

PROCEEDINGS (215)

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# BOARD OF FORESTRY

AT MEETINGS HELD AT

DEHRA DUN (35)

BETWEEN THE

31ST MARCH AND 6TH APRIL 1910

WITH (1)

APPENDICES.



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**Proceedings of the Board of Forestry at meetings held at Dehra Dun  
between the 31st March and 6th April 1910.**

*Introduction.*—The Board of Forestry, as approved by the Government of India, met for the first time at Dehra Dun on the 31st March 1910.

The orders of the Government of India constituting the Board and defining its functions are contained in Revenue and Agriculture Department Circular No. 2-F.-177-16, dated the 13th January 1910.

*Vide Appendix A (a).*

The pressing necessity for putting the work of the Imperial Forest Research Institute and College on a sound footing rendered it advisable for the Board to meet as soon as possible, and the favourable opportunity presented by the annual meeting of the Board of Control for the Forest College was taken advantage of.

Evidence of the great interest taken by the Government of India in Forest matters has not been lacking in recent years, and it was again proved by the attendance at several meetings of the first Board of Forestry of the Hon'ble Mr. J. O. Miller, C.S.I., the Member of Council in charge of Forests, and of the Hon'ble Mr. R. W. Carlyle, C.I.E., Secretary to the Government of India in the Revenue and Agriculture Department. An address delivered by the Hon'ble Mr. Miller and the Inspector General of Forests' reply will be found in Appendix A (b).

The Board was constituted as follows :—

- Mr. F. Beadon Bryant, Inspector-General of Forests, *President*.
- „ J. H. Lace, Chief Conservator of Forests, Burma.
- „ C. E. Brasier, Conservator of Forests, Central Circle, Madras.
- „ G. P. Millett, Conservator of Forests, Northern Circle, Bombay.
- „ L. Mercer, President, Imperial Forest Research Institute.
- „ H. Jackson, Conservator of Forests, Eastern Circle, United Provinces.
- „ C. P. Fisher, Conservator of Forests, Punjab.
- „ C. G. Rogers, Conservator of Forests, Berar Circle, Central Provinces.
- „ G. S. Hart, Conservator of Forests, Bengal.
- „ M. Hill, Conservator of Forests, Western Circle, Eastern Bengal and Assam.
- „ S. Carr, Assistant Inspector-General of Forests, *Secretary*.

The following is a list of the subjects which, with the sanction of the Government of India, were discussed by the Board :—

- I. Rules defining the general scope of the work of each Research Officer and the general lines on which Research work is to be conducted in future.
- II. The triennial programme of Research work for the period 1910-1913.
- III. The qualifications which candidates for direct appointment to the Provincial Service should possess in the event of the special two years' course of training being introduced.
- IV. Forest Engineering.—Should this subject be dealt with at the Imperial Forest Research Institute ; and if so, how.



- V. Suggested formation of a separate Imperial Cadre for the Imperial Forest Research Institute and College, on lines similar to those of the cadre of a province.
- VI. How can Research work in the provinces best be co-ordinated with the work being done by the Imperial Forest Research Institute.
- VII. How far the time of Research Officers should be taken up in analysing samples of forest soils sent them for examination, and under what rules this should be done.
- VIII. The necessity for an agent in England to answer enquiries regarding Indian Forest Products, to receive samples of timbers, etc., and to generally push the trade in forest products.
- IX. The standardization of the formation and management of sample plots.
- X. The standardization of tree measurements.
- XI. Research Institute publications, their scope, necessity and size.
- XII. Proposal that the constitution of the Board of Forestry be extended so as to include at least one Divisional Forest Officer from each province.
- XIII. Proposed institution of short staff courses for the more important subjects in order that any Imperial Forest Officer who wishes to pursue any branch of research can further his knowledge and ascertain the right lines to start upon.
- XIV. Proposal to hold an Imperial Forest Conference to discuss general subjects, to promote progress and to improve the efficiency of the Department.

**I.—Rules defining the general scope of the work of each Research Officer and the general lines on which research work is to be conducted in future.**

From time to time since the inauguration of the Imperial Forest Research Institute various rules have been drawn up for the conduct of work at this Institution, but they have proved unsatisfactory, mainly because they did not lay down the duties and responsibilities of each officer with sufficient precision. Rules designed to rectify this, and also to bring the Department as a whole into closer touch with the Research Institute, were discussed by a Committee of Forest Officers at Dehra Dun in March 1909 and recommended to the Government of India for adoption. Since then, these proposed rules have been circulated to all Conservators for opinion and criticism. They were modified in the light of the suggestions received and of further experience, and placed before the present Board for consideration. The amended rules and the Conservators' suggestions regarding those originally promulgated were fully discussed and, after consulting the Research Officers concerned, some further modifications were agreed to.

*Resolved.*—The Board recommends the rules given in Appendix B for the approval of the Government of India.

**II.—Triennial Programme of Research Work for the period 1910 to 1913.**

At the first meeting of the Board, it was proposed by the President that a sub-committee consisting of Messrs. Millett, Mercer and Hart and, as regards each subject, the Research Officer concerned, be appointed to consider the proposed triennial programme and submit proposals to the Board. This was agreed to. The proposals of the sub-committee were subsequently considered by the Board as a whole and the programme still further modified.

All the suggestions made by Conservators and other Forest officers consulted by them were discussed by the Board, but it is unnecessary to refer to them in detail. Some have been met by the alterations made in the programme, others are not of sufficient importance or are matters which it is quite impossible, owing to want of staff, to include in the programme for the next three years and which must, for the present at any rate, be investigated by the local officers concerned. The following may, however, be briefly mentioned:—

- (a) Suggested by Mr. A. M. Reuther, Chief Conservator of Forests, Central Provinces. "The influence of forests in India and Burma on the retention of moisture in the soil, the flow of streams, the precipitation and distribution of rain and on climatic conditions generally in relation to agriculture."

Mr. Reuther wrote as follows:—"I consider it desirable that no more time be lost in beginning the enquiry on a sufficiently extensive basis, and in pursuing it steadfastly with the practical object of demonstrating the immense value of maintaining and promoting adequate density of the forests in India and Burma by protection against fire and by other suitable means, and with a view to securing by dint of such demonstration the introduction and development of practical measures for eliminating, as far as possible, adverse conditions such as excessive injury by cattle, avoidable disforestsments, and deterioration by injurious methods of forest management and of forest utilization.

In many respects much practical evidence is already available, but much more is needed and the collection and effective marshalling of facts and adequate presentment is required."

The Board understand that the enquiry suggested is already being carried out by the Government of India. They agree with Mr. Reuther in regarding it as of the utmost importance, but they regret that it is quite impossible to include it in the programme of the Research Institute as at present constituted.

Mr. Reuther's further suggestions involve the whole question of the value of Forest administration and protection in India; the Board regret that they do not see their way to include them in the 3 years' programme under discussion.

(b) Mr. Fisher, Conservator of Forests, Punjab, suggested the inclusion in the programme of an enquiry into the grazing incidence per acre of horned cattle, sheep and goats in hill forests, compatible with the maintenance of hill sides in an afforested condition. Mr. Haines, Conservator, Southern Circle, Central Provinces, suggested an enquiry into the number of cattle that can be conveniently grazed in different types of forest without serious damage to the crop, and with reference to the proper nourishment of the cattle.

The Board agreed that the grazing question generally is one of the greatest importance and that in some places the very existence of the forests depends on the proper regulation of grazing. They considered, however, that, owing to the limited staff of the Research Institute, the investigations into the incidence of grazing in the different provinces must for the present be carried out by local officers, but that the Sylviculturist should give all possible assistance and should record and tabulate the results of the local investigations.

After a full discussion of the whole question the Board agreed that, in view of the circumstances, as many subjects as it is possible for the Research Officers to undertake have been entered in the triennial programme.

The Board then considered the additional establishment recommended by the President of the Research Institute (*vide* below), and are of opinion that this represents the minimum necessary, and that if it cannot be sanctioned the programme must be still further curtailed. If this is necessary, the time of the Research Officers will not be used to the best advantage.

*Resolved.*—The programme as amended (Appendix C) is recommended for the sanction of the Government of India, and the Board are convinced that progress in Research work will be greatly retarded unless the additional establishment recommended by the President of the Research Institute can be made available.

*Establishment (excluding clerks and peons) considered necessary by the President to carry out the proposed programme.*

*President, Research Institute.*

- |                        |     |  |
|------------------------|-----|--|
| 1. Draftsman           | ... | (Already entertained.)   |
| 1. Ditto               | ..  | (Sanctioned but not entertained at present.)                                   |
| 1. Photographic Artist | ... | (Entertained as sanctioned in 1909-10. Sanction not yet received for 1910-11.) |

*Imperial Sylviculturist and Superintendent of Working Plans.*

- |                  |     |                          |
|------------------|-----|--------------------------|
| 2. Assistants    | ..  | } (Not yet entertained.) |
| 1. Deputy Ranger | ... |                          |
| 1. Duffri        | ... | (Entertained.)           |

*Imperial Forest Botanist.*

- |                        |     |  |
|------------------------|-----|--|
| 1. Herbarium Caretaker | ... | (Already entertained.)   |
| 1. Artist              | ... | (Now entertained as sanctioned in 1909-10. Sanction not yet received for 1910-11.) |
| 1. Mali                | ... | (Not entertained.)   |
| 1. Collector           | ... | } (Already entertained.)   |
| 1. Ditto               | ..  |  |
| 1. Mounter             | ... |  |
| 1. Ditto               | ..  |  |

*Imperial Forest Economist.*

1. Collector ... (Already entertained.)

---

*Imperial Forest Zoologist.*

1. Artist	...	...	} (Not entertained.)
1. Assistant	...	...	
1. Setter	...	...	} (Already entertained.)
1. Do.	...	...	
1. Collector	...	...	
1. Do.	...	...	

---

*Imperial Forest Chemist and Assistant Chemist.*

1. Scientific Assistant ... (Not entertained.)  
 1. Laboratory Assistant ... (Already entertained.)  
 1. Driver ... (Not entertained.)

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**III.—The qualifications which candidates for direct appointment to the Provincial Service should possess in the event of the special two years' course of training being introduced.**

The Board discussed the desirability of instituting a separate two years' course of training for candidates for direct appointment to the Provincial Service, and the qualifications which such candidates should possess before they are admitted to this course. The Board is in entire agreement with Resolution No. VIII of the Board of Control for 1909, which was as follows:—

“ The Board considered the question as to whether an entirely separate two-years' course should not be given to Provincial Service probationers instead of the present arrangement of a third year's training in continuation of the Rangers' course. It was considered in every way preferable that there should be an entirely separate course for the candidates for direct appointment to the Provincial Service. This is the system in force at the Roorkee Engineering College and it would, it is thought, tend to encourage a better class of men to come forward than those hitherto obtained.”

The Board consider that in the interests of the Provincial Service it is essential that this separate course, in which a thorough training in Forestry and the allied sciences would be given, should be instituted as soon as possible. The Board are of opinion also that candidates for this course should possess high educational qualifications, but that, instead of educational certificates being accepted as sufficient proof of a good education, no candidate should be admitted who has not satisfactorily passed a special qualifying or entrance examination designed to show that he has received a good general education and possesses a thorough knowledge of English, and is consequently in a position to follow the College course with advantage. The subjects of the examination should not be numerous and need include only English and elementary mathematics (including arithmetic, mensuration, algebra, trigonometry and geometry). Only candidates nominated by Local Governments should be admitted to the qualifying examination, and after passing it they should be required to undergo a period of practical training in the forests for at least 6 months before being

admitted to the College. Candidates should not be less than 18 or more than 22 years of age when they enter the College.

#### IV.—Forest Engineering—Should this subject be dealt with at the Imperial Forest Research Institute; and if so, how.

In discussing this subject the Board considered a letter \* addressed to the Inspector General of Forests by Mr. Caccia, when President of the Research Institute, in which the necessity for an expert engineer is dealt with.

\*Appendix D.

Some of the members of the Board also brought forward instances in their own experience in which the advice of an engineering expert would have been of the greatest assistance in deciding on the best method of mechanical transport to adopt, in facilitating the erection of suitable works, or in preventing defects of design or construction which have resulted in the partial or complete failure of more or less extensive engineering projects, and consequent waste of money.

Mr. Rogers stated that at a Forest Conference held at Nagpur in 1908, a resolution was passed recommending the appointment in the Central Provinces of a specially trained Forest Officer to enquire into the question of transport.

† Appendix D.

This was referred to in an editorial in the "Indian Forester" for May 1909.†

After a full discussion, the Board agreed that there can be no question but that the services of an expert Forest Engineer would be extremely useful in many cases. They doubt whether one such officer will eventually be sufficient for the whole of India and Burma, but experience will soon show whether this is the case or not.

*Resolution.*—The Board consider that the subject of Forest Engineering can for the present be best dealt with at the Research Institute, and in order that the subject may be put on a satisfactory footing they recommend that an expert engineer should be appointed on the Research Institute cadre. The Board agreed that a trained engineer would be more suitable than a Forest officer for this appointment, and that special training or experience in Forest Engineering in Europe and America should be regarded as an essential qualification for the appointment.

In Appendix D are some memoranda drawn up by some of the members of the Board, indicating a few instances in their provinces in which the services of a Forest Engineer could be employed with advantage.

#### V.—Suggested formation of a separate Imperial Cadre for the Imperial Forest Research Institute and College, on lines similar to those of the cadre of a Province.

The President of the Research Institute represented that the formation of a separate Imperial Service cadre is expedient because:—

(a) Experience not only at Dehra but in other countries has shown that, in order that research and education work may be really efficacious, it is essential that continuity of appointment be assured, and that as a general rule the incumbents of the various posts should remain permanently in them, this having been admitted and given effect to in both France and Germany.

(b) It is often extremely difficult to obtain suitable Forest Officers for these posts, owing in some cases to such not being always available, and in others to Local Governments and Administrations being unwilling to depute the men asked for, and sometimes even being desirous of recalling men after they have been a comparatively short time at Dehra.

The President also expressed the opinion that it would be expedient to form subsequently a Provincial Service cadre on similar lines, but that action in this direction might be postponed pending the orders of Government on the proposal to create an Imperial Service cadre.

The Board discussed this question at considerable length. It was agreed that it is necessary that a separate cadre should be sanctioned for the Research Institute and College, but that certain of the Research appointments could better be held by trained experts in the respective subjects than by Forest Officers, and that difficulties might be experienced in bringing such officers on to an Imperial Service cadre. The Board considered that one cadre should be formed for the Research Institute and College, on which all the appointments sanctioned, whether of the Imperial or Provincial Forest Service, or of specially trained experts, should be borne.

