.

In Nilgahappilly the bamboo is on an average still less dense than in New Amarampalam, though the northwest quarter of the reserve is more fully stocked or at least denser than any other forests in the division. Karumpoyas reserve, Karim, Murit, Brambadau, Vallavaheri and Panayangode, though not now specially inspected for the distribution of bamboo, contain considerable quantities. While not being so fully stocked as Kanakuth, etc., the bamboo in these areas is as dense and in some cases much denser than the average density of stocking in Nilgahappilly reserve.

In Edacode, the oldest of the flowering areas, an enumeration was made (see appendix II) to ascertain the minimum stocking of bamboo when it shall come into bearing. The size of the culms varies principally between the forests in the Amarampalam range (nearest the ghats) and those in Nilambur range.

The culms of New Amarampalam, Nilgahappilly and Karumpoyas are classed together, while the culms from all the other areas may be considered to be on the average, the same as the culms in Pokote and Kanakuth, dimensions of which were taken by Mr. Pearson.

The method of felling bamboos in the past must be mentioned. It has been the custom to cut our bamboos some 12-18% above the ground for two reasons (1) to avoid the thorny palisade and so to obtain clearness in extraction, and (2) it was found by experiment that the bamboos cut at the base though sufficiently buoyant to float by themselves, were insufficiently buoyant to float the teak saplings, which from the conditions of the market it was necessary to float green.

The result is to depress the palisade in most cases the centre of the clump becoming so dense as to prevent any new culms being sent up except on the edges of the clump. This must affect the reproductive power of the clump from the root stock. It is noted in the Nilambur Teak Plantation Working Plan, page 42, that as a result of the flowering of many bamboos in 1861 from 1858 onwards a number of the giant bamboo of Burma, *Cephalostachyum pergracile*, were introduced along the banks of the river. No record is forthcoming as to how they were introduced but probably from seed. In 1895 Mr. P. M. Lushington reported that they had formed splendid clumps though the culms were of no great size. In 1904 the same officer reported that the clumps were decidedly disappointing and that the actual culms were still very small and appeared to be brittle. There is some doubt as to the identity of this species, the real bamboo of Burma is *Dendrocalamus giganteus*. *Cephalostachyum pergracile* as will be seen from appendix IV, grows no bigger in its natural habitat than it has here. Further this bamboo has a dense covering of stiff black hairs on the internodes which I find very irritating and so in the culms. It probably is *Cephalostachyum pergracile*, examined the giant bamboo of Burma and in that case it grows even better here than in Burma. The only doubt remaining is that *Cephalostachyum pergracile* is said to have dense rigid green spinescent branches from the lowest nodes, while the specimens here are practically clean. This bamboo has very succulent leaves and as the culms can be easily broken by elephants, all the culms in these areas in which Government elephants are put out to graze have been completely browsed down. The possibility of introducing this bamboo on a plantation scale is dealt with in chapter IV.

5. *Form factors, including coefficients, etc., used in the calculation of the yield.*—These have been worked out in detail in appendices I and II. In chapter II the yield in the form of measurement is adopted, allowing to leave about 25 per cent. of the culms per clump standing.

1. Yield from Kanakuth, Pokote and Valsahappilly and Edacode—

262 culms per acre.

8.4 tons per acre dry.

2. Yield from New Amarampalam reserve—

Green culms alone—

174 culms per acre.

9 tons per acre dry.

Fully stocked—

226 culms per acre.

14.75 tons per acre dry.

3. Yield from Nilgahappilly and Karumpoyas reserves—

Green culms alone—

146 culms per acre.

Fully stocked—

7.25 tons per acre dry.

126 culms per acre.

9.85 tons per acre dry.

4. Yield from Karim, Murit, Brambadau, Vallavaheri and Panayangode—

81 culms per acre.

2.9 tons per acre.

N.B.—These figures are calculated on the density of green culms in Nilgahappilly, i.e., 126 culms per acre and the average number of culms per clump to be left and the diameter of the average culm from Mr. Pearson's figures in Pokote and Kanakuth.

(b) Return yield from Edacode, Valsahappilly and Chintambora—

119 culms per acre.

3.8 tons per acre.

(c) Of the bamboos from New Amarampalam, Nilgahappilly and Karumpoyas reserves—

20 dry culms will yield 1 ton.

(7) Of the bamboos from Pokote, Kanakuth, etc.—

31 dry culms will yield 1 ton.

6. *Rate of growth.*—See appendix III.

7. *Supply of labour.*—Owing to the rubber estates on the edges of the valley, which by the displacements they suffer, are to a large extent an ordinary supply, the better by the fact that a woman or child, who does more and more useful work, have attracted most of the labour, in addition to imported labour brought in by coolie contractors and owing to the general timber work labour is scarce. Government pay at present is Rs. 4 6 a day per coolie in Nilambur range and Rs. 5 a day in Amarampalam range.

The scientific felling of *Bambusa arundinacea* clumps at the base needs skilful labour and is tiring and distasteful to the coolies.

Consequently, to offer an inducement to labour, it is proposed to pay for felling *Bambusa arundinacea*—

	Daily per day
In Nilambur range—	5
In Amarampalam range—	6
For felling <i>Cephalostachyum pergracile</i> —	5
In Nilambur range—	5
In Amarampalam range—	6

These rates are allowed for calculating the rates of extraction in appendix V.

Coolie lines are proposed to be built in Amarampalam range, as without them it will be impossible to count on a copious supply of labour for the entire of the vast forested forests of that range.

It is also proposed that only cutting assistants would have to be employed in timber labour.