The final conclusions arrived at are embodied in the following Resolution:—

In the opinion of this Board it is desirable that—

- (i) A separate cadre be formed for the Research Institute and College on lines similar to those of the cadre of a Province, with allowance for leave vacancies.
- (ii) Once officers join this cadre, and prove suitable for research or educational work, their services should as a rule be retained on it for the greater part of, if not their entire, service; officers of the Forest service should be paid their incremental pay, with local allowance, until such time as any officer below them on the general list is appointed substantively or temporarily to the administrative grades, and they should then be granted the pay of such officer, with or without local allowance;
- (iii) The officers on this cadre who are employed as Instructors should be encouraged at the same time to take up some special branch of research, so that they may qualify themselves to replace, at least temporarily, the Research Officer in this branch;
- (iv) This cadre should be recruited—
  - (a) By transfer from Provincial cadres;
  - (b) By direct appointment of experts who are not members of the Forest Department, on average pay which would generally be lower than that of officers of the Forest Department and which would thus be a certain set-off against the additional expenditure entailed by the proposal that Forest Officers on the new cadre should draw the pay of administrative grades, on their seniority and efficiency rendering them eligible for such.
- (v) The cadre should be constituted as follows and should be gradually formed as circumstances and funds permit:—
  - 1. President of the Research Institute and Principal of the College.
  - 2. Imperial Forest Sylviculturist (to include Working Plans branch).
  - 3. Assistant to Sylviculturist.
  - † 4. Imperial Forest Botanist and Mycologist.
  - 5. Imperial Forest Economist.
  - † 6. Imperial Forest Chemist.
  - † 7. Imperial Forest Zoologist.
  - ‡ 8. Assistant to Zoologist.
  - † 9. Imperial Forest Engineer.
  - 10. Instructor No. 1, Provincial Service Class.
  - 11. Instructor No. 2, Provincial Service Class.

- 12. Instructor No. 3, Rangers' Class.
- 13. Instructor No. 4, Rangers' Class.
- ‡14. Instructor No. 5, to assist with the Ranger Class.
- ‡15. Instructor No. 6, to assist with the Ranger Class.
- ‡16. Provincial Service Officer in charge of Ledgering and Forest publications.

The appointments marked • should as a rule be held by Imperial Service Forest Officers; those marked ‡ by Provincial Service Forest Officers and those marked † by experts trained in the special subjects.

(vi) The early appointment of the Imperial Service officers required for the education of the Provincial Service and Rangers' classes is of the greatest importance. These officers are urgently required in the interests of education and the efficiency of future members of the Provincial and Subordinate Forest Services, and their appointment should have precedence before all other considerations. (It may be noted that the increase in Imperial Service Officers suggested is chiefly in the cause of education and for the benefit of the Provincial and Subordinate Services.)

(vii) The following posts should, as opportunity offers, be filled by experts in the various subjects, and not necessarily by Forest Officers:—

The Imperial Forest Botanist and Mycologist.

The Imperial Forest Chemist.

The Imperial Forest Zoologist.

The Imperial Forest Engineer.

(viii) The Botanist should also be a specialist in Mycology and the diseases of trees, as prevention of damage to forest crops due to fungoid or other diseases is considered to be of greater importance than systematic Botany, so far as Forestry is concerned. Some notes by members of the Board, showing the damage done to forest crops by fungoid and other diseases, appear in Appendix E.

(ix) The assistant Sylviculturist should, if possible, be an Imperial Service Officer.

(x) The Board would be glad to see a Provincial Service Officer appointed as assistant to the Zoologist, but if any reduction has to be made in the suggested staff, they consider that this post can be dispensed with more easily than any other.

## VI.—How can research work in the Provinces best be co-ordinated with the work being done at the Imperial Forest Research Institute?

Copies of a note and a set of proposed rules for affiliating Provincial Research officers in Sylviculture and Working Plans with the Imperial Forest Research Institute, which had been drawn up by Mr. R. S. Troup, the Imperial Sylviculturist, together with a draft Resolution prepared by Mr. Rogers were placed before the Board. It was generally agreed that the future progress of research in some subjects, and especially in Sylviculture and Working Plans, must depend in a great measure on the amount of assistance that local officers may be able to afford. The special research officers can do a great deal, but their work must be supplemented by local investigations, the results of which should be collated and recorded by the special research officers. The Board were of opinion that in some provinces, if not in all, it will be found advisable to appoint provincial research officers to work in collaboration with the staff of the Research Institute. This is a matter for Local Governments and Administrations to decide, but the Board hoped that it

may occasionally be possible for selected local officers to be put on special duty, or relieved of a portion of their ordinary work, in order that a particular investigation may be carried out.

The Board recognized that the results of many local investigations and much useful information are buried in local records and thought that steps should be taken to examine these records, and to bring together such of the available information as is reliable, with view to placing it on record in a convenient and uniform manner.

The conclusions arrived at are summarized in the following resolution:—

The Board are of opinion that local research work is, and always must be, of the greatest value in connection with the economic and scientific development of Indian forests, and they consider that it is imperative to enlist the sympathy and cordial co-operation of local officers in research work of all kinds.

They recognise that a great deal of research work of much value has been done in the past and is now being done by local Forest officers, especially as regards:—

- (i) The silviculture of the more important trees and crops,
- (ii) The collection of statistical data,
- (iii) Minor forest produce of economic value,

and they consider that immediate steps should be taken to collect such of this information as is reliable and place it on record for the benefit of the department as a whole.

They agree that much of the information collected locally in the past cannot be utilized owing to the great differences in the manner of carrying out investigations and experiments, but they consider that it is essential that the work of the special research officer should be very largely supplemented by local research if adequate progress is to be made. They strongly recommend that local officers should be encouraged by every possible means to continue original work on the lines adopted at the Research Institute, not only in the subjects for investigation included in the 3 years' programme approved by the Board, but in other subjects of importance locally, *e.g.* information regarding the more important trees and forest crops, and other matters affecting Forest management.

In order to give practical effect to this recommendation, the Board consider that Local Governments and Administrations should be asked to assist by—

- (i) Encouraging selected officers to place on record, in a convenient form, all that is known of the most important forest trees, as well as any facts of an interesting nature that have not hitherto been published.
- (ii) Affording facilities in special cases to local forest officers to collaborate, within their province, with the special research officer in any particular investigation.
- (iii) Publishing the information collected by local officers in the same form as has been adopted for the publications of the Research Institute.

The Board wish to enlist the sympathy of Provincial Administrations, and the active co-operation of local officers, in research work, but they do not in any way wish to lay down what investigations should be undertaken by local officers. They consider that, in order to allow of the results of local investigations being fully utilized and to prevent duplication of work, local officers engaged in any investigation should be encouraged to keep in touch with the Research Institute.

#### **VII.—How far the time of Research officers should be taken up in analysing samples of forest soils sent to them for examination, and under what rules this should be done.**

The President of the Research Institute represented that little or no inference can be drawn from the chemical analyses of soils, and that such analyses



have been carried out for a long time for agricultural soils without any authoritative decision having been come to. Also that, if any analysis of soils be undertaken, it should rather be a physical analysis restricted to the Sal bearing areas, this being the main species under investigation during the next three years; and that such physical analysis would deal with, *inter alia*, the æration, the consistency and texture, absorption capacity, nitrogen supply, and possibly bacteriology of the soil. It is, however, quite possible that, owing to the want of laboratory facilities, this physical analysis would make slow progress.

*Resolution* :—The Board are of opinion that the Chemist's time is fully occupied with more important work, in connection with forest products of economic and commercial importance. He cannot generally, at present, spend much time in analysing soils, but with the President's sanction he should assist Forest officers by doing so in special circumstances.

### VIII.—The necessity for an agent in England to answer enquiries regarding Indian Forest products, to receive samples of timbers; etc., and to generally push the trade in forest products.

The following note by the Inspector-General of Forests formed the basis of the discussion on this subject :—

“ So far as I am aware there is no Government agency in England to assist the quasi-commercial departments in bringing their goods to the notice of likely purchasers. This is a great drawback in the case of the Forest Department at any rate, and we find it very difficult to get into touch with the trade in Europe. The only way we can do this is through agents who absorb a considerable proportion of the profits. There are many valuable woods and a great variety of minor forest products for which a demand would surely be forthcoming if properly put forward in London. Our large stores of Padouk are lying unused in the Andamans. We hope shortly to be able to produce tannin extracts from sal and mangrove bark, of good commercial quality. But I think we shall never get them on the European market without special assistance in London.

I should like to see a Government Forest agent appointed, to whom consignments of forest products might be sent for sale. He would be in direct touch with our Imperial Forest Economist, and under the orders of the President, Research Institute, or perhaps the Secretary of State. He would be kept informed of what we had to sell and endeavour to book orders for it. He might suitably be a retired Forest Officer, and I think the appointment of such an agent would lead to considerable business and increased revenue. At present enormous quantities of valuable forest products are being wasted because they are not properly known.”

The Board understand from a note written by the Economist that the present method of sending samples of forest products to commercial firms in Europe, for valuation and report, does not in practice work well. Commercial firms have their own ends to serve and do not always give the necessary information in their reports. Nor, when making enquiries regarding timber, etc., do they always give sufficient details to enable the Economist to meet their wishes and supply the information they require. Again, when forest products have to be tested or experiments on a commercial scale carried out, the Economist has usually to apply to some expert in England for information as to the best firm for the purpose, or for assistance in making the necessary arrangements. The Board consider that an agent in England, who could personally interview commercial firms, supply information regarding (a) markets for various forest products, (b) the best firms to deal with for any particular purpose, and obtain estimates for plant required for tramways, monorails or other engineering projects, or for forest industries, would supply a much needed want.

After discussing the question the following Resolution was agreed to :—

The Board are of opinion that, following the example of commercial firms, the appointment of an agent in England is desirable, and that he might be paid

partly by commission on the results obtained. The agent should be in close touch with the Imperial Forest Economist.

### IX.—The Standardization of the formation and management of sample Plots.

A note on the establishment and upkeep of sample plots by Mr. R. S. Troup, the Imperial Sylviculturist, and extracts from a Circular addressed to all his Divisional Officers by Mr. G. S. Hart, Conservator of Forests, Bengal, together with a draft resolution by Mr. Hart, were placed before the Board and considered.

After discussing the matter, the following Resolution was agreed to:—

That it is very desirable to obtain uniformity in the upkeep and management of experimental plots. The Board considered Forest Pamphlet No. 8.—“The collection of Statistical Data relating to the principal Indian Species”—and are of opinion that the control of sample plots established for the purpose of collecting data regarding the rates of girth (or diameter) and height growth of selected type seedling trees and coppice shoots of various species may be carried out by local officers, the work to be done in each Circle being fixed by Conservators. They recommend that Forest Pamphlet No. 8 be brought to the notice of all Chief Conservators and Conservators, who should be invited to adopt the lines suggested and the forms detailed in the pamphlet, so far as these are suitable to local requirements. The actual forms to be used in each case should be decided by Conservators, in communication with the President of the Research Institute.

Annual measurements are not necessary. Quinquennial measurements will be sufficient, and these should be communicated to the Imperial Sylviculturist by the Conservator concerned.

The Board are of opinion that the more detailed investigations relating to volume increments, and in plots taken over by him all measurements, should be left to the Sylviculturist, local officers being made responsible for the maintenance of the plots in proper order.

The Board desire to lay stress on the necessity for the proper maintenance of all experimental plots.

### X.—The Standardization of Tree Measurements.

The following note by the Sylviculturist formed the basis of the discussion on this subject:—

“In the November number of the “Indian Forester” of 1909, page 607, attention was drawn to the advisability of standardizing the measurements of trees, not only as regards the method of measuring (girth or diameter) but also as regards the size classes to be adopted.

2. *Girth and Diameter measurement.*—In the great majority of Indian Working Plans the size classes are recorded by girth and not by diameter measurements. In a few plans, notably some of the older Burma plans and one plan in Oudh, diameter measurements were recorded; but in the marking of trees for felling a girth limit not corresponding to any of the diameter measurements, is taken; this is obviously liable to result in error to a considerable extent. As girth measurements are almost invariably employed in forest operations in India, it is proposed that girth measurements only, and not diameter measurements, should be recorded in working plans in future: whether the measurements be made with a tape or with callipers graduated to read girth measurements is immaterial.

3. *Standardization of size classes.*—The question of standardizing size classes is a more difficult one. The most general classifications adopted in India and Burma respectively are as follows:—

	INDIA.	BURMA.
	(Girth).	(Girth).
I Class ... ..	6 ft. and over	7 ft. and over.
II „ ... ..	4½ ft. to 6 ft.	6 ft. to 7 ft.
III „ ... ..	3 ft. to 4½ ft.	4½ ft. to 6 ft.
IV „ ... ..	1½ ft. to 3 ft.	3 ft. to 4½ ft.
V „ ... ..	Under 1½ ft.	Under 3 ft.

One of the main defects of any such classification is that trees of intermediate girths are not considered: for instance, if trees are silviculturally and economically mature at 5 ft. girth a special sub-class would have to be created for such trees. This seems to indicate that 6" or 1 ft. girth classes would be of more use for general application than classes of the present wider limits. On the other hand, it might be difficult to overcome local usage and introduce any such change.

4. The "Indian Forester" proposes adopting the Indian classification noted above, and adding another class for mature trees, to be called "M" class, which will represent the exploitable size and will differ in different working plans. This, however, does not get over the fact that the introduction of a separate series of dimensions on the same system would lead to great confusion: thus a I class tree in Burma is a 7' tree, and if the class was changed to 6', the change would prove a fruitful source of error.

5. If any change is to be made, therefore, it would seem necessary to discard the class numbers (I, II, III, etc.) and employ letters, such as the following (in the case of 6" girth classes):—

A Class	...	...	...	...	0—6" girth.
B „	...	...	...	...	6"—1' „
C „	...	...	...	...	1'—1' 6" „

and so on.

An alternative would be to denote the classes according to their dimensions thus:—

Sapling class	...	...	...	...	0—6" girth.
6" class	...	...	...	...	6"—1' „
1' „	...	...	...	...	1'—1' 6" „
1½' „	...	...	...	...	1½'—2' „

and so on.

6. The question of height classes is also raised in the "Indian Forester". Until the height measurements to be undertaken by the Imperial Sylviculturist are further advanced, however, it would be premature to lay down rigid rules on the subject, which might have to be altered in the light of future experience.

7. These questions have been raised with a view to arriving at some decision after discussion at the forthcoming Forest Conference. The questions for decision are:—

- (1) Are girth classes to be adopted universally in working plans, in preference to diameter classes?