8. *Cost of extraction and transport to mill site.*—Rates—Figures have been worked out in detail in appendix V. It has there been shown that the floating charges of these big timber lines green is very high per 100 bamboos, though in the case of the biggest culms from Amarampalam range, of which 20 are equivalent to 1 ton, see paragraph 5 of this chapter, the cost per ton is proportionately reduced. It will be a simple matter to have a monthly supply floated and dragged and stored under shelter in river side depots, always on hand, so that the figures of floating the bamboo dry have been adopted. Long low temporary rafts could be created at river side depots for storing purposes.

Locality and range	Number of culms per acre											
	Cost of felling 100 bamboos				Cost of floating 100 bamboos from cutting place to				Obsolescence			
	Rotation		Reserve		December		June to November		December to May		June to November	
Nilambur	12	8	0	0	0	0	0	0	0	0	0	0
Amarampalam, Karim, and Murit	15	10	0	0	0	0	0	0	0	0	0	0
New Amarampalam, Nilgahappilly and Karumpoyas	10	10	0	0	0	0	0	0	0	0	0	0

Continued on page 156

Total cost of felling, carting and floating 100 bamboo.

To Chalisparam.				To Beyyore.			
I Rotation.		II Rotation.		I Rotation.		II Rotation.	
December to May.	June to November.	December to May.	June to November.	December to May.	June to November.	December to May.	June to November.
Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
22 3 0	47 5 1	18 3 10	13 6 5	28 4 7	17 15 3	19 4 39	32 15 11
26 12 0	26 6 2	1 3 4	37 15 2	37 15 2	37 15 12	36 8 9	54 4 6
87 3 0	83 8 3	19 4 2	50 15 7	65 12 2	54 3 2	55 8 9	78 14 7

Total cost of felling, carting and floating 1 ton dry cuttings.

To Chalisparam.				To Beyyore.			
I Rotation.		II Rotation.		I Rotation.		II Rotation.	
December to May.	June to November.	December to May.	June to November.	December to May.	June to November.	December to May.	June to November.
Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.	Rs. A. P.
8 14 0	5 3 5	5 19 0	4 3 3	7 2 2	5 9 1	1 14 7	4 15 5
11 7 0	8 27 0	9 12 0	6 9 0	11 11 7	8 9 11	16 1 4	6 15 8
9 0 0	5 10 0	8 7 4	5 9 5	20 22 8	6 18 4	9 11 4	8 13 7

The figures in these columns have been corrected after allowing for arithmetical errors. Others have not been corrected as only delivery at Beyyore is required—(Initialled—O.D.M.)

The improvement of the floating channels and the alignment and construction of main drag roads in those areas to be worked would reduce the cost of extraction considerably.

CHAPTER II.—PROPOSED OUTLINES OF WORKING.

1. *Objects of management.*—It is understood that the minimum supply in tons of dry bamboo which would be required to start a paper-pulp mill on financial lines would be approximately 10,000 tons in the first year and 20,000 tons every year thereafter, with the prospect always in view of being able after the first five years to extend up to twice or even more than twice that amount. To boom this new industry which the more financially it is successful, the bigger the markets it will introduce to the extensive bamboo forests of this country, it is essential to produce the raw material at the lowest cost per ton possible.

It is therefore the object of Government to ascertain the highest sustained annual yield in tons of dry bamboo per annum exploitable within an expenditure financially favourable to a private firm.

The indigenous bamboo having flowered during the last three years, the primary object to be ascertained is the possible yield in the next five years, it having been found on inspection that flowered culms after exposure to more than one monsoon are useless for paper-pulp manufacture.

2. *Method of treatment and future of felling.*—It is seen from appendix III that failure to leave standing the number of culms necessary to provide sufficient leaf-surface for the supply of assimilation-products to the root stock, results in the tardy recovery of the latter from the effects of the felling. In working on a large scale, for want of adequate supervision, it would be impossible to leave standing any fixed proportion of the numbers of the culms in the clump. So it is proposed to leave some number of culms, say 2-3 per clump, according to its size and that they should be one year old culms in any case in which there were not three one year old culms; that a sufficient number of old culms should be retained to bring the total in every case to three or more. The culms should be felled within one foot of the ground. 3. *Bamboo for departmental timber floating operations* should be felled on the same principles as soon as definite information is received that the mill will be started. The bottom ends of the cut off and stored under cover and will augment the supply in the first year of working. It is believed that if these bamboos are processed from the cut they can be kept for several seasons and still be fit for paper-pulping.

It has been shown in Appendix I that after the first felling the thorny palms are considerably reduced and no longer form such a formidable obstacle in attacking a clump.

3. *Rotation.*—It has been shown in Appendix III that it would not be at present safe to fell over bamboo areas on less than a five-year rotation. It may be possible subsequently to reduce the rotation to four years.

A rotation of five years is adopted for the first cycle.

4. *Division of the working circle into annual coupes.*—It is not within the scope of this report to detail the annual coupes. A much more detailed enumeration of the density of bamboo in each block is necessary before areas in any block can be apportioned to the annual coupes with the object of maintaining a uniformity in distribution in the different ranges, in the fully stocked and only partly stocked areas, in the more and least accessible areas, etc.

5. *Determination of the yield.*—Determination of the total yield available in the Government forests 1914-15.

Block.	Name of block.	Bamboo area in acres.	Number of culms to be left per acre.	Number of culms to be cut per acre.	Yield of culms in tons per acre.	Total yield dry culms in tons.	Total yield dry culms and standing culms in tons.
Mishnagar.	Yallichappalli	620				2772	
	Palkote	608	37	2208	84	5750	
	Kalyankottai	608				2611	
	Kanayangudi	282				785	
	Brankhalan	581				288	
Aharanpalam.	New Aharanpalam	14,000	All culms to be cut	346	9	126,000	126,000
	Kalyankottai	1,561	20 per cent	142	1	2,322	12,976
	Kanayankottai	1,560	20 per cent	142	7.20	12,197	13,757
	Karim	900	of 1917			2,790	
	Mishnagar	1,053			3 2/3	4,500	
						Total	171,478

In this preliminary estimate, as some of the areas are of such an enormous extent and as several blocks have not been inspected especially to ascertain the stocking of bamboo, it is safest to assume that one-half of such areas contain no bamboo at all. In the fully stocked areas of Kanakul, Palkote and Yallichappalli and Missoode it is known that the whole area is stocked with bamboo, so that in these cases the full area may be retained.

The yield revised as above is—

Range.	Name of block.	Bamboo area in acres.	Number of culms to be left per acre.	Number of culms to be cut per acre.	Yield in tons per acre.	Total yield (1917) in tons.	Yield of dry culms and standing culms in tons.
Mishnagar.	Yallichappalli	620				2,772	
	Palkote	608	37	2,208	84	5,750	
	Kalyankottai	608				2,611	
	Kanayangudi	282				785	
	Brankhalan	581				288	
Aharanpalam.	New Aharanpalam	14,000	All culms to be cut	346	9	126,000	126,000
	Kalyankottai	1,561	20 per cent	142	1	2,322	12,976
	Kanayankottai	1,560	20 per cent	142	7.20	12,197	13,757
	Karim	900	of 1917			2,790	
	Mishnagar	1,053			3 2/3	4,500	
						Total	171,478

This yield of 26,272 tons, equivalent to more than 2,060,000 bamboos has to be realized in five years, 10,000 tons in the first year and 2,000 tons in each of the four years thereafter. To obtain uniformity of distribution the areas are grouped together according to their yield in tons per acre. One-ninth of the area of each such group is felled in the first year of working and two-ninths in each of the four years thereafter. It is calculated that the first year

of felling would be in 1915-16. No allowance is made for the new culms likely to be put on in the monsoon of 1914 and 1915, for it is assumed that the purpose of silviculture is to maintain the annual increment in each of these years would be out of the departmental felling operations.

Name of blocks in group.	Area of group in acres.	Quantity of culms of groups to be felled in 1914.	Total yield in new dry culms in 1914.	Equivalent in number of culms.	Two-thirds of area of group to be felled in each year 1914, 1915, etc.	Total yield in new dry culms in each year 1914, 1915, etc.	Equivalent in number of culms.	Yield in new dry culms in each year 1914-1926.	Equivalent in number of culms.
Yalachappali and Edavada Poldas	2,506	157	453	13,434	534	1,806	54,986		
Kanakuth									
Panayappode									
Vellavacher	1,891	219	544	16,928	410	1,792	53,852		
Erambadam									
Kariem									
Mariat	7,000	779	7,003	140,010	1,650	14,014	280,080		
New Amarasappalam									
Nelluitta	1,500-5	185	1,549	37,764	376	3,716	11,520		
Karumpoya									
Total	13,087.4	1,843	10,314	217,718	2,480	20,618	450,438	93,826	2,949,671

For the calculation of the yield in the second rotation it can be shown, on the assumption that in one year's growth, one culm is put on for every four standing culms at the commencement of the growth, that after five years growth from the date of felling a culm will contain exactly the same number of culms as in the year of felling, so that from the same area exactly the same yield is expected. Hence, thousands of culms however will be required and the balance will be obtained at the end of the second rotation from those areas which flowered in 1911 and have been enumerated: see appendix III.

Additional yield expected at the end of the second rotation.

Locality.	Bamboo culms in stock.	Number of culms to be felled per acre.	Yield of dry culms in tons per acre.	Total yield in tons.
Nitambar block	2,700	119	4.5	10,395
Chalombolam	140			

For the calculation of the yield in the third rotation, all the areas which have flowered may be considered to be again fully stocked, see previous chapter, paragraph 16, and Appendix II, enumeration of flowered clumps.

Yield in the third rotation.

Group.	Name of block.	Bamboo culms in stock.	Number of culms to be felled per acre.	Yield in dry culms in tons per acre.	Total yield in tons.	Total yield dry culms and culms in stock.
Nitambar.	Yalachappali and Edavada Poldas	540	200	6.4	3,516	4,056
	Kanakuth	980			5,311	5,311
	Panayappode	141			620.5	620.5
	Vellavacher	1,100	43	1.9	363	1,463
	Erambadam	200-9			731.3	731.3
	Chalombolam	2,790	119	4.5	10,350	13,140
New Amarasappalam.	Nelluitta	1,500	201	14.32	10,450	11,950
	Karumpoya	650	188	7.2	4,714.5	5,364.5
	Kariem	475			2,200	2,200
	Mariat	3,000-3	31	1.3	1,304.5	3,304.5
	Total	46,952.4			147,048.5	194,000.5

or approximately 36,000 tons dry per annum.

Owing to the apparent steady advance of the region of flowering across the valley from west to east in 1911, and to the fact that the only localities flowering in 1914 are on the extreme eastern boundary, it is hoped that no further flowering will occur after this year, so that the above figures of yield may not be affected.

6. Estimate for working approximately 10,000 tons of dry bamboo in 1915-16.—Bamboo operations.—

(1) Nitambar Range.

ESTIMATE for felling, dragging, cutting, rafting and storing bamboos at Beypore or Chalapparam in 1915-16.