- (2) Are the existing girth classes, which differ locally, to be retained, or are new standard ones to be adopted for general use?
- (3) In the latter case, what system of classification should be adopted?
- (4) Are height classes to be standardized now, or should this be left till further experience is gained?"

Mr. Fisher advocated the introduction of diameter classes, but the majority or the members of the Board were of opinion that any advantage there may be in the use of such classes would be more than counter-balanced by the necessity for altering nearly all the existing working plans, and the confusion that would inevitably result from the change. The following Resolution was passed:—

The Board recommend that girth classes be retained, the measurements being taken with callipers, graduated to correspond with the girth classes, when data for working plans are being collected.

They consider it impracticable to standardize girth classes throughout India, and that the question of height classes may remain in abeyance until further experience has been gained.

#### XI—Research Institute publications; their scope, necessity and size.

The following note was submitted to the Board by the President of the Research Institute:—

"That the size of the memoirs of the Institute is unsuitable. The Board of Forestry is also asked to consider—

- (i) whether memoirs are a suitable and necessary form of publication; if not that they be abandoned for the present; if it is deemed advisable to retain them, the Board is asked to consider whether the size and shape of the Agricultural memoirs is not more suitable;
- (ii) whether small publications, such as leaflets, could not be more suitably inserted in the "Forester", as such do not generally appeal to a large class of readers."

After a discussion, the Board agreed that no change in the size of the "memoirs" is desirable but that this form of publication has not always been used for the purpose for which it was originally intended. Mr. Troup's work on Indian Woods and their uses, for example, should have been published in as compact and handy a form as possible and not as a memoir.

It was also agreed that some modification of the orders in force regarding the scope of the "memoirs" is required, *e.g.*, the results of a full investigation, and not merely the results of a partial investigation regarding any particular enquiry, should alone be regarded as suitable for publication in this form.

*Resolved.*—That in the opinion of this Board—

- (1) The size and form of the "memoirs", "records" and "pamphlets" are suitable, but the "leaflet" series may be discontinued.
- (2) Amendments are desirable in the existing orders regarding the scope of the "memoirs" to ensure that publications in this form are confined to works of importance, giving the results of full and original investigations.
- (3) The "pamphlets" should in future be called "bulletins".

**XII.—Proposal that the constitution of the Board of Forestry be extended so as to include at least one Divisional Forest Officer from each province.**

This proposal was submitted by Mr. Clutterbuck, Officiating Conservator of Forests, Western Circle, United Provinces, with the following explanatory note :—

“ The assistance of the Forest Department as a whole in the work of the Institute depends chiefly on Divisional Forest Officers and their subordinates, and such assistance will it is believed be more readily ensured if Divisional Forest Officers are given direct representation on the Board, *c.f.*, paragraph 5 of Inspector General of Forests’ Circular No. 1-367-3, dated 17th January 1910.”

*Resolution.*—It is agreed that the Board, as constituted by the Government of India, is sufficiently large and representative for present purposes.

**XIII.—Proposed institution of short staff courses for the more important subjects, in order that any Imperial Forest Officer who wishes to pursue any branch of research can further his knowledge and ascertain the right lines to start upon.**

In support of this proposal Mr. Clutterbuck submitted an explanatory note, pointing out that in order that the work of research may successfully progress it is necessary that there should be, in the various provinces, officers in sympathy with and interested in the various branches of research. He suggested that, as out-door work in most parts of India is usually more or less in abeyance during the rains, when the Research Officers are generally in Dehra Dun, Forest officers could be spared from their provinces to attend short courses of about three months during this period without inconvenience, and that much advantage would result, not only to the officers themselves but to research and general progress.

After discussing the proposal the Board resolved as follows :—

The institution of separate staff courses is at present out of the question inasmuch as the sanctioned staff has already more work to do than can be properly carried out. The Board are of opinion, however, that it would be of great advantage if selected Forest officers are allowed to visit Dehra Dun for such periods as Local Governments and Administrations think desirable, during which time these officers could study any particular subjects in which they desire to carry out research work. In such cases the officers of the Research Institute should afford all assistance it is in their power to give.

**XIV.—Proposal to hold an Imperial Forest Conference to discuss general subjects, to promote progress and to improve the efficiency of the Department.**

In an explanatory note submitted with this proposal Mr. Clutterbuck suggested a number of subjects suitable for discussion, and proposed that the conference be held at Allahabad between December 1910 and February 1911, during which period the United Provinces Exhibition will be open.

After discussing the proposal it was agreed that the time has hardly come for a general conference of Forest officers.

*Resolved.*—A large number of subjects have been discussed by the present Board, and it is considered advisable to wait some time before inviting Forest officers to attend such a conference as that suggested.

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**APPENDICES.**

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## APPENDIX A (a).

Circular No. 2-F.—177-16, dated Calcutta, the 13th January 1910.

From—**R. W. CARLILE**, Esq., C.S.I., I.C.S., Secretary to the Government of India, Department of Revenue and Agriculture,

To—All Local Governments and Administrations.

In this Department's Circular No. 19-F.—177-2, dated the 19th July 1909, a proposal to constitute a Board of Forestry on the same lines as the Board of Agriculture was circulated for the consideration of all Local Governments. The proposal has been unanimously approved by the Local Governments, and the Government of India have accordingly decided to appoint a Board of Forestry to hold its first meeting in April 1910.

2. The Board will for the present be composed of the following members, provided that their services can be spared :—

- |  |                       |
|--|-----------------------|
| (I) The Inspector-General of Forests to the Government of India  | ... <i>President.</i> |
| (II) A Chief Conservator or Conservator from each province where officers of this rank are stationed, to be nominated by the Local Government or Administration. | }                     |
| (III) The President of the Imperial Forest Research Institute  |                       |
| (IV) The Assistant Inspector-General of Forests  | ... <i>Secretary.</i> |

The Governments of Madras and Bombay will each be at liberty to depute a Revenue Officer as Member of the Board if they desire to do so. The Inspector-General of Forests may invite officers other than members of the Board to attend the meetings and to assist the Board in its deliberations on subjects on which they may be specially qualified to advise.

3. One of the chief functions of the Board will be to advise on the management and work of the Imperial Forest Research Institute at Dehra Dun, and the Government of India trust that the constitution of the Board will serve to bring officers from all provinces into close touch with the work which is being carried on there and that the Institute will thus in an increasing degree command the interest and active support of the Department. The Board will also deal with any general problems connected with Forestry, whether scientific or administrative, which may be referred to it for advice. It is not intended, however, that the Board of Forestry should exercise any executive control over the Research Institute or College or the Forest Department generally, or that it should in any way interfere with the functions of Local Governments. It will be a purely advisory body and will deliberate only on such questions as are specially brought before it by the Inspector-General of Forests who will, with the sanction of the Government of India, draw up a programme for its meetings.

4. Any resolutions that the Board may pass will be submitted, by the Inspector-General, to the Government of India for information and orders; and Local Governments will ordinarily be left to take any action on them which they may think necessary. In no case will action be taken by the Government of India on any recommendation of the Board until the Local Government concerned has been consulted.

5. The first meeting of the Board will be held at Dehra Dun, but it will not necessarily meet there every time, and it will be convened on each occasion at such time and place as may be fixed by the Inspector-General of Forests with the approval of the Government of India. After a time and place for holding a meeting has been fixed, the Inspector-General will make the necessary arrangements directly in consultation with Local Governments.

## APPENDIX A (b).

### THE HON'BLE MR. MILLER'S ADDRESS.

"It has been a matter of great satisfaction to me to be able to accept the suggestion that was kindly made that I should be present at this the first meeting of the Forest Board. I was glad to come here both out of interest in the work, and because of the certainty of learning much at this meeting of representatives of the Forest Service from all the large provinces. There has been a great extension of the system of conferences in recent years in all branches of Indian work. The improvement of communication has facilitated such meetings, and while they undoubtedly interfere with the administrative duties that are always pressing more heavily upon public servants of all classes, there can be no doubt that they do an immense amount of good. It is beneficial for all of us to get away from the routine of work, to learn what is being done in other Provinces, to make or to receive suggestions. Work is always far better done, and with far less strain to the individual when he is above and ahead of it, and not below it or struggling to keep abreast. There are times in the experience of

most of us when the number and complexity of the affairs to be dealt with in the day seem to make it hopeless to grapple with them, when small matters assume an exaggerated importance, and when the larger matters of policy are apt to be left out of sight; when, to take a forest metaphor, the wood cannot be seen for the trees. One benefit of these conferences is to bring the larger questions into prominence and to relegate details to the position they deserve. It is a consolation to find that difficulties such as we have ourselves experienced are of universal occurrence; it is a help to know how they have been dealt with elsewhere; and perhaps, a satisfaction to be able to point out how one has successfully surmounted them oneself.

I am very glad that the various Governments have been able to spare your services for the time required for this meeting and that so many of you have been able to come to Dehra on this occasion—some from great distances and at a trying time of year. We cannot hope to have you very often here, but I am glad that at this stage we have been able to induce you to come to see what is being attempted at the Forest Institute, to give us your advice as to how we can make that work most useful to the Department at large, and to obtain, I trust, with the permission of the Governments concerned, your sympathy and co-operation in its future development.

A layman had need to walk warily in addressing a body like this in its own home and on its special subject. There would, however, be a great drying up in the flow of speech in this world if we only dealt with subjects that we knew in all their details; and some degree of technical ignorance may be held to be compensated for by a large amount of interest and of acquaintance with the main features of your work. Still an outsider may be allowed to feel some diffidence, which is not diminished by the fact that I am speaking to what I believe to be a very homogeneous service. No doubt all experts are like doctors and disagree at times, but speaking generally, the Forest Service seems to me to be one in which, notwithstanding the dispersion of its members in the solitudes of the country, and in spite of difference in the methods of its recruitment at different times, there is a remarkably strong fellow feeling and unanimity of purpose. Possibly, this may be, in some degree, due to that very isolation in which the most of you must pass the greater part of the earlier years of your service; and to a feeling that the aims and objects of your work are not in all cases fully appreciated by the layman, and that even statesmen and administrators do not always realise fully the great ideals and conceptions that forestry sets before itself for the distant future.

Whatever the cause may be, the fact has impressed itself on my mind that there is an essential solidarity in the feelings and aims of the Forest service, which is not only shown in matters relating to this country, but which appears in the sympathetic interest that you extend to forest problems in all parts of the world, regarding them in Germany and France with the reverence of a pupil, and in America and England with the considerate benevolence of an elder brother. Your magazine shows how very wide is the outlook and how cosmopolitan are the interests of Indian forestry; and I am glad to think that in recent years there has been a more general recognition of the exceedingly important place that Indian forestry has already taken, and some realisation of the still more important position that it must inevitably attain both in future developments inside the country and in its influence beyond Indian limits.

It is perhaps superfluous, in addressing you, to refer to statistics with which you are well acquainted, but as some outside interest may be taken in your proceedings here, I should like, just for a moment, to indulge in a little of that statistical comparison which is so popular at the present time. The latest statistics of the Inspector-General give the total area of State forests as amounting to 240,000 square miles, which is very nearly twice the area of Great Britain and Ireland. But these figures give a somewhat exaggerated view of the extent of our actual forestry operations. More than half of this area is unclassed forest, that is to say, it has not been brought under definite regulation; the operations have not been reduced to a system; it is even uncertain how much of the area may ultimately be retained as forest, and what part of it may be made over to meet the purely agricultural needs of a growing population. We shall be on surer ground if we confine ourselves to the areas that have for the present been reserved or placed under a definite system of conservation, which amount to 94,000 square miles, and which considerably exceed the area of England and Wales and Scotland combined. It may be said, therefore, that your duties primarily extend over an area exceeding that of the United Kingdom excluding Ireland, and that you have, in addition, a share, which varies from place to place, in determining the management and the future destiny of a further and much greater area.

In the conservation of this great property you have many problems to face—scientific, commercial, economic and administrative. The formation of this Institute shows the great importance which the Government of India attach to scientific work, which must go hand in hand with commercial exploitation, if that is to be so carried out as to enable the State to work its property to the greatest advantage. I will return to the Institute later, and will in first place refer very briefly to some of the more general economic and administrative aspects of the forestry question in this country, where the forest officer requires not merely technical skill and knowledge, but a broadminded outlook on men and affairs. He has to appreciate the bearing of his operations on the administration of the country: he has to keep in touch and co-operation with officers of other departments and especially with revenue officers, he may have to organise and manage large forces of labour, and he should also at all times cultivate a



sympathetic knowledge of the feelings and wants and grievances of the rural population in or near his forests.

You are all aware that the Government of India laid down in 1894 the general lines of its forest policy on a comprehensive and liberal plan. All forestry administration must eventually be restrictive. That, however, is not the traditional conception of forestry: the natural man connects it rather with the idea of destruction, its symbols are the axe and the *Kukri*, and early associations suggest as the appropriate form of address to a woodman "Spare thatt rea". These ideas spring from the almost universal habit in the earlier stages of development of regarding forests as forming an inexhaustible source of national and individual wealth. The cultivator, the charcoal-burner, the contractor, the ironworker, the railway-man and the lumberman are too apt to treat them as if they would last for ever, and I do not know that it is going too far to say there is often an idea that the wholesale sweeping away of forests is to be welcomed in the interests of development and of civilization. Experience shows the danger of these ideas, but experience often comes too late, and as a rule, it is only when immense damage has been done that the public begin to realise that in forestry, as in other matters, they cannot both eat their cake and have it, and that a country which lives on its forest capital must share the fate of an individual with the same propensities, apart altogether from the further injurious consequences, of which we do not yet know the exact extent, to their climate and their water-supply.

Forestry must, therefore, be restrictive. It cannot help itself. Where forests are to be preserved, the forester must check the demand for exploitation in excess of the annual yield, and it becomes a delicate and difficult problem to decide to what extent such preservation is really necessary for the general welfare of the country.