Item number.	Particulars.	Quantity.	Rate.	Per.	Amount.	Remarks.
1	Felling bamboos	60,000	12 1/2	Rs.	7,500 0 0	
2	Dragging and sorting bamboos to the rafting place.	13 0 0	Rs.	100	1,300 0 0	
3	Cost of rafting bamboos to the Beypore.	1 0 0	Rs.	1,500	1,500 0 0	
4	Cost of rafting bamboos to Beypore.	0 0 0	Rs.	1,750	1,750 0 0	
5	Major's wages	42 mths.	4 0 0	Rs.	168 0 0	
6	Transporting boats with consignments	5	35 0 0	Rs.	175 0 0	
7	Transport of old culms from Beypore to Chalapparam to Nilambur including weighing and storing in the Nilambur Range office.	7 mths.	4 8 0	Rs.	336 0 0	Two-thirds of the original culms are available.
	Additional estimates such as security for the movement of heavy loads, transporting boat, rafting and other incidental works.			Rs.	114 0 0	
	Minor value of old culms to be used second time.	7 mths.	50 0 0	Rs.	350 0 0	
	Total to Beypore			Rs.	13,000 0 0	
	Total to Chalapparam			Rs.	13,114 0 0	

Estimated minimum number of coolies required 96,000.

(2) Amarasappalam Range.

ESTIMATE for felling, dragging, cutting, rafting and storing bamboos at Beypore or Chalapparam in 1915-16.

Item number.	Particulars.	Quantity.	Rate.	Per.	Amount.	Remarks.
1	Felling bamboos Kariem, Mariat, New Amarasappalam, etc.	770,000	15 0 0	Rs.	11,550 0 0	
2	Dragging and sorting bamboos to the rafting place. Kariem, Mariat.	13,200	4 0 0	Rs.	528 0 0	
3	New Amarasappalam, etc.	195,000	3 4 0	Rs.	6,750 0 0	
4	Cost of rafting bamboos to Chalapparam, Kariem, Mariat.	72,000	7 5 0	Rs.	5,400 0 0	
5	New Amarasappalam, etc.	11,155 0 0	20 1 0	Rs.	224,225 0 0	Two-thirds of the bamboo only can be used second time.
6	Cost of rafting bamboos to Beypore, Kariem, Mariat.	50,000	3 5 0	Rs.	1,750 0 0	
7	New Amarasappalam, etc.	112,000	15 0 0	Rs.	1,680 0 0	
8	Major's wages	2,282 mths.	20 1 0	Rs.	45,888 0 0	
9	Transporting boats with consignments	25	6 0 0	Rs.	150 0 0	
10	Transport of old culms from Beypore or Chalapparam to Nilambur including weighing in the Nilambur Range office and sorting consignment to Beypore or Nilambur.	25 mths.	1 0 0	Rs.	250 0 0	
	Additional estimates such as security for the movement of heavy loads, transport of old culms and other incidental works.			Rs.	230 0 0	
	Minor value of old culms to be used second time.	20 0 0	20 0 0	Rs.	4,000 0 0	
	Total to Beypore			Rs.	94,000 0 0	
	Total to Chalapparam			Rs.	23,114 0 0	

Estimated minimum number of coolies required 96,000.

CHAPTER III.—PROPOSALS FOR LEASING OR ACQUIRING PRIVATE BAMBOO CLUMPS.

It was stated in chapter I that no bamboo would be available from private forests in the valley and this must be accepted as a fact, for every bamboo is required for floating timber. Even when all the valuable timber has been removed the bamboo could be sold in the market, for as a compensation Government would be removing some 55,000 bamboos from the market every year being about the number necessary for floating the teak and which would be delivered to the paper-pulp mill. However the foot hills of the Kuddahs, the silent and Attapady Valleys in Malenadu range are densely stocked with bamboo. It has been shown that Government can from their forests in the valley maintain the sustained annual yield

Not printed.

necessary for the demand, but in the event of unforeseen circumstances it may be advisable to have additional areas on lease under working. The map shows two densely stocked areas A and B, the differences in the two areas being that while extraction from the former has to be by the Palkon River, a tributary of the Kadalandi River, connected near its mouth by a navigable backwater with Beypore, extraction from the latter lies to the Kundipath and the Poushi River and thence by sea to Beypore. The cost of extraction from the latter must necessarily be high.

Area A is partly registered in the name of the Kuthiravathal Nayar, partly as Government poramboke.

Area B is partly registered in the name of the Kuthiravathal Nayar, and partly in the name of M. R. By. Palat Ramam Menon, though there are in both cases several additional claimants, but it would be the safest policy to acquire the land. These foot hills are death traps in the monsoon so that they must be worked from August-May and the stored bamboo floated on the floods.

Assuming that the areas are as densely stocked with bamboo as Kanakush, etc., to maintain a sustained annual yield of 10,000 tons an area of 6,000 acres would be required. The cost of extraction is estimated for area A as follows, the labour charges in Nilambur range being adopted; and allowance only made for floating dry bamboo on the floods.

Name and locality	Cost of felling 100 bamboos		Dragging and carting 100 bamboos over one mile at 10 rials per cart and 4 rials per mile.	No. of bamboos per raft.	Cost of outlogs required at 1 rial per piece.	Cost of tying one raft at 10 rials.
	Rotation	II Rotation				
Manjeriattara	12 4 7	24 4 3	50 4 0	100	10 0 0	10 0 0
Area A	12 4 7	24 4 3	50 4 0	100	10 0 0	10 0 0

Total cost of felling, dragging, carting and rafting to Beypore.