The orders of 1894 emphasise the fact that forestry must be subservient to the general interests of the country, and more particularly to its agriculture; and even the most enthusiastic forester will find nothing, I trust, to object to in the general principle, though he may sometimes hesitate as to the best method of its application for the benefit of all the interests involved. In the classification made of forests at that time, the first two classes refer chiefly to general as opposed to merely local interests, that is, the forests which must for climatic and other reasons be preserved, and the valuable commercial forests. India was fortunate beyond many countries in the initiation of measures to preserve its forests at a comparatively early date; and here let me acknowledge that it was in Southern India—in Madras over a century ago, and then in Bombay—that definite measures of conservation were first undertaken. A more systematic and comprehensive policy owed its origin to the wise forethought of Lord Dalhousie and the energy of Sir Dietrich Brandis. Even with these advantages we know that in some places almost irreparable damage has been done, jeopardising the stability of local agriculture, endangering the supplies of water on which agriculture at a distance is dependent; and probably affecting the climate. We have most of us seen examples of such damage, sometimes on a very serious scale, and forestry will have a hard task to repair it, and even to prevent further mischief. Fortunately public opinion is becoming increasingly awake to these dangers, and not only our own officers, but enlightened rulers of Native States recognise the necessity of placing some check on the tendencies to wasteful destruction that have become more and more serious owing to the growth of population, the extension of communications and the curtailment of the old grazing grounds and reserves elsewhere.

It is no exaggeration that, as the article in the Gazetteer on Forests puts it, "The forests form the headworks of nature's Irrigation scheme in India," and from this point of view alone the necessity for their conservation is of pre-eminent importance to the agriculture of the country. You are aware that we are now making enquiries with reference to the necessity of an extension of tree planting in the interest both of the climate and of the protection of our water-supplies. This is much more than a question of departmental forestry. It is a general arboricultural question, for provided there is the requisite amount of tree growth, and that its maintenance can be arranged for, it need not necessarily be in the hands of a Government Department. It may be better that it should not be, or it may be possible to arrange for a certain measure of State control and advice, without actual State management. You must adapt to the circumstances the old saying of political economy, and remember that while the Department can do more than any single landholder, it cannot do so much as all the landholders combined; and I hope that your influence acting on public opinion may result in an intelligent appreciation of the value of arboriculture and reboisement such as spread through our own country—backward as it is in scientific forestry—a century, or a century and a half ago.

I am afraid that you, trained and scientific foresters, do not rate the English conception of forestry very high, and I will make that an excuse for a quotation from Pope, who expressed his appreciation of the value of reclothing our bare hill sides in words that even at the present day you could not greatly improve on:—

"Who hung with woods you mountain's lofty brow,  
From the dry rock who bade the waters flow.  
Not to the sky in senseless torrents tost,  
Nor in proud falls magnificently lost,  
But clear and artless pouring o'er the plain,  
Health to the sick and solace to the swain."

If his experience had extended to India, he would perhaps have substituted "Wealth to the soil" for "Health to the sick"; for we are accustomed in this country to hear doubts expressed as to the healthiness of irrigation, but never any as to its wealth-creating powers.

Time prevents my referring at length to the local benefits of forestry to agriculture in the case of the tracts classed as Minor Forests and Pastoral Areas in 1894. I would only say here that the greatest care is necessary in enforcing restrictions that tell against the interests of the often primitive populations in the neighbourhood of our forests. The man is to be envied who succeeds in getting these people on his side in making them realise that their own interests are bound up with the forests, and so securing their constant co-operation. That is the aim that should always be before us: It may be difficult of attainment, but it is being attained in fuller measure as our forests are developed and the needs and wants of the population are more fully studied and better understood. Liberal treatment to the people near the forests—as liberal as is possible with due regard to conservation—for the supply of grazing and of the many petty wants to which the forests minister—that is the policy that should be adopted. When it is a case of dealing with the agricultural population further off, then it may be the case that forestry best subserves the interests of agriculture by more purely commercial methods. We can give to the people in the immediate neighbourhood of the forests, liberal treatment on a scale that cannot be adopted for the agricultural population generally without risk of eventual ruin to the forests themselves.

Passing from these general remarks I now come to matters more closely connected with the work of this meeting. While it has been felt for some time that a Forest Board, such as that which has been doing such good work for agriculture, would prove most useful in developing forest policy, the actual initiation of this Board is to be found in the conclusions arrived at by an influential committee of Forest officers, who met at Dehra in March 1909 and passed a Resolution in which a set of rules for the guidance of work at the Research Institute was formulated for the approval of the Government of India. In that Resolution it was proposed that the programme of work at the Institute should be a triennial one, that all Conservators should be consulted as to the matters they would wish to see taken up, and that the programme should be approved by a Forest Board, consisting of representatives from all Provinces with the Inspector General of Forests at their head. This appeared to the Government of India to be an excellent proposal, and before they approved the suggested rules, they desired to hear what the Forest Board had to say about them. The chief subject with which the Board has had to deal at this, its first meeting, has no doubt been the programme and work of the Research Institute, which was founded in 1906 after long and strenuous efforts on the part of your late Inspector General of Forests, Mr. Eardley-Wilmot. Since then progress has been rapid, notwithstanding that work has been much handicapped by the fact that suitable buildings and laboratories are still not available, and that the demands of education have taken up much of the time of Research Officers. The education of Forest Officers, certainly of the Provincial, and also for some time to come of the subordinate, service, at any rate as far as Upper India is concerned, must be closely connected with the Research Institute. When the Institute was started it was intended, in the interest of research, that the education of the Rangers should be carried out chiefly by Provincial Service Officers, and no special arrangements were made for the training of men for direct appointment to the Provincial Service. This was, however, found to be unsatisfactory, and during the past year it has been necessary to employ two Imperial Research Officers, the Forest Chemist and the Forest Zoologist on educational work, Provincial Service Officers being appointed, temporarily, to carry on research work in these branches. It is recognized that this arrangement is only a make-shift and should not be allowed to continue, and I trust that the Forest Board will be able to put forward a reasonable proposal for dealing satisfactorily with both education and research. But I am unfortunately obliged to add the warning that we must cut our coat according to our cloth, and that at the present time the cloth at the disposal of the Government is somewhat limited.

As regards buildings there has been considerable difficulty in deciding upon the best site, and as to the most suitable form that the various buildings should take. I am glad to say that a definite and satisfactory policy has now been decided upon, and I have every hope that satisfactory buildings on a good and roomy site will be constructed with the least possible delay.

Notwithstanding these difficulties, the Research Institute can already point to a good record of progress. A very fine Herbarium has been got together, consisting of the old Saharanpore Herbarium, amalgamated with that of the Forest College. This has been well arranged and properly housed at Chandbagh, and will, it is hoped, prove one of the most valuable in India. The economic collections have been re-arranged and added to, and a good beginning has been made towards the formation of a representative collection of injurious forest insects. These collections have been gradually got together during the past 30 years or more, and many Forest and Research Officers, past and present, have contributed towards them. They cannot be properly arranged until the new buildings are ready for them, but they will form the nucleus of a valuable economical and entomological collection. A large number of investigations has been instituted, most of which must, from their nature, require some time for examination before reliable conclusions can be published. Of these may be mentioned the enquiry into the best method of treating the Teak forests of Burma so as to combine the benefits

of fire protection with satisfactory natural reproduction; the investigations into the determination of the height, diameter and volume growth of individual trees at various ages, the preparation of yield tables for the various important Indian species, and the enquiry as to the suitability of the uniform method of treatment for our Indian forests, and the effects of fire conservancy on the growth of the various grasses. All such enquiries must take many years to bring to a definite conclusion, but a good beginning has been made. Many enquiries of economic importance are in progress, such as the improvement in the manufacture of lac, the preparation of tannin extract from the bark and fruits of Indian trees, the antiseptic treatment of timbers, especially for railway sleepers, and the manufacture of wood and bamboo pulp for paper. Many important works have been published and more are in the press, whether in the shape of manuals for educational purposes, such as the Manual of Sylviculture, the Manual of Forest Botany by Mr. Hole, of Forest utilization by Mr. Troup, of Forest Engineering by Mr. Rogers, and the Revision of D'Arcy's Forest Working-Plans by Mr. Caccia; or giving the results so far as they have gone, of investigations undertaken, such as the many interesting publications on Forest Insects by Mr. Stebbing, the notes on the selection system in Indian forests, and on the collection of statistical data by Mr. Caccia, the publications on Indian Woods and their uses, and on the prospects of the match industry in India by Mr. Troup, the chemical treatises by Mr. Puran Singh, and the Forest Floras of Chota Nagpur by Mr. Haines. Many other useful publications have been issued, but I have perhaps said enough to show that the Research Institute is making excellent progress and that Mr. Mercer and the past and present research officers are to be congratulated on the results obtained.

There is one point on which I wish to lay some stress, this is the care that must be exercised before giving the results of your investigations to the public. There is a tendency in young Institutes to endeavour to justify their existence by premature publications of Research work, by premature I mean publication on insufficient data or before results have been proved to be commercially successful. The public is often critical and it is unwise to afford opportunities for adverse criticism. I would therefore impress upon you the need there is for caution before publishing results. "*Festina lente*" is an excellent motto to bear in mind especially as many investigations take years to carry to a successful issue.

There seem to me now to be three main points in which improvement is to be aimed at. First in the laying down of a definite line of research in each branch. So far I understand nothing very definite has been decided on as to the lines which research in Sylviculture and in the preparation of Working-Plans for instance should follow. This is a matter of some difficulty and it is one in which the deliberations and recommendations of the Forest Board should prove most valuable.

The next point is the co-operation of the Forest Department, as a whole, in the work of the Research Institute. There is some reason to fear that the Research Institute has not hitherto enjoyed the full appreciation and confidence of the Department in the work which it is carrying out. Demands for assistance and information made by research officers on local officers already fully occupied, are sometimes looked on as irksome addition to existing duties. But they are unavoidable if the Institute is to fulfil its purpose. The Institute must always be to a considerable extent dependent on local officers for information and support. Too much stress can hardly be laid on the importance of research work and on its influence on the treatment by forest officers of the important estates committed to their charge, and on the development of those estates on correct, scientific and practical lines. I look confidently to the Forest Board, drawn as it is from all provinces and likely to have so much influence in the management of the Institute, to secure the whole-hearted support of the Department for the work that is being done at Dehra, and to give the officers employed there useful guidance as to the most suitable and most practical field in which to employ their energies.

The third point is the question of the arrangements by which we can best enable the research officers to carry out the programme of research approved by the Board. At present we cannot look for large grants; the financial position is too unsatisfactory, but as it improves I hope we shall be able to employ a suitable staff to do full justice to the work both of the Institute and the College.

I do not propose on the present occasion to make more than a brief reference to the Dehra Dun Forest College, but it must of course always be closely connected with the Research Institute.

For the present the education of the Rangers required for the greater part of India must continue to be given at the College, special Imperial Instructors being appointed for them when possible. The classes are too large at present and we hope to be able to reduce them so that they should not exceed 40 in the near future.

There can be no doubt of the soundness of the opinion expressed by the Board of Control in 1909, that an entirely separate course of education should be organized for the candidates for direct appointment to the Provincial Forest Service. This service is being considerably improved in pay and prospects. In return it may be expected that a better stamp of men will come forward and the Government must arrange to provide them with the best education in forestry and allied subjects that can be given. The present idea which appears to me to be sound is to give these candidates a special two years' course at the Institute,

distinct from the College which will probably be reserved for the training of rangers. The Institute will be equipped with lecture rooms, museums and laboratories and will afford every opportunity for a higher forest training. There will thus be a distinct line drawn from the start between the controlling and subordinate services.

I have had many proofs of the value attached to the training given at the College here in forestry, and we may look forward to a time when the influence and importance of the two Institutions at Dehra will be still more widely recognised, and their value to the country still more thoroughly appreciated. It is research rather than training that is the principal topic before us to-day; but they must go together, and it is the training to which I would personally attach most importance at the present stage of development. It is an inspiring task to take part in fitting the youth of this land for an honourable career that opens out the prospect of doing much actual and practical good to the country, both in their every-day work and in the opportunities they have of explaining the beneficent objects with which the restrictions of forestry are designed, and so assisting in the creation of a public opinion that will facilitate the further progress that is essential. It is well to place your ideal high, and I see no reason why the Dehra Dun College and Institute should not hereafter take a high rank in the forestry schools of the world, and be a recognised centre of scientific forestry of which the whole Department may be proud.

#### THE INSPECTOR-GENERAL'S REPLY.

On the conclusion of Mr. Miller's address, Mr. Beadon Bryant replied as follows:—

"MR. MILLER—GENTLEMEN,—I believe that I am expressing the views of all present, and of the Forest Service generally, when I say that we are extremely gratified that the Hon'ble Member in charge of the Revenue and Agriculture Department of the Government of India has been able to come here to Dehra, and to be present at this meeting of the first Forest Board. It shows clearly the interest that the Government of India takes in the work that we Forest officers have to do, and encourages us to believe that that work is appreciated. We have, I am sure, all listened with much interest to Mr. Miller's address. I think he is correct in giving the Forest Service credit for a strong *esprit de corps* amongst its members. It seems to me that this may be due to the fact that our Forest officers have one main object before them throughout their professional career, *i. e.*, the conservation and proper treatment of the forest resources of the country, and that their strong belief in the vital influence that this conservation exercises on the general prosperity of the country has not always been shared by those in authority over them or by the community by which they are surrounded. Happily of recent years matters have much improved in this respect, and it is now, I am glad to believe, generally recognised by Government and by a large section of the public that the protection of the forests should be an essential feature of the administration of this or any other country.

If full advantage is to be made of our forests, they must be managed scientifically, and though continuous efforts have been made in this direction for the past 40 years, during which time a regular recruitment for India of officers trained in Europe has been in force, it must be acknowledged that our knowledge of silviculture, as it should be applied to our Indian species of trees, is still very defective. There are many unsolved problems in every branch of forestry waiting to be solved and on their solution depends, to a great extent, the future welfare of our forests, and the substantial increase of revenue which may confidently be expected from them. The formation of the Research Institute in 1906 was a notable step in the right direction and showed clearly the interest which the Government of India took in scientific forestry and the importance which they attributed to it. To-day we see Forest officers from all the provinces called together by the Government of India to discuss important forest questions, and in particular the work of the Research Institute; and this, which is I trust the first of many such meetings is, I think, a step in advance from which I anticipate a general improvement in the work of the Institute, and a more general sympathy throughout the Forest Service, and the country generally with that work.

"I may say that since the Institute was started, the staff have had a great many difficulties to contend with. They have been constantly and are still shorthanded. They have no proper accommodation for their laboratories, experiments and economic collections; they will be glad to know that their difficulties are recognised and that the progress made in spite of these difficulties is nevertheless considered satisfactory. They will be particularly glad that suitable buildings and a full staff may now be said to be in sight.