Average distance from felling place to Beypore in miles	Cost of floating 100 bamboos to Beypore.	Total cost of tying and floating 100 bamboos to Beypore.	100 bamboos			
			Rotation I	II Rotation	III Rotation	IV Rotation
10	10 0 0	60 4 0	10 0 0	10 0 0	10 0 0	10 0 0

The calculated cost of extraction to Ponnant is 2 annas less per 100 bamboos in both the I and II rotations and 4 annas less per ton dry cuttings.

The bamboo would then have to be shipped 30 miles up the coast to Beypore.

CHAPTER IV.—SPECIAL OUTLINES FOR THE FORESTATION OF BAMBOO PLANTATIONS WITH

Ophioclystis Pergracilis.

It has been shown in appendix IV that enormous possibilities lie before a plantation of *Ophioclystis Pergracilis*. Grown from seed in 1888 it had formed splendid clumps by 1891, so that if seed were obtained from Burma and sown over a suitable site, presumably moist as it prefers river banks, within 5 or 6 years it could be brought under working. It is understood that a large number of seedlings, raised by ploughing in lines to a depth about 10" and sowing by the broadcast method, and just covering them with earth. Each node produces a full grown culm in the first year's growth and from this a yield of 50 tons per acre is produced. There seems no reason why this bamboo should not do the same.

The clumps lie in the formation of at least 30 underground culms can be found containing on an average 100 to 150 culms of average length 4' and average number of nodes per culm 25. Last end is end 10' apart, 100 per acre would be needed. From the 30 clumps, 7,200 culms would be available. This would plant up at least 70 acres. If 50 per cent. of these culms alone produced one full-sized culm in one year's growth, 37,500 culms would be available which would plant up 855 acres. On the same assumptions the yield from this area in the second year's growth would plant up 10,500 acres.

Working could therefore commence after three years' growth.

2 Other works involved.—A plantation of this kind would, if situated in elephant country, need rigid protection in the form of a 6' x 6' trench all round the endangered circumference, with an elaborate system of pits. Such a trench in laterite work at the rate of Rs. 14-4-0 per 1,000 ft. would cost Rs. 2,708-10-3 a mile or allowing for 2,050 ft. of solid rock blasting Rs. 2,044-3-7 per mile. Some bamboo could be planted outside the trench amongst the pits as a bait for the wild elephants.

3 Cost of extraction.—It is shown in appendix V that the cost of extraction is extraordinarily low.

B. BOURKE,
District Forest Officer, South Malabar.

NILAMBUR.
23rd January 1914.

APPENDIX I.

(Fully stocked areas)

In appendix VI of Mr. Pearson's note he gives the statistics obtained from sample acres laid out in Kanakush and Pokote and from which he calculated his figures of yield on pages 101 and 102 of his note. They are reproduced here for easy reference.

SAMPLE PLOTS IN NILAMBUR RANGE TAKEN IN FEBRUARY 1910.

Locality	Area of plot in acres	Bamboo clumps per acre			Average size of culm in ft.	Length in ft. of culms in clump	Total weight in lbs. of culms in clump	Local weight in lbs. of culms in clump	Weight of dry culms in clump in lbs.	Weight of dry culms in clump per acre in lbs.
		Number of clumps	Number of culms in clump	Number of culms in clump						
Kanakush	1.00	100	250	10	10	100	100	100	25,544	
Pokote	1.00	121	110	10	10	100	100	100	21,511	
Average per acre	1.00	110	110	10	10	100	100	100	23,527	

These sample acres are taken by him as fully stocked bamboo areas. Unfortunately they were not demarcated and the exact position could not now be located.

A sample acre was laid out in an average area of Pokote as a check on Mr. Pearson's figures and only 60 culms were counted. It is thought advisable to reduce Mr. Pearson's figures to 60 culms per acre and the average per acre based on this figure works out at—

Average per acre	60	21	Average	60	10	100	100	100	21,700	16,375
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It is necessary to point out that Mr. Pearson in calculating the yield per acre of dry culms in pounds in his figure 25,544 lbs. above has, if his calculation is of the yield in the year of measurement, based his figure on clear felling. He has however shown that the proportion of new culms to old is as 1 is to 4 at 25 per cent. (page 106 of his note) so that his figure is the correct calculation of the yield in the year subsequent to measurement if 25 per cent. of the culms per clump are left standing. Further he has not taken into consideration the average number of stems per acre, but based the figure on the number of stems in 10 clumps alone. Under average per acre 25,544 lbs. should be 24,490 lbs. In the calculation based on the figures of 60 culms per acre, culms 10 represent the yield of dry culms per acre in pounds in the year of measurement. If 25 per cent. of the culms per clump are left standing, from the data shown 13,820 lbs. is the yield of dry bamboo, nodes and internodes, per acre in the year of measurement, if 25 per cent. of the culms in a clump are left standing (i.e. 24,490 lbs. per acre).

No. 2421, Reserve, 20th August 1914.

No. 2421, Reserve, 20th August 1914.

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LINEAR survey in *Nelumbita* reserve starting from the Punnappo's, a short distance south-west of Moochikal in an east to west straight line. Two chains broad.

APPENDIX III

(Partly stocked areas.)

LINEAR survey in *Neu* *Amorpha* reserve starting from the Punnappo's, a short distance south-west of the Korampoo sarathi in a north-west to south-east straight line. Two chains broad.