"I think we shall all agree in the three main points in which Mr. Miller considered improvement is to be aimed at. The Forest Board will recommend definite lines of research, and put forward rules for the conduct of work which will, I trust, amongst other matters, ensure the co-operation of the Forest Service, as a whole, in the work of the Institute. They will also recommend, for the sanction of the Government of India, the Imperial staff they consider necessary both for education and research, with assistants subordinate to that staff. As regards this latter point, I should wish to say that until a complete staff of specially selected officers is made available for teaching the Rangers and Provincial Service Classes, and until proper arrangements are made for filling the posts sanctioned for Research experts, success will not be obtained either in education or in research. Moreover a Research Officer, without

subordinates to carry out his orders, is like a captain of a ship without a crew. Without an establishment under them, they cannot do themselves justice and the programme of work approved by the Board cannot be carried out. Our demands will not be extravagant; and in this connection I would desire to remind the authorities that the Forest Department can show a net surplus revenue of some 120 lakhs of rupees, and I hold that the expense incurred on a full educational and research staff at Dehra is, in the long run, certain to result in a largely increased revenue; from this point of view alone, the Dehra College and Institute deserves liberal treatment. Gentlemen, I will conclude by again thanking Mr. Miller in the name of the Forest Service generally for being present at this Forest Board and for the interesting address he has been good enough to deliver to us."

## APPENDIX B.

Rules and Regulations defining the general scope of the work of each Research Officer, both educational and research, and the general lines on which such work is to be conducted at the Imperial Forest Research Institute, Dehra Dun.

### *I.—Educational.*

As a general rule no Research Officer will be employed on educational work in connection with the Ranger classes. The Instructors in charge, who should be Imperial Service Officers, are responsible for the lectures and practical work in camp of these classes, and for the formation of adequate sylvicultural, zoological, botanical and economic collections required for the practical illustration of the lectures given by them, although the advice of Research Officers regarding the formation and arrangement of such collections should be freely asked for and given. The educational duties of Research Officers will generally be confined to lecturing (including laboratory instruction) to the Provincial Service probationers, each in his own subject.

### *II.—Research.*

The main object of the work to be carried out at the Research Institute is to obtain results which will be of practical utility to Government and to the public; and it is of the greatest importance that this should be constantly borne in mind by all Research Officers. The investigations and experiments carried out will incidentally lead to additions to scientific knowledge but, important as these may be, it is the practical results which are of the greatest importance.

In all publications, therefore, the fullest practical details must be given. This is more especially necessary in connection with the commercial utilization of forest produce, in order that those interested may be able to judge whether it is likely to be profitable for them to invest capital in the industry dealt with in any particular publication.

### *III.—Rules for the conduct of Research Work.*

#### A.—GENERAL.

1. The programme of research work to be undertaken by the different branches of the Research Institute will be drawn up for three forest years at a time for all important subjects requiring protracted investigation and continuity of action for their elucidation.

2. One year prior to the commencement of every three-year period, each Research Officer will address all Conservators,\* asking them if there is any investigation they wish him to make during the coming three years' period. On receipt of their replies, each Research Officer shall draw up his periodical programme, indicating all the proposals which have been made by Conservators and giving full reasons for wishing to exclude any such proposal from his programme.

The programme must in all cases be drawn up in sufficient detail to clearly define each officer's responsibility in respect of every item of work, so that co-operation for a common end among Research Officers may be secured and duplication of work prevented.

These programmes and explanations will be submitted to the President, Forest Research Institute, who will place them before the Board of Forestry with his opinion. The Board will decide what shall be entered in the combined three-year programme. The programme, as approved by the Board, will be submitted for the sanction of the Government of India, and shall, when sanctioned, be circulated to all Conservators for information. These officers may, however, forward at any time suggestions regarding any investigations in the sanctioned programme, or may propose supplementary investigations to the President, who will be at liberty to lay such before the Inspector General of Forests; but no new item not approved by the Board of Forestry may at any time be introduced into the programme of work sanctioned by the Government of India without the Inspector General's sanction. The above does not preclude a Research Officer making any minor investigation (provided that the same does not interfere with his sanctioned programme) on any subject that may attract his notice when on tour or otherwise.

\* In provinces where there is a Chief Conservator, that officer will be addressed and not individual Conservators. Similarly, whenever the words 'Conservator' or 'Conservators' appear in these rules, they must be understood to mean the Chief Conservator in provinces where such an appointment exists.

Nothing in these rules is to be taken as precluding local officers from undertaking any investigations that they may wish to carry out. The results of such investigations may be published by the local officers direct, or at their request by the President of the Research Institute, subject to the sanction of the Inspector General of Forests. Notice of any investigation being locally carried out should be given to the President, with the object of preventing duplication of work.

3. The programme so sanctioned shall be binding on the officers of the Research Institute, who will be responsible for the actual execution of the work prescribed. They shall be assisted as far as possible by Conservators in the collection of necessary specimens and materials and the supply of all available local information. The work to be undertaken shall follow a definite sequence as laid down in the periodical programmes, and experiments once initiated shall be carried to a definite conclusion and the results published for the information of all concerned. If required to do so, the Research Institute will defray all charges in connection with the collection and supply of materials.

4. On the 1st January in each year, the President of the Research Institute shall submit to the Inspector-General of Forests a statement\* showing what has already been carried out in the sanctioned periodic programme, and what it is proposed to carry out during the coming forest year, together with proposals regarding the inclusion of additional items (see Rule 2 above). On the 1st July of each year, the President shall submit to the Inspector-General of Forests a revised annual programme prepared in the manner prescribed for the statement to be submitted on the 1st January, together with a programme of the tours proposed for the various officers.

This annual programme and the programme of tours shall, on approval by the Inspector-General, be circulated for information to all Conservators by the President, and special assistance asked for on their part where this is required.

5. Research work will be carried out by Research Officers and their assistants under their special orders, except in so far as they may be able to obtain assistance from local officers, whose services will be acknowledged in any publication that may issue.

6. With the exception of the Imperial Sylviculturist and Superintendent of Working Plans and the Imperial Economist, the most important duty of each Research Officer consists less in the collection and collation of information which already exists or which has been reported to him on the authority of others, and for the accuracy of which he can give no guarantee, than in the investigation of unsolved problems and in the discovery of new facts. At the same time all reliable available information should be got together and made full use of.

Each Research Officer is required to place permanently on record in any form, ledger or otherwise, which may be approved by the President, all useful information, observations and notes collected by him in the course of his investigations, and which must admit of his successor taking up the work at the point where he has discontinued it.

All data collected will be at the disposal of all Forest Officers. Conservators may call for any information they may require, and this will be supplied by the President so far as possible.

It is hoped that Conservators will communicate any matters of interest to the President.

7. The results of investigations will usually not be published until the investigation is complete. In the case of a protracted investigation, it will be permissible at any time to publish the results so far obtained.

8. If the advice of a Research Officer or his services for a short period are required by any Conservator, application should be made to the President who will endeavour to meet the Conservator's wishes in this respect.

9. Research Officers will be responsible for the upkeep of the Research Institute collections connected with their particular branch of work. These collections will always be accessible to Forest Officers and others, with the permission of the President, and Research Officers will give any help they can to persons desirous of inspecting them.

#### B.—SPECIAL.

##### *Sylviculture and Working Plans Branch.*

1. The main work of the Sylviculturist and Superintendent of Working Plans will come under one or other of the following heads:—

- (a) The study of the more important Indian trees and types of forest, with the object of determining the effects of various factors on their development and reproduction, and deciding on the best method of treatment to apply in order to secure a given object.—

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\*NOTE.—This is required for consideration by the Board of Scientific Advice.

- (b) The collection and collation of statistical and other data regarding the chief Indian trees and types of forest. The preparation of yield tables and the collection of data for fixing the exploitable size and age, as well as the possibility in forests under the different silvicultural systems.
- (c) The collection of information regarding the practical methods of preparing working plans with the object of ascertaining the best methods applicable in India, and the standardization and simplification of such work as far as possible.

2. In connection with the work detailed above, certain experimental areas and sample plots will be taken over or established, with the consent of the Conservator concerned, in such localities and in such a manner as may be necessary for the elucidation of any problem or for the compilation of statistical or other information. The actual upkeep and maintenance of these plots will rest with the Divisional Forest Officers concerned, care being taken not to throw any considerable amount of work on any one Divisional Forest Officer. The measurements and observations in such plots will be made by the Superintendent of Working Plans and his assistants. It is not intended that this rule shall interfere in any way with the upkeep of sample plots by local officers, which should be continued as heretofore.

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#### *Zoology Branch.*

1. The Zoologist is required to study systematically the effect, beneficial or otherwise, exercised by animals on the development and reproduction of Indian forests, with the object of discovering the measures which can be undertaken, with the greatest prospect of success, to encourage the development of useful species and to destroy those which are injurious. As insects are probably of most importance from a forest point of view, the Zoologist will specialise in Indian Forest Entomology.

2. The most important work of the Zoologist at present must be the formation of a good reference collection of insects of importance from a forest point of view, correctly named as far as possible and carefully kept up in the Research Institute. The system of classification in force at Pusa should be followed.

This collection should be extended by asking Forest Officers to assist by sending specimens, by collecting from outside sources and by exchange. Conservators will, if they desire this, be supplied with materials for collection for distribution to their staff, together with copies of printed instructions,\* all contributions will be welcomed and should be sent by the collector direct to the Forest Zoologist, together with an account of when and where obtained, damage done and any other interesting details that may be forthcoming. The name of the collector will invariably be recorded. All insects received should be placed in the collection at once and their receipt acknowledged.

A list of experts and specialists should be kept up, showing the group or family in which each specialises, in order that the Zoologist may know to whom to send insects with a view to getting them named.

3. The Zoologist should be in communication with experts in India and elsewhere, in order to obtain and afford information.

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#### *Botany Branch.*

1. The principal work of the Botanist and Mycologist consists of studying the botany, including the diseases, of forest plants of economic importance, and the factors that govern their distribution and their reproduction from a physiological point of view. The Botanist will not undertake the general systematic study of forest fungi, but he will study the life history of fungi which are exceptionally injurious to the trees of greatest economic importance.

2. The Botanist will not himself undertake the preparation of local floras. Such work must be left to local officers; but he will always be ready to assist local officers to the best of his ability, especially during his tours in any locality for which a flora is under preparation.

3. The Botanist will hold charge of the Research Institute Herbarium, and will maintain it in an efficient condition and endeavour to extend it and make it as complete as possible, especially as regards species of forest importance. This, together with the connected Botanical Reference Library, will always be available for reference by officers of the department and others obtaining permission from the President to inspect it; the Botanist will give any help he can to any officers who may visit Dehra for this purpose.

4. The Botanist will help officers of the department by identifying specimens to such extent as may be feasible, and by giving advice on general botanical subjects and on the most suitable lines to adopt for local forest experiments.

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\*NOTE.—Mr. Lefroy has kindly supplied specimen instructions,



*Economic Branch.*

1. The duty of the Economist is to make a special study of the best methods of rendering forest produce of all kinds available at such cost as will enable a trade in them to be possible, and to keep in touch with the commerce of India with the view of fostering and meeting the demands for forest products.

2. When an investigation has been sanctioned and taken up, a circular\* will be issued by the Economist stating the investigation to be made, the end in view and the assistance required from local forest officers, and including a summary of the existing knowledge of the subject.

3. No experimental work on a commercial scale will be carried out by the Economist. His duty will be to collect all possible information and place this at the disposal of all interested parties, either by publication or by letter. Should any experimental plant be erected by Conservators or others, the Economist's advice and assistance will be at their disposal to such extent as may be feasible.

*Chemistry Branch.*

1. The work to be undertaken will comprise chemical research work required for (a) the creation and improvement of the commercial demand for forest products, (b) the chemical research work required for the solution of various forest problems in connection with the food and nutrition of forest plants, the rotation of forest crops, etc., which may involve the analysis of soils, of plants, water-cultures and so on, as laid down in the sanctioned programme.

2. The Chemist and Assistant Chemist will work either jointly or independently as the President may decide. In the latter case, independent investigations will be assigned to each and the Assistant Chemist will then correspond direct with the President, with Conservators, etc.—and keep his files and cases separate from those of the Chemist.

3. The work of the Chemist and Assistant Chemist as defined in Rule 1 above is intimately connected with that of the Economist, Botanist and Sylviculturist, and should be done in communication with these officers. The periodic programme of the Forest Chemist shall be drawn up in consultation with the other members of the Research Institute who may require his assistance in their investigations. In cases of this nature, the results will generally form part of the publication of other separate investigations, unless for any special reason the President decides otherwise.

*IV.—Tours and Procedure.*

1. Research Officers may, with the approval of the President, pay visits to localities where they may require to collect information or study any particular problem, either in connection with their own investigations or in cases where local officers desire their advice or assistance.

2. When the initiation of an investigation has been approved, the President of the Research Institute will address the Local Government concerned in order to obtain their assent to any proposed tour, assistance in carrying it out, and permission for the Research Officer to conduct correspondence on the subject with the local officers. When such permission has been accorded, the Research Officer may, subject to any restrictions which the Local Government may in any case think it necessary to impose, correspond direct with Conservators in connection with such investigation. He may also, with the Conservator's special permission, conduct such correspondence direct with Forest Officers subordinate to the Conservator. The Research Officer will report to the Conservator the date of his actual arrival in the province.\*

3. The President of the Research Institute will correspond direct with the Inspector General of Forests in connection with sanctioned investigations. No official or demi-official correspondence with the Inspector General of Forests or the Government of India is permitted on the part of other members of the Research Institute. No files may be removed from the offices without the consent of the President.

4. The offices of members of the Research Institute will be inspected annually by the President, who shall embody in his annual report the results of his inspection.

\* NOTE.—In the case of a visit by a Research Officer to the Madras Presidency, he will acquaint the Board of Revenue with the date and objects of his visit, and will also report to that authority his actual arrival in the province.

**APPENDIX C.**

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**Programme of work to be carried out at the Imperial Forest Research Institute,  
Dehra Dun, during the three Forest years 1910-11 to 1912-13.**

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Programme of work to be carried out by the Imperial Forest Research Institute, Dehra Dun, commencing 1910-11.

Part I.—Investigations into certain matters connected with the Sal tree (*Shorea robusta*) by all members of the Research Institute.