Parlange and acres	Number of plants	Number of established grass clumps	Number of flowered clumps of 1913.	Number of flowered clumps of 1914.	Number of flowered clumps of 1914.	Number of grass clumps per acre.	Total number of clumps per acre.
1 acre	1		7				
	2		9				
	3		7				
	4		8				
	5		16		9	1	25
	6		3				
	7	10					
	8	1					
	9	1				26	26
	10						
	11	9					
	12	6					
	13	7					
	14	3					
	15	2		1	1	26	28
	16	3					
	17	2					
	18	3					
	19	3					
	20						
	21	1					
	22						
	23						
	24	5		1		4	18
	25	3					
	26	4					
	27	2					
	28	4		1			
	29	3					
	30	3					27
	31	4					
	32	4					
	33	6		1			
	34	4					
	35	7		1	3	1	64
	36	1					
	37	2					6
	38						
	39						
	40					4	22
	41						
	42						
	43						
	44						
	45					24	18
	46						
	47						
	48						
	49						
	50						

Chains 41-46 were half a chain further west from station to station.

Parlange and acres	Number of plants	Number of established grass clumps	Number of flowered clumps of 1913.	Number of flowered clumps of 1914.	Number of flowered clumps of 1914.	Number of grass clumps per acre.	Total number of clumps per acre.
	1						
	2						
	3						
	4						
	5						72
	6						
	7						
	8						
	9						
	10						
	11						
	12						
	13						
	14						
	15						
	16						
	17						
	18						
	19						
	20						19
	21						
	22						
	23						
	24						
	25						11
	26						11
	27						
	28						
	29						
	30						
	31						
	32						
	33						
	34						
	35						
	36						
	37						
	38						
	39						
	40						
	41						
	42						
	43						
	44						
	45						
	46						
	47						
	48						
	49						
	50						
	51						
	52						
	53						
	54						
	55						
	56						
	57						
	58						
	59						
	60						
	61						
	62						
	63						
	64						
	65						
	66						
	67						
	68						
	69						
	70						

Chains 41-46 were half a chain further west from station to station.

Furlongs and acres.	Number of culms.	Number of established green clumps.	Number of lowered clumps of 1913.	Number of lowered clumps of 1914.	Number of flowers culms of 1913.	Number of flowers culms of 1914.	Total number of culms per acre.
16 acres	71	4	2	11	...	...	36
	72	4	2	11	...	...	36
	73	5	2	11	...	...	36
	74	5	2	11	...	...	36
	75	5	2	11	...	...	36
1 mile and 10 acres	76	7	2	11	...	...	30
	77	7	2	11	...	...	30
	78	7	2	11	...	...	30
	79	7	2	11	...	...	30
Average per acre	7	2	11	...	...	12.5	12.5

The continuation of this line to the reserve, boundary passes through very dense bamboo, so that this is a very conservative estimate.

In order to find the average number of culms per clump, an area which had been cut over for departmental bamboos in 1913 was investigated. Every culm in each clump was counted, in order to find the number of cuttable culms after the next monsoon. Every clump big and small was taken into consideration. New Amarampalam reserve; Korampoya beat

Number of clumps investigated	Number of culms per clump	Average number of culms per clump
1	10	
2	16	
3	3	
4	8	
5	4	
6	9	
7	16	
8	5	
9	12	
10	17	
11	7	
12	30	
13	13	
14	7	
15	22	
16	12	
17	17	11.85
18	20	
19	5	
20	18	
21	9	
22	9	
23	14	
24	16	
25	16	
26	5	
27	5	
28	8	
29	5	
30	26	
31	8	
32	7	
33	7	
34	9	

This again is a conservative estimate as every clump had been cut over in the year. This figure may also be taken for Bellur as the same was only available at Bellur it was decided to take an average between New Amarampalam and Bellur, always 10 to 15 bamboo and there was 11. For this purpose a one year culm, being of less weight than an

and that of the same clump, was taken from a small clump on the hill side and a few more culms. The measurements derived may therefore be considered conservative as the growth in the valleys is greater. The measurements were as follows:—

Shortest culm in ft.	Mid-girth in inches.	Least girth in inches.	Greatest girth in inches.	Number of internodes.	Average breadth of wall of flag.	Total weight green in lb.	Total weight dry in lb.
92	6	14	20	80	1.0	211.6	146.8

The dry weight measurement in the last column, as the culm could not be left for want of time to dry, is calculated on the assumption that the green weight is to the dry weight of these bamboos as the green weight is to the dry weight of the bamboos measured by Mr. Pearson from Pokote. To be absolutely safe a 50 per cent. dryage loss of weight will be allowed or 110 lb. taken as the dry weight of one culm.

Calculations of the yield per acre for Nalligutta and New Amarampalam reserves separately.

Locality	Average number of green culms per acre.	Average number of culms per acre.	Average number of culms per acre.	Weight of one culm dry in lb.	Yield when fully stocked (dry) in tons per acre in lb.	Yield from green culms per acre in lb.	Yield from green culms per acre in lb.	Yield when fully stocked (dry) in tons per acre in lb.
New Amarampalam	12.5	12.5	12.5	11.85	148.125	20.64	16.293	14.75
Nalligutta	12.5	12.5	12.5	11.85	148.125	20.64	16.293	14.75

LUKKA survey through Edhoda, a future bamboo zone. Starting from the northernmost point in planting 1914 due north in a straight line, one chain broad. — Three successive growth.