Serial Number.	Subjects and details of investigations.	Officer by whom investigations will be carried out.	Localities in which investigation will first be taken in hand.	REMARKS.
1	The conversion of an irregular Sal Forest into a regular Sal forest, experiment to be carried out on a practical scale, a careful working scheme being prepared for the Thano Experimental area.	Sylviculturist and Superintendent of Working Plans.	Thano Experimental area, Dehra Dun District, U. P.	It is recognized that owing to the prevalence of frost in the Thano forest, it will be necessary to extend the experiment to other localities, where more favourable climate conditions exist, in order to obtain conclusive results.
2	Experiments to ascertain the best methods of ensuring natural regeneration of Sal; severity of cuttings to bring it about, and the degree to which young Sal will stand shade.	"	"	...
3	Methods of artificially cultivating Sal and assisting natural reproduction to be tested, and experiments made.	"	Thano Experimental Station, Dehra Dun, U. P.	The experiments under this head being carried out in Kheri Division, U. P., and elsewhere, will be visited and the results obtained there will be tested in Thano, as well as such other experiments as may suggest themselves. Other experimental stations may also eventually be started in Sal localities where special difficulties are being encountered.
4	The effect of age of tree on fertility and abundance of seed; the frequency of seed years; the effect of environment on the same.	"	"	Notes will be collected from all Sal forests visited, and reliable information obtained from other sources will be utilized.
5	Sal coppice experiments and fertility of coppice seed.	"	Gorakhpur Division, Gonda Division, and other U. P. Sal coppice areas.	

6	Investigation of effects of drought, fire, frost and grazing.	"	For drought and fire: Kheri Division, United Provinces. For frost : Siwalik Division. For grazing : Bahraich Division.	
7	Rate of growth of Sal :—			
	(i) Rate of girth and height increment in high forests.	"	(i) Siwalik Division ...	It will be impossible to obtain data applicable to the Sal region as a whole, and consequently it is considered that (i) at any rate should be left to local officers to investigate in areas in which the Sylviculturist is unable to take the initiative. The investigation as regards (ii) should be undertaken by the Sylviculturist.
	(ii) Yield Tables for Sal high forest and coppice.	"	(ii) Gorakhpur Division ...	
8	Thinnings in uniform Sal crops; the age at which they should be commenced; their intensity, and the proper density to be maintained in crops of different ages.	"	Wherever uniform crops are found in the United Provinces.	
9	Effect of subterranean water level and of geological formation (and soil drainage) on Sal development.	"	Kheri Division ...	It is hoped that this investigation in the Central Provinces, especially as regards geological formation, will be undertaken by local officers. <span style="float: right;">co</span>
10	Collection of notes and information regarding other matters relating to Sal, including the companions associated with it in natural forests.	"	"	
*11	The pollination of the flowers and distribution of the seeds of Sal. Description and illustration of fruit, seed, process of germination and the seedling.	Botanist	... Most of these investigations will be carried out at the Research Institute, short tours being arranged as required.	<i>Note.</i> —The items marked with an asterisk will first be taken in hand.
*12	Study of the conditions favourable and unfavourable for successful germination and early development. This will include among other things the determination of the most suitable physical conditions of the soil.	"	.....	For the purposes of these investigations analysis of soils selected by the Botanist will be carried out by the Chemist. The method of analysis to be adopted in each case will be decided by the Botanist and Chemist in consultation.

Programme of work to be carried out by the Imperial Forest Research Institute, Dehra Dun, commencing 1910-11.

Part I.—Investigations into certain matters connected with the Sal tree (*Shorea robusta*) by all members of the Research Institute.

Serial Number.	Subjects and details of investigations.	Officer by whom investigations will be carried out.	Localities in which investigations will first be taken in hand.	REMARKS.
*13	The dying back of seedlings and its causes. How does dying back interfere with the normal development of root and shoot, and does it induce decay in the mature stem?	Botanist.		
*14	Study of grasses characteristic of Sal forest with special reference to— (a) Preparation of descriptions and illustrations, enabling the various species to be easily recognised. (b) Their relation to Sal, their competitive action, excretion of poisonous substances, increasing damage by frost, etc. (c) Their value as indicators of soil suitable or unsuitable for Sal. (d) Their economic value in preventing erosion, as fodder plants and in other ways. (e) Effect of fire and grazing upon them. (f) Best method of propagating or increasing the proportion of the more valuable species.	„ ...	.....	This investigation is in progress.
15	Study of the diseases of Sal, whether caused by fungi or otherwise.	„ ...	Wherever found in Sal forests.	

<p>16 Technical properties of wood—</p> <p>(a) To carry out experiments with regard to the shearing, crushing and bending strength of wood of seedling and coppice origin, respectively; seasoned and green— (i) Grown in the hills, (ii) grown in the plains.</p> <p>(b) To test the fissibility of wood of seedling and coppice origin, grown in the hills and plains, seasoned and green— (i) Vertically and tangentially. (ii) „ and radially. (iii) Horizontally and tangentially. (iv) „ and radially.</p> <p>(c) The time taken for Sal to season under various conditions, and the best methods of seasoning, with special reference to the liability of the timber to crack, warp and shrink.</p> <p>(d) The specific gravity of timber of (i) seedling, (ii) coppice origin, grown at various altitudes and on different soils and aspects.</p> <p>(e) The relative properties of wood when felled at different times of the year.</p>	<p>Economist</p>	<p>... Research Institute and Sibpur Engineering College.</p>	<p>It is proposed to send the wood to Sibpur for testing, provided the Sibpur authorities can undertake the work.</p>
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Programme of work to be carried out by the Imperial Forest Research Institute, Dehra Dun, commencing 1910-11.

Part I.—Investigations into certain matters connected with the Sal tree (*Shorea robusta*) by all members of the Research Institute.

Serial Number.	Subjects and details of investigations.	Officers by whom investigations will be carried out.	Localities in which investigations will first be taken in hand.	REMARKS.
17	Durability— ... .. Investigations regarding— (a) The life of Sal timber when used (i) under cover; (ii) in the open; (iii) under water. (b) The life of Sal sleepers. (c) The effects of iron fastenings on Sal sleepers. (d) The effect of various antiseptic solutions on Sal timber.	Economist ...	.....	
18	Uses to which the products of Sal can be put— (a) Major, e.g. timber. (b) Minor, e.g., resin, oil, bark tanning extracts and fibre.	„ ...	.....	
19	The calorific value of wood when used as (i) fuel, (ii) charcoal.	„ ...	.....	

20	Supply of and market for Sal—			.....	
	(a) Enquiry as to the actual annual out-turn of Sal timber—			.	
	(i) from Government forests ;				
	(ii) from private forests, so far as the principal markets are concerned.				
	(b) General note on past and present prices of Sal timber.				
	(c) The available annual supply of Sal sleepers and the past and present prices of the same.				
	(d) Past and present prices of minor products, and possibility of improving the demand.				
	(e) Forecast of the Sal trade.				
21	The study of all insects which cause serious damage to, or which are beneficial to the Sal tree or its timber.	Zoologist	...	.....	<p><i>Note.</i>—With regard to Sal <i>insect pests</i> a considerable series of investigations have already been undertaken, and the results have been published or are under publication. The Botanist and Sylviculturist will be able to render considerable assistance in this study.</p>
22	A special enquiry into Sal bark tanning extracts	Chemist	...	.....	

NOTE.—It is recognised that the general restriction during the next three years of investigations regarding the Sal to the United Provinces may not be advantageous from the point of view of acquiring data applicable to this species throughout India, but, owing to the paucity of the staff sanctioned for the Sylvicultural branch of the Institute, it is considered that this cannot be avoided at present. As soon as the necessary staff is forthcoming investigations should be extended to Bengal, Eastern Bengal and Assam and the Central Provinces.



Programme of work to be carried out by the Imperial Forest Research Institute, Dehra Dun, commencing 1910-11.

Part II.—Investigations into various subjects by the officers of the Imperial Forest Research Institute.

Serial Number.	Subjects and details of investigations.	Officer by whom investigations will be carried out.	Localities in which investigations will first be taken in hand.	REMARKS.
1	<p>The Uniform and Group Methods of Working Forests. Enquiries will be made as to the suitability of these two methods, or modifications of them, in Indian forests.</p>	<p>Sylviculturist and Superintendent of Working Plans.</p>	<p>Forests under these methods of treatment, or which it is proposed to put under them, may be visited, <i>e.g.</i>, the Chir forests of the United Provinces, the Teak forests of Burma (Tharrawaddy and Mohnyin) and the Sal Forests of the Kumaon Division, United Provinces.</p>	
2	<p>Compilation of Statistics of Plantations of various species and enquiries, if necessary, into any difficulties met with in the propagation of any particular species, including an enquiry as to the best density to be maintained at different periods. This is in progress for several species, but before anything reliable can be published visits to many of the plantations concerned will be found necessary.</p>	<p>„ ...</p>	<p>The United Provinces.</p>	
3	<p>Investigation into the best Methods of Cutting and Working Bamboos. Detailed experiments will be carried out in specially demarcated plots.</p>	<p>„ ...</p>	<p>Siwalik and Ganges Divisions, United Provinces.</p>	

4	<p>The Cultivation of trees for the Growth of Lac Experiments, which have been commenced, will be continued with reference to the best methods of (i) preparing trees for the reception of lac and (2) working prepared trees in rotation.</p>	„	...	Siwalik Division, United Provinces	This will be carried out in conjunction with the Economist.
5	<p>Sylvicultural Notes on various Species ...</p> <p>The collection and collation of statistical and other data regarding the chief Indian trees and types of forest, commencing with Deodar, Pinus excelsa and Pinus longifolia. The preparation of yield tables and the collection of data for fixing the exploitable size and age as well as the possibility in forests under the different sylvicultural systems.</p>	„	...	The United Provinces	The progress of this enquiry must depend to a great extent on information communicated by local officers.
6	<p>Study of teak, including the factors favouring the rapid germination of the seed and the development of the young plant; the dying back of seedlings, the mode of origin of coppice shoots, the structure of young and old seedling and coppice plants and pollination of the flowers.</p>	Botanist	...	.....	A quantity of plants of various ages and of coppice shoots collected in various forests in the Central Provinces are now in hand. A preliminary pamphlet on teak coppice is in the Press and others will follow as the material collected is worked up. Germination experiments have also been commenced.

Programme of work to be carried out by the Imperial Forest Research Institute, Dehra Dun, commencing 1910-11.

PART II.—Investigations into various subjects by the officers of the Imperial Forest Research Institute.

Serial Number.	Subjects and details of investigations.	Officer by whom investigations will be carried out.	Localities in which investigations will first be taken in hand.	REMARKS.
7	Detailed systematic study and description of all forms of forest plants of economic value, when such is required owing to the commercial importance of the species and to the fact that the existing classification and description are unsatisfactory and confusing.	Botanist.		
8	The study of the fungoid diseases affecting the Blue pine in the Punjab and the Casuarina in Madras. Also of the spike disease of sandal in Madras.	"		
9	An Experimental Botanical Garden will be laid out and maintained in good order.	"	... Dehra Dun, United Provinces.	

10	Wood, Bamboo and Grass Pulp— (a) Woods, bamboos and grasses sui able for the manufacture of pulp, and the available supply.  (b) Suitable sites for factories.  (c) The financial aspect of the business.	Economist	...	India and Burma generally.	
11	To keep under observation and encourage the match business in India, which is already started but which is still not firmly established.	"			
12	Antiseptic Treatment of Woods— To carry out experiments with various antiseptic processes, with special reference to the use of important inferior species for Railway sleepers.	"			
13	Investigations into the physical properties and seasoning powers of various woods.	"	..	.....	For details see items 16 and 17 in Part I.
14	Enquiry as to the use of and the possibility of putting certain gums, resins and oleo resins on the European markets.	"	...	.....	In communication with the Reporter on Economic Products.
15	Investigations to be carried out with regard to the disposal of products obtained from the destructive distillation of woods.	"	...	.....	In conjunction with the Chemist.
16	Enquiry as to the commercial value of certain oil-seeds.	"	...	.....	In communication with the Reporter on Economic Products.

Programme of work to be carried out by the Imperial Forest Research Institute, Dehra Dun, commencing 1910-11.

Part II.—Investigations into various subjects by the officers of the Imperial Forest Research Institute.

Serial Number	Subjects and details of investigations.	Officer by whom investigations will be carried out.	Localities in which investigations will first be taken in hand.	REMARKS.
17	Investigations regarding woods suitable for— (i) Packing cases. (ii) Tea boxes. (iii) Opium chests. (iv) Paving blocks (v) Railway rolling stock. (vi) Carriage building. (vii) Harbour construction. (viii) Other miscellaneous purposes, such as pencils, pipes, hair brushes, fishing rods, veneers, cooperage, etc.	Economist.		
18	Description of the woods at present little known in the market— Yearly a number of woods will be examined and information collected on each species likely to prove of commercial importance, with a view to bringing them to public notice.	„ ..	.....	This work will be in continuation of a series of articles already published.
19	Resin tapping of conifers and enquiry into the possibility of improving the present system of distillation.	„ ..	.....	In conjunction with the Chemist.
20	Enquiry into the subject of useful fibres.	„		

21	Enquiry as to the use, if any, of Strobilanthes Spp., e.g., the flowers contain an oil.	Economist	...	.....	...
22	Enquiry as to the suitability of various tan barks, especially Terminalias and Oaks.	"	...	.....	In conjunction with the Chemist.
23	Enquiry into the best method of disposing of rosin, including the preparation of a list of the industries in which it is used, with the names of the firms engaged in these industries.	"	...	.....	...
24	Enquiry into the most profitable method of disposing of lac.	"	...	.....	In conjunction with the Chemist.
25	Preparation of a satisfactory reference collection of insects for the Research Institute.	Zoologist	...	.....	This collection should be confined to insects of practical importance from a Forest point of view.
26	Investigation regarding the lac insect	"	...	.....	This investigation will be carried out in conjunction with the Agricultural Research Institute at Pusa.

Programme of work to be carried out by the Imperial Forest Research Institute, Dehra Dun, commencing 1910-11.

Part II.—Investigations into various subjects by the officers of the Imperial Forest Research Institute.

Serial Number.	Subjects and details of investigations.	Officer by whom investigations will be carried out.	Localities in which investigations will first be taken in hand.	REMARKS.
27	Rusa grass oil, to study the causes of differences between the two varieties, Motia and Sophia, and the possibility of the conversion of Sophia-oil into Motia-oil.	Chemist ...	.....	In communication with the Reporter on Economic Products. <i>Note.</i> —These investigations will be carried out chiefly in the laboratory of the Imperial Forest Research Institute.
28	The commercial possibilities of the manufacture of Shellac by various processes (In hand.)	„ ...	.....	In conjunction with the Economist.
29	Distillation of <i>Blumea Balsamifera</i> on a commercial scale (In hand); and of <i>Cinnamomum glanduliferum</i> .	„ ...	.....	
30	Oil yielding forest seeds, their oil value and the determination of the constituents of various oils.	„ ...	.....	In conjunction with the Economist, and in communication with the Reporter on Economic Products.
31	Destructive distillation of Indian woods, including the manufacture of Ethyl Alcohol.	„ ...	.....	
32	Manufacture of decolourised Mangrove extract on a commercial scale.	„ ...	.....	
33	Decolourisation and clarification of Indian Colophony. (In hand.)	„ ...	.....	