Furlongs and acres.	Number of culms.	Number of formed culms.	Number of formed culms.	Furlongs and acres.	Number of culms.	Number of formed culms.	Number of formed culms.
1 furlong and 1 acre	1	5	5	1 furlong and 1 acre	77	77	77
	2	5	5		78	78	78
	3	5	5		79	79	79
	4	5	5		80	80	80
	5	5	5		81	81	81
2 furlongs and 1 acre	6	5	5	2 furlongs and 1 acre	82	82	82
	7	5	5		83	83	83
	8	5	5		84	84	84
	9	5	5		85	85	85
	10	5	5		86	86	86
	11	5	5		87	87	87
	12	5	5		88	88	88
	13	5	5		89	89	89
	14	5	5		90	90	90
	15	5	5		91	91	91
3 furlongs and 1 acre	16	5	5	3 furlongs and 1 acre	92	92	92
	17	5	5		93	93	93
	18	5	5		94	94	94
	19	5	5		95	95	95
	20	5	5		96	96	96
	21	5	5		97	97	97
	22	5	5		98	98	98
	23	5	5		99	99	99
	24	5	5		100	100	100
	25	5	5		101	101	101
Average per acre	5	5	5	5	5	5	5

The growth when mature may be calculated by Mr. Pearson's figures from Pokro:

Locality	Area (sq. acres)	Number of clumps per acre	Number of culms	Number of culms per clump	Yield of dry culms per acre	Length in feet	Midlength in inches	Total weight in lbs.	Total weight in tons	Yield of dry culms per acre
Pokro	20	11	101	Average of one clump	62	10 1/2	100 1/2	72	2,320	3.9

APPENDIX III.

(Rate of growth.)

In May 1912, the Guards' Veterinary Training School felled one or two clumps in Kamath on scientific principles at the base. These being the only statistics available of the application from the root stocks two adjacent clumps were enumerated. The Beat Guard who attended the school stated that in every clump all the one year old culms were left standing. The number of culms cut would be easily counted by the number of clumps remaining.

Number of clumps	Number of culms felled	Number of culms standing in 1912	Number of culms standing in 1913	Number of culms in 1914	Number of culms in 1915	Number of culms in 1916	Estimated number of culms in 1917	Estimated number of culms in 1918
I	1	10	8	6	5	3 1/2	2	1 1/2
II	1	16	8	6	5	3 1/2	2	1 1/2
Total	2	26	16	12	10	7	4	3
Average per clump		13	8	6	5	3 1/2	2	1 1/2

Note 1.—In this table the yield of dry culms is calculated by the method's growth of that year.

Note 2.—That the number of old culms in 1914 shows the average growth in the same as the number of culms left standing in 1912 shows that no new culms were put out in the first year of the scientific clump.

Note 3.—The estimated number of one year old culms in 1914, i.e., which will be put out in the autumn of 1915 is based on a week in a conservative field. (Clump II. It was estimated to give).

These figures show that after four successive years' growth the average number of stems per clump cut out will have been reduced. To save a margin of safety a conservative estimate should be adopted. It was observed that by scientific felling the primary palisade behind the clump is considerably reduced.

APPENDIX IV.

Cephalostachyum Ferrugineum

Two clumps were selected in Kamath on the north bank of the Ghalar river, one big and one small. They were felled at the base, all the one year old culms being left in the big clump No. I, while 29 per cent. of the total number of culms in the small clump No. II were left standing.

One kilogram stem from each clump was measured and weighed green and the dry weight calculated as a 50 per cent. allowance for loss of weight in drying.

If this bamboo were introduced on a plantation scale, being smaller, and taking less room per clump than the *Bambusa Arundinacea*, we may easily estimate to allow for features that we should get 40 clumps per acre, the density of fully stocked natural bamboo. On these two conservative assumptions of dryage and density the following figures of yield per acre are based.

Number of clumps	Number of culms felled per clump	Number of culms left standing per clump	Ratio of live culms to old	Number of culms per acre	Number of culms to be cut per acre	Number of culms to be left per acre	Length of average culm in each clump in feet
1	2	3	4	5	6	7	8
11	24	83	3 1/2	40	4,040	2,220	41
	100	40		40	6,400	1,600	42
Average per clump or acre	18 1/2			40	7,180		40.5

Number of clumps	Midlength of average culm in each clump in inches	Total weight of average culm in each clump in lbs.	Number of nodes in each clump	Thickness of culm in inches	Total weight of average culm in lb.	Yield of dry culms per acre in lb.	Yield of dry culms per acre in tons
I	10	11	12	13	14	15	16
II	10	10 1/2	21	60	75	214,000	20 1/2
	7 1/2	8 1/2	31	84	117	308,000	40 1/2
Average per clump or acre	8 3/4	9 1/4	27	78	119	161,400	7 1/2

These clumps can be at the most 25 years old.

107 dry culms are equivalent to one ton.

APPENDIX V.

(Cost of extraction.)

Bambusa Arundinacea.—In order to obtain statistics of the expenditure occurred in felling these clumps scientifically at the base, two clumps in Valluvakeri with average palisades were felled, and accurate data of the labour employed collected.

It was found that it took as long to fell a dried or green stump as a full bamboo, so that in clumps that have never hitherto been felled for bamboos, as many full bamboos would be obtained as the total output of dried and green stumps, half bamboos and full bamboos from these sample clumps.

The whole of the area proposed in this report for working bamboo has already been felled over from time to time, though less heavily than these sample clumps.

It will be most accurate then to estimate that the number of coolies working on three sample clumps produced in output per coolie per day the mean between the output per coolie per day of full bamboos and the total output per coolie per day in units in these sample clumps. Every stump in the areas to be worked must be felled on scientific lines, so that the mean between per coolie works out at—

Number of clumps	Number of one year old culms left	Number of culms per clump	Number of young culms	Number of half bamboos	Number of full bamboos	Total output.	Number of coolies for one day
I	2	32	40	1	30	110	20 1/2
II	29	26	81	2	84	193	42 1/2
Average	15	29 1/4	120 1/4	1 1/2	107 1/4	303 1/4	31 1/2

In calculating the actual cost of extraction in the first and second instances, it is assumed that in the second instance there will be no dry culms in the clump, but that every culm removed will be a full bamboo. No further allowance is made in the second column on account of the expected reduction in the palisade as the above assumption is not in fact in fact.