34	Distillation of miscellaneous fragrant grasses, <i>e.g.</i> , khas oil, and the investigation into the properties of the essential oils obtained from them.	”	...	... ..
35	Examination of the resins of the principal conifers in connection with the production of turpentine.	”	...	.....
36	Investigation regarding the best season for the collection of myrabolams so as to obtain the greatest yield of tannin.	”	...	.....
37	Enquiry regarding collection and utilization of the milk of <i>Dickopsis Elliptica</i> .	”	...	...



## APPENDIX D.

*Letter No. 2298-15, dated 3rd December 1909, from A. M. F. Caccia, Esq., M.F.O., F.Z.S., President, Imperial Forest Research Institute, to the Inspector General of Forests to the Government of India.*

I have the honour to address you regarding the necessity of increasing the staff of the Imperial Forest Research Institute by the addition to it of an appointment to be held by a duly qualified Forest Officer or Engineer, who would specialize in *Forest Engineering*.

That the introduction of better and cheaper methods of transporting forest produce is a subject of the greatest importance, leading, as it does, to the working of areas and species hitherto untouched, will be readily admitted and it is quite impossible for any one who has not studied in detail the various systems and methods of forest transport in use in different localities to decide which would be the most suitable and the cheapest to adopt under any given set of conditions.

An expert in Forest Engineering would thus be of the greatest value to the Department generally, not only on account of the work he could do at the Research Institute in combination with the Forest Economist, in connection with all questions concerned with the economical exploitation of commercial products, but also on account of the valuable advice he could give local forest officers who might be desirous of introducing improved methods of transport.

That the Department generally recognises the necessity for such an officer will be seen by referring to the "Indian Forester," Volume XXXV, page 245, where a resolution passed at the Forest Conference held at Nagpur in 1908 is commented on in an editorial.

I have recently also received a letter from the Conservator of Forests, Punjab, in which he hopes that we may be able to give attention to this subject of transport at the Research Institute and it is believed that the Punjab and possibly also other Provinces have already approached you on this subject of obtaining the services of a specialist in Forest Engineering to give advice on local transport schemes.

2. The subject of transport would of course form only a portion of the duties of the specialist now asked for, as he would be required to deal also with buildings, wells, tanks, canals, erosion schemes, demarcation, etc., in so far as these are concerned with forest management. He would also give a course of instruction in his subject to the students at Dehra Dun.

3. I request, therefore, that you will, if possible, obtain the necessary sanction for this appointment.

*Editorial in the "Indian Forester" for May 1909, Volume XXXV, pages 245 et seq.*

## THE IMPORTANCE OF FOREST ENGINEERING.

We are well aware that it is very easy for any one to maintain that a certain appointment is essentially necessary for the progress of their Department, but it seems always to be a very difficult matter to obtain sanction for a new appointment, however obviously necessary it may be. The case in point is the appointment of an officer as Specialist on Forest Engineering—an appointment which we consider is, in the immediate present, perhaps more urgently required than any other special post in the Department, for while the existing research appointments are more concerned with future developments, the Forest Engineering expert is required to elucidate all the problems for the facilitation of the transport of our products, which would find a ready market now if we only knew how to arrange economically for their exploitation.

The necessity for such an officer has been recognised at the Forest conference recently held at Nagpur, where one of the resolutions passed was as follows:—(Resolution on the Allapilli Monorail Tramway, dated 26th November 1908). "II.—That this Conference agrees that the question of transport is one of great importance that has not received sufficient attention in these Provinces in the past. III.—That the appointment in these Provinces of a specially trained Forest Officer to enquire into the conditions and possibilities of divisions where the local officers consider the existing transport arrangements are insufficient or might be improved, is urgently required."

It seems needless to state that what applies to the Central Provinces, applies with still greater force to several other provinces where the forests are more valuable and the means of communication more backward.

At present, Forest Engineering is tacked on to the Economic Branch of the Research Institute. The officer in charge of that branch, if he is to carry out research work in order to

develop the economic resources of our forests, will have his time fully occupied and cannot possibly give the requisite attention to the development of forest transport. His work, too, must often be rendered more or less abortive, for even when he has found a suitable product for a particular use and a market could be developed, he has to reply in many cases, that though there are quantities of the product concerned in the forest, it cannot be taken out as there are no means of extracting it. We are assured that replies of this nature are the rule rather than the exception, and we are thus led to the conclusion that some action is necessary to improve matters.

Divisional Forest Officers cannot be expected to have all the knowledge necessary for laying out of tramways, monorails, wire rope-ways, and the like, and to be able to decide, without any experience to guide them, what form of transport is most suitable in each particular case. This is the work of an officer who can devote his whole time to the study of the subject. It would be his duty to keep up to date in transport methods, and advise officers on such projects. He might also be required to keep in touch with the firms who can supply the requisite materials for such works, so that accurate estimates could be drawn up.

In many cases, at present, the export from forests is limited to the most valuable species—often only one, because being so valuable it can be sold at a profit in spite of the crude arrangements for transport. If the most suitable means of transport were applied—as they could be if we had a fuller grasp of the subject—there would remain in our forests few products which would not find a market. The forests could then be worked in a much more regular manner, the industries of the country would benefit by the increased output of raw material, and the financial gain would also be considerable. In many cases, we are now tied down to the selection method of treatment, chiefly because only one species, or so, of the crop is saleable under present conditions of transport. Whereas, could a market be found for all the species of the crop, the introduction of a more regular system of management would render the exploitation of the timber easier and cheaper still. What we wish to emphasise is that there exists, at this moment, a vast quantity of produce of all kinds in our forests, which, under present conditions, we are not able to export, that suitable methods of transport are being applied in such cases in other countries, and that what we require is a special officer to study the subject and help the Department to apply suitable methods in India. We maintain that this is no uncertain goal to which we aspire, such as research in some other branches must often be, and that if a special officer is appointed to study the subject, we shall soon make enormous strides in the development of the rich resources of our forests.

#### Instances in which the services of a Forest Engineer could be employed with advantage.

##### *Bombay.*

1. Construction of a timber slide in Gund, N. D. Kanara, to enable teak logs to be transported to the Kaneri River, 2,000' below.
2. Improvement of the channels of the Kalinadi and Gungavali rivers in Kanara to facilitate the floating of logs. At present continuous floating is impossible, and much expense is incurred in taking logs out of the rivers, carrying them considerable distances and then relaunching them. Timber from four working circles, aggregating about 6,000 tons annually, is taken out by means of the above rivers.
3. Construction of either a canal or a tramline at the Kodibag Timber Depot at the mouth of Kalinadi in Karwar, Kanara, to facilitate the moving of logs; and of a jetty and crane to enable logs to be loaded into ships for export.
4. The construction of a ghat road from the Gund plateau to the Shirpur river, in Kanara.
5. The erection of a wire rope for the removal of fuel down steep slopes in forests included in the Khandala Working Circle, Poona Division.
6. Improvement of the channels of the Ambika river, Dangs, and the Vaiturna river, Thana, if found practicable, to enable the extraction of timber by floating to be carried on.

DEHRA DUN;  
6th April 1910.

}

G. P. MILLETT,  
Conservator of Forests, Northern Circle,  
Bombay.

##### *Madras.*

1. The tramway in the Mount Stuart Forests on the Anamalai Hills, Coimbatore District, has never worked to its maximum utility owing to being originally badly aligned. Its gradients are too steep, it is not very well laid and a far more favourable natural alignment could have been found. Its realignment is under consideration and in this connection the advice of an Engineer would be advisable.

2. The wire rope-way in the same forests has proved a financial failure owing to want of engineering knowledge in laying it out and erecting it. An Engineer's advice would probably have prevented this.

3. The timber slide in the same forests, which might very easily have been made a financial success never arrived at this stage owing to want of engineering knowledge, and possibly also owing to amateur engineers in the shape of Forest Officers substituting a wire rope before the slide had a fair trial.

4. There are numerous hill Forests in Madras which are unworked, except for bamboos, solely owing to difficulties in transport. In many of these cases probably the best means of transport to adopt is a rough cart road. Several of these are being cut but great delay is caused in obtaining sanction of estimates of more than Rs. 2,000 as the Government and the Board of Revenue generally refer the estimates to the Public Works Department for opinion and check. If there was an Engineer who first approved of the alignment this would be unnecessary. Suitable mechanical means of transport would also solve many difficulties in this connection.

C. E. Brasier,

*Conservator of Forests,*

*Central Circle, Madras.*

*The Punjab.*

*I. Sawmills.*—A proposal to establish saw-mills, to utilise some of the water-power of the Simla hydro-electric scheme, is likely to materialise, the proposals, which are almost complete, seeming to justify the scheme.

2. In this event it will be necessary to employ portable saw-mills in the high hills, and to work them by means of water power.

3. I have obtained what seems to be a suitable saw-mill, and it is now in Lahore; but I have had to get the Public Works Department to help me to erect it; this they have difficulty in doing, owing to press of other work.

4. Similarly, I have had to ask for their help in obtaining the water-motor required; I have done what I could, but my knowledge of the subject is insufficient to enable me to complete this part of the scheme.

5. In both these cases a Forest Engineer would have been of great assistance, and his services would have materially hastened the completion of the project.

6. Should the scheme prove to be feasible, it will be capable of great development, and the services of a Forest Engineer will be frequently required.

*II. Wire-ropeways.*—With the assistance of Mr. Percival a wire-rope-way has been ordered from England. In the absence of a suitable engineer in the department one of the conditions of purchase has been that the firm supplying the plant shall erect it and deliver it in working order. This has added materially to the cost, and this additional cost would have been saved had the services of a Forest Engineer been available.

2. Mr. Percival has also studied two other wire-rope-way schemes in the Punjab, both of which will probably be carried out. The Forest Engineer will be required again.

3. In connection with the saw-mills scheme, described above, it is certain that numerous small wire-ropeways will be required. The Forest Engineer will be wanted.

*III. Tramways.*—In the course of the next few years 90,000 acres of irrigation plantations will be inaugurated in the Punjab. These will require many miles of tramways to enable the produce to be extracted. Having in view the difficulties of obtaining animals to work the Changa Manga tramways, there is little doubt that some form of motor traction will be required for the new plantations. The services of a Forest Engineer will be invaluable.

*IV. Denudation.*—A strong committee, presided over by the Financial Commissioner, has just recommended the formation, in the Punjab, of a Land Improvement Board modelled on the lines of the existing Sanitary Board, to deal with the denudation question. An essential feature of the scheme is that an engineer must be placed at the services of the board. Should this proposed board not be inaugurated we shall have no engineer to assist the department in denudation works, and since it is on the department that the burden of the work must fall, the services of a Forest Engineer will be of great value.

C. P. FISHER,

*Conservator of Forests, Punjab.*

## CENTRAL PROVINCES.

*Berar Circle.*

1. Laying out of a proper system of cart roads for export of forest produce in the Betul Division.
2. Enquiry into scheme for laying down a tramway to allow timber and fuel in mixed teak forests of Punasa Range being brought down to the nearest railway.
3. Preparation of tanks for watering of cattle in forests.

*Southern Circle.*

4. Determination of most economical means of transport of timber in the North and South Chanda Divisions to allow of teak forests being worked at a profit.

*Generally.*

To study the question of extraction of timber and fuel with a view to decreasing the cost of carriage, which at present is too great to allow of the majority of the forests being worked at a profit.

NOTE—I am unable to enumerate all the work which exists for the Forest Engineer in the Northern and Southern Circles.

DEBRA DUN,  
The 4th April 1910. }

C. G. ROGERS,  
Conservator of Forests, Berar Circle,  
Central Provinces.

## BENGAL.

(Addressed to the Inspector General of Forests.)

The case as regards the appointment of a Forest Engineer is different. You are aware of the great importance of improved facilities for transport in the valuable sal forests of the Singhbhum District, and of the fact that it will be quite impossible for the Department to provide those facilities without expert advice and assistance. In the Darjeeling District, also, engineering works in the form of wire ropeways are bound to force themselves to the front within a few years. Very many tea gardens, the station of Darjeeling and the troops located in the District are mainly, and indeed often entirely, dependent on the Government forests for their supplies of timber, firewood and charcoal. I am convinced that we shall soon reach the point where we shall be compelled to replace the existing transport by carts, men and animals, by more modern and up-to-date methods. All works of this kind will involve expert assistance which will cost very much less to obtain if we are able to rely on an Engineer with expert knowledge of his profession as applied to Forestry.

G. S. HART,  
Conservator of Forests, Bengal.

*Eastern Bengal and Assam.*

Although I cannot say that there is any immediate necessity for such an appointment in the province of Eastern Bengal and Assam, it is quite likely that in the near future his services would be required, e.g., for making dams and other works on the Sirneswari river to render this river suitable for the extraction of timber from the Garo Hills. Possibly wire-ropeways and slides may be found advantageous in the hill forests of the Eastern Circle.

The advice of an expert engineer in our ordinary works (roads, buildings and bridges) would, often be sought if the services of such a man were available.

M. HILL,  
Conservator of Forests, Western Circle, Eastern Bengal and Assam.

## APPENDIX E.

Notes indicating the damage done to Forest crops by fungoid and other diseases.

*Burma.*

I think a Mycologist attached to the Forest Institute would be of little practical utility as far as Burma is concerned. I should say that our principal species, the teak, is singularly free from fungoid diseases. A cankerous growth has been noticed in a few plantations in the Katha District, but it appears to be very local. Of course there are many fungoid diseases which attack the Para rubber and we have the large plantation of it at Mergui, but there are so many people in the Straits and Ceylon who are interested in working them out and suggesting remedies that it is hardly necessary for the Forest Department to take action in the matter.

(Sd.) J. H. LACE,

*Chief Conservator of Forests, Burma.*

*Madras.*

1. During the years 1905 and 1906 between four and five hundred acres of casuarina plantations in the Nellore District were killed by this cause, while numerous groups of trees and scattered trees were killed by the same cause in the Districts of South Arcot and Nellore. It also attacked the plantations of private owners and did much damage. This fungus not only kills the tree but reduces greatly the calorific value of the wood as firewood. The wood so affected, instead of burning with a bright flame, only smoulders like an inferior firewood.

2. In nearly all the plain forests of the Madras Presidency, numerous undergrowth species are attacked with fungoid disease but *Randia dumetorum* seems more liable to it than any other. This species is killed in many instances by it. This is, however, probably due to the fact that the goat relishes the leaves and young shoots of this shrub probably more than any other, consequently the wounds caused by the daily browsing of the goat afford fruitful means of spread of fungus. Sheep also eat the leaves of this species.