It is estimated that if all bamboos were cut under shelter after felling for six months and then floated dry, it will be possible to float twice as many bamboos to a raft than if they were green. The cost of rafting per 100 and per ton dry outturn would then be halved.

Locality and range	Total cost of rafting 100 bamboos to Chalappuram.			Total cost of rafting 100 bamboos to Beypore.			Total cost of rafting 1 ton dry outturn to Chalappuram.			Total cost of rafting 1 ton dry outturn to Beypore.		
	Six months, December-March.	Six months, June-November.	Six months, December-March.	Six months, June-November.	Six months, December-March.	Six months, June-November.	Six months, December-March.	Six months, June-November.	Six months, December-March.	Six months, June-November.	Six months, December-March.	Six months, June-November.
Chalappuram	80	4	5	80	4	5	80	4	5	80	4	5
Amarampalam, Karum and Marat.	12	10	8	12	10	8	12	10	8	12	10	8
New Amarampalam, Nellouta and Karumpoya.	16	1	8	11	12	9	7	8	6	7	8	6

Cephalotachyum Pergrabile — In the case of the two clumps felled, date of felling, rafting, etc., were collected.

Three hundred and seventy-four clumps were felled and five half-bamboos or a total of 379 units by 19 coolies in one day, or 20 clumps per coolie per day.

Range	Cost of felling 100 bamboos (1 ton dry outturn).		Average (clumps to be rafted to water).	Cost of rafting 1 ton dry outturn to Chalappuram.	Average cost of rafting 1 ton dry outturn to Beypore.	Numbers of bamboo per 100.	Number of coolies in the day to be felled.	Cost of felling 1 ton dry outturn to Chalappuram.	Cost of felling 1 ton dry outturn to Beypore.	Average (clumps to be rafted to water).	Cost of rafting 1 ton dry outturn to Chalappuram.	Average cost of rafting 1 ton dry outturn to Beypore.
	May	June-November										
Chalappuram	14	19	16	17	17	19	11	14	19	16	17	17
Amarampalam, Karum and Marat.	21	10	20	15	15	15	11	21	15	20	15	15
New Amarampalam, Nellouta and Karumpoya.	11	6	11	11	11	11	11	11	11	11	11	11
Total	46	29	47	43	43	45	33	46	45	47	43	43

Note: — The number of men and dry weight is equivalent to one ton, so that the difference of variation per 100 bamboos is approximately the cost of rafting of 1 ton dry outturn.

Order—No. 2421, Revenue, dated 20th August 1914.

With its Forest Reference No. 88-GI/14-1, dated 20th January 1914, the

Forest No. 121.

Board of Revenue submitted a scheme formulated by Mr. T. Nelson of Messrs. Nelson & Co., Edinburgh, for the establishment on the West Coast of a factory for the manufacture of paper pulp from bamboo. In furtherance of his scheme Mr. Nelson has asked for certain concessions, the more important of which are dealt with below.

2. Mr. Nelson requests that the Government should either themselves sell bamboos to his company at a low price, or grant, free of rent for five years and thereafter subject to rent, an extent of about 3,000 acres of land suitable for bamboo growth with an option on a further area for extension of bamboo plantations in the event of the enterprise proving a success. The Government cannot undertake to alienate to a private firm any considerable extent of land below its proper value, but they are prepared to consider an application for temporary remission of assessment on the analogy of the concessions specified in the notes to clause 15 of Board's Standing Order No. 20.

3. As to the quantity of the supply of bamboos desired, Mr. Nelson asks that the Government should deliver to the company 10,000 tons air dry in the first year and 20,000 tons annually thereafter until the company's plantations are in bearing. The Board has submitted with its own remarks and those of the Conservator of Forests, Western Circle, a careful detailed report prepared by Mr. Bourne on the possibility of working for bamboo certain natural forests in South Malabar. The Government are inclined to agree with the Board in the view that the felling of bamboo should benefit, rather than injure, the forests and for that reason they consider it unnecessary to stipulate that the company shall continue to buy bamboos from the Forest Department after the expiry of the proposed initial period of five years. As regards the rate at which bamboo should be sold to the company, the Government are prepared to supply at cost price for two years, but after that period they must stipulate for a profit of 12½ per cent. The cost price cannot be guaranteed but on the data available Mr. Nelson may be informed that it seems likely to work out to about Rs. 7-5-0 per ton.

4. With reference to his request for the grant of water rights to the company's factory free of charge, the Government consider that while water power may be given, if locally available, there should be a fair payment for the supply taken.

5. Mr. Nelson next asks that all the materials imported for constructing the company's mill and manufacturing the pulp should be exempted from import duty and that for a term of years no export duty should be levied on bamboo pulp or paper. He should be informed that there is no export duty on paper pulp and that no concession in respect of import duty can be granted.

6. Mr. Nelson's last request is that bamboo pulp paper should be specified in Government contracts for paper. The Government can give no such promise until the price and the quality of the paper manufactured by the company are known. But Mr. Nelson may be assured of all reasonable official advice and assistance in the proposed enterprise.

7. The Board of Revenue will be requested to communicate to Mr. Nelson the substance of the foregoing remarks and to issue instructions to the Forest officers concerned to continue careful experiments and observation as to the reproductive power of bamboo, the cost of its production, etc.

(True Extract.)

L. DAVIDSON,
Ag. Secretary to Government