3. The spike disease in Sandal, although not proved to be of fungoid origin, may be so and evidently requires close study by a Mycologist. The ravages caused by it are immense in Mysore and in the Coimbatore District and it is gradually spreading to the Salem and North Arcot Districts. It kills a tree in a comparatively short time after attack.

C. E. BRASIER,

3rd April 1910.

*Conservator of Forests, Central Circle,*

*Madras.*

*The Punjab.*

I. *Trametes pini*.—Thousands of acres of P. Excelsa forests are attacked by the *Trametes pini* in the Simla hills, and the attack is so serious that the areas affected are likely to be denuded of all tree growth, whereby the water supply of the Sutlej and Jumna rivers is likely to be seriously affected. We have spent much money in felling and burning thousands of trees in these areas, but some better way of dealing with the pest is urgently required. The Pusa authorities have given us what help they can, but they have not time to do much. A Mycologist is urgently required.

2. The *Trametes pini* now seems to be attacking the deodar, and Mr. Hole to whom I applied to identify the fungus has had to apply to Pusa for help. A Forest Mycologist is wanted.

II. *Unknown fungus*.—Many deodar are dying in Kulu from an attack by a fungus or a beetle. I have obtained help from the Lyallpur scientists; but they cannot send a man to study the pest on the spot, with the result that we have not yet found out the cause of the evil. In the meantime the attack is not being controlled, and is spreading. A Mycologist is wanted.

2. There are believed to be other fungi attacking the hill forests, but no study of them is feasible, and in the meantime they are very likely getting a hold of the forests from which it may be impossible to dislodge them. It is only too likely that this is happening considering how exploitation works, consequent on the more intense working, which has been in progress for the last few years, filling the forests with dead wood.

*III. Shisham fungus.*—In Changa Manga the existence of a fungus which attacks the *Shisham* has been known for ten years or so. It has not yet been identified, nor has any serious attempt at identification been made: consequently it has not been controlled. When there is a whole-time Divisional Forest Officer in Lahore we may be able to deal with it, obtaining help from Pusa or Lyallpur. In the meantime it is spreading, and may seriously affect the fixing of the crop rotation when the Working Plan is revised. A Mycologist is clearly wanted.

3rd April 1910.

C. P. FISHER,

*Conservator of Forests, Punjab.*

*Bengal.*

At the recent meeting of the Board of Forestry it was resolved that the main duty of future incumbents of the post of Forest Botanist should be the study of the diseases of forest trees rather than systematic botany. It is not easy to give instances how this would be of particular benefit to the Bengal Circle, for our valuable forests are comprised principally of Sal, Sundri and the numerous miscellaneous broad-leaved species of the Eastern Himalayas. No doubt these species all suffer to some extent from fungoid disease, but as far as I know no instance has yet been noticed of any general and dangerous attack, such as is common in the coniferous forests of Northern India. At the same time I am convinced that the view adopted by the Board of Forestry is correct. It is ridiculous that the Botanist should spend his time endeavouring to ascertain the exact number of different species of a genus which is, or may be, of no practical importance to Forestry in India, instead of studying the diseases which affect species of real economic importance.

G. S. HART,

*Conservator of Forests, Bengal.*

*Berar Circle, Central Provinces.*

*Fungus attacks to be investigated.*

1. *Fungus on Babul (Acacia Arabica).*—This fungus was reported to be doing a great deal of harm by Mr. Fernandez 6 or 7 years ago. At present the damage done is not very serious and does not seem to be on the increase.

2. *Leaf Mould on Teak.*—The leaves of the teak trees are in some localities (part of Betul and Melghat) covered with a white mould which must prevent assimilation and in consequence decrease the volume of wood formed annually.

NOTE—I do not know what fungi in the Northern and Southern Circles do serious damage.

DEHRA DUN ;  
4th April 1910. }

C. G. ROGERS,

*Conservator of Forests, Berar Circle,*

*Central Provinces.*

*Eastern Bengal and Assam.*

As far as I am aware there is not much damage being done to the forests of the province of Eastern Bengal and Assam by attacks of fungi, but it is quite likely that diseases due to fungi are in existence and should be investigated.

On general grounds and in view of the immense amount of damage that is being caused in other Provinces the appointment is I think fully justified.

M. HILL,

*Conservator of Forests, Western Circle,*

*Eastern Bengal and Assam.*

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PROCEEDINGS

OF THE

BOARD OF FORESTRY S/835

AT MEETINGS HELD AT

DEHRA DUN

BETWEEN THE

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24TH AND 29TH MARCH 1913,

WITH

APPENDICES.



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OF THE

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**Proceedings of the Board of Forestry at meetings held at Dehra Dun  
between the 24th and 29th March 1913.**

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*Introduction.*—This was the second meeting of the Board which was constituted as follows:—

- Mr. F. Beadon Bryant, C.S.I., Inspector General of Forests.—*President.*
- „ J. H. Lace, Chief Conservator of Forests, Burma.
- „ G. S. Hart, C.I.E., Chief Conservator of Forests, Central Provinces.
- „ F. A. Lodge, C.I.E., Conservator of Forests, Western Circle, Madras.
- „ J. Copeland, Conservator of Forests, Punjab.
- „ G. P. Millett, Conservator of Forests, Central Circle, Bombay.
- „ L. Mercer, President, Forest Research Institute and College.
- „ C. E. Muriel, Conservator of Forests, Bengal.
- „ M. Hill, Conservator of Forests, Northern Circle, Central Provinces.
- „ B. B. Osmaston, Conservator of Forests, Western Circle, United Provinces.
- „ A. V. Monro, Conservator of Forests, Western Circle, Assam.
- „ H. Carter, Conservator of Forests, Bihar and Orissa.
- „ W. H. Lovegrove, Conservator of Forests, Jammu and Kashmir.
- „ H. G. Billson, Officiating Assistant Inspector General of Forests.  
*Secretary.*
- „ G. E. S. Cubitt, Deputy Conservator of Forests, on special duty.  
*Joint Secretary.*

With the previous sanction of the Government of India, the following subjects were discussed by the Board:—

- I. The triennial programme of work of the Forest Research Institute for the period 1913-16.
- II. Certain amendments to the Forest College Admission Rules.
- III. The modification of rule III-A-2 of the Research Rules and Regulations.
- IV. Proposals for extending the scope of silvicultural research in provinces.
- V. The collection and tabulation of statistical data in the Silvicultural branch.
- VI. The position of the sleeper trade in India and the advisability of attempting to bring treated sleepers into more general use, thus extending the utilization of Indian timbers.
- VII. The possibility of introducing tan extracts on to the market.
- VIII. The future lines along which the enquiry into the destructive distillation of wood should be carried out, and the advisability of appointing a specialist for this purpose.
- IX. The centralization of forest economic research, and of the necessary establishment required to carry out this work in future.
- X. The utilization of forest grasses.
- XI. The scale of forest maps.

- XII. The work and training of Divisional Forest Officers.
- XIII. The syllabus for the separate two years' course for the Provincial Forest Service.
- XIV. The advisability of preparing local Floras, and the best way of getting this work done.
- XV. The working of road trains and mechanical traction generally, the success that has been attained, and the desirability of a further advance in this direction.
- XVI. The feasibility and desirability of eradicating lantana and prickly pear.
- XVII. The advisability of placing Revenue Officers on special duty in connection with the preparation of working plans.

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In addition, an interesting paper on the progress and prospects of the cellulose industry was read by Mr. W. Raitt, Paper Pulp Expert to the Government of India. Mr. Raitt sketched the progress of the enquiry, referred to the success so far attained, and gave figures showing the enormous annual increase in the consumption of cellulose, especially in the form of pulp for paper-making. He pointed out that paper must always be manufactured from nature's waste products in order that it may be produced sufficiently cheaply, and he predicted confidently that India, with its vast and almost untouched supplies of bamboos and grasses, would one day become one of the principal paper pulp producing countries of the world. He enumerated a long list of articles that could be manufactured from cellulose, and exhibited to the members of the Board a specimen of a material made from it named textilose, which could be produced exceedingly cheaply and was likely largely to replace jute in the manufacture of sacks. Mr. Raitt was thanked for his paper, which it is proposed to publish in the *Indian Forester*.

In opening the proceedings, Mr. Beadon Bryant expressed his pleasure at again presiding at the deliberations of the Board and reviewed the results of the meeting in 1910 which he considered satisfactory. The rules defining the scope and conduct of research work had been approved almost without alteration, while the triennial programme had been sanctioned and worked up to as far as possible. The separate two years' course at the Forest College for candidates for direct appointment to the Provincial Service had been introduced, and the appointment of a Forest Engineer had been recommended to the Secretary of State. It was true that the Government of India had been unable to accept the recommendation regarding the formation of a separate cadre for the Forest Research Institute and College; but still, with three exceptions, all the staff asked for had been sanctioned and for one of these exceptions, the appointment of a Forest Engineer, the views of the Government of India had undergone modification. Again the appointment of a retired forest officer as agent in England to push the trade in forest products had been suggested to the Secretary of State, while the proposal that selected forest officers should be allowed to visit the Research Institute for purposes of study had been brought into force.

## I.—Triennial programme of work at the Forest Research Institute for the period 1913-1916.

The programme submitted by the President,\* Forest Research Institute and College, was first considered by a sub-committee consisting of Messrs. Lodge, Mercer and Hart, with the assistance of the Research Officers concerned. The proposals made by the sub-committee were then considered by the Board in detail, and the programme as passed finally is given in Appendix A to these Proceedings. The only point that need be noted as regards the general discussion, was the expression of a decided opinion that in the past the work of the Botanist had at times been too purely scientific in character. With reference therefore to head II 2 (b) the Board desired to record its opinion that while enquiries now in hand should be completed, further investigations should be confined to species of real economic importance. At the conclusion of the discussion the following resolution was recorded:—

*That the triennial programme of work of the Sylviculturist, the Botanist, the Zoologist and the Economist, as passed by the Board† should be approved, but that no detailed programme is necessary for the Chemist, who should not, as a rule, undertake or initiate independent research, but who, under the general direction of the President, should assist Research and other officers asking for his co-operation.*

† Appendix A.

## II.—Forest College Admission Rules.

(a) Omission of the note under rule 19 regarding the physical test.

Mr. Mercer, in explaining the proposal, urged that the test was unsuitable and had to take place in unfavourable weather, and that candidates, who failed to pass the test, would be put to unnecessary expense and subjected to great and avoidable disappointment. Several members considered the period of preliminary practical training afforded ample opportunity to test the physical capacity of candidates and, after discussion, the following resolution was accepted:—

*That rule 19 of the Forest College Admission Rules should be deleted and the words "and physical fitness" added after the word "suitability" in the second line of rule 27.*

(b) Addition of the following to rule 21 (d):—

"and provided that they have not already gone through the rangers' course"

(c) Addition of the following to rule 24:—

"as a rule students who have already been through the rangers' course, will not be accepted."

The reasons put forward by the President in favour of these proposals were that the Provincial and Subordinate Services, are, or should be, recruited from two different classes of men, and that a ranger, even if capable of following and profiting by the Provincial Service course, would have to retrace much of the ground covered by his former training, so that some portion of the four years he would spend at the College would be wasted.

The discussion which followed showed that the members of the Board were averse to entirely restricting rangers from the possibility of joining the Provincial Service Course as they held that this possibility would be an incentive to good work. It was agreed, however, that as a general rule it was not desirable for

rangers to return to the Forest College, and the following resolution was recorded:—

*That the following addition should be made to rules 21 (d) and 24:—*

*“ as a rule those who have already been through the rangers' course at the Forest College, will not be accepted.”*

(d) Alteration in rule 30 so as to allow of the course be ginning in the middle of August instead of the 1st November.

(e) Alteration of “October” to “August” in the last clause of rule 31.

In support of these proposals Mr. Mercer pointed out that experience has shown that students cannot profitably be taken out for practical work in the field without at least two months' previous theoretical training, and that, if this theoretical training is to be given, November is too late for the first term of the course to begin. He considered that July 1st would not be too early for the course to start, but, in view of the little time available during the current year to notify the proposed change, he suggested the first September as the most suitable date for 1913.

Mr. Mercer's proposals were generally approved, it being noted that in several provinces less time would be wasted by candidates between the end of their period of preliminary practical training and the beginning of the College course. The alteration that would be necessary in rule 16 was also noted and the following resolution was carried:—

*That the Provincial Service Course should begin on or about the 1st July, except in 1913, when it should begin on or about the 1st September, the necessary alteration in the terms being made by the President of the College. As a result of these changes other dates effected should be altered as necessary.*

### III.—Modification of rule III-A-2 of the Forest Research Institute Rules.

Mr. Troup's\* letter No. 790-42, dated the 19th November 1912, was read and the Board concurring with the views expressed, passed the following resolution:—

\* Appendix B.

tion:—

*That the first paragraph of rule III-A-2 of the Institute Rules should be altered as follows:—*

*“One year prior to the commencement of every three years' period, the President, Forest Research Institute and College, will address all Conservators asking them if there are any investigations they wish to have made during the coming three years' period. On receipt of replies, the Research Officers concerned will be instructed by the President to draw up their periodical programmes, indicating all the proposals which have been made by Conservators and giving full reasons for wishing to exclude any such proposal.”*

### IV.—The extension of Sylvicultural Research.

Certain proposals put forward by the Sylviculturist were first considered by a sub-committee consisting of Messrs. Muriel and Carter, with the assistance of Mr. Troup. The Board then proceeded to discuss the findings of the sub-committee. It was at once agreed that provincial sylviculturists were yearly becoming more and more necessary, but the Board was unable to accept the suggestion that comparatively junior officers should be employed on this work, though it recorded the opinion that the officers selected should be changed as little as possible. It was also considered necessary to make it plain that while local sylviculturists should work in collaboration with the Research Institute, they should be under the direct control of the heads of the department in their own provinces.

An interesting discussion ended in the passing of the following resolution :—

*That the extension of sylvicultural research in the different provinces is a matter of great urgency, in view of its importance to the future working of the forests. Such research can be carried out only to a limited extent by local officers in addition to their own duties, and even then considerable loss of time and money may result through lack of continuity and duplication work. The Board is therefore strongly of opinion that, in provinces where this is feasible, local research in sylviculture should be carried out by officers specially detailed for the purpose. The Board also considers that in order to ensure uniformity, prevent duplication of work and take advantage of the experience already gained by the Sylviculturist in the conduct of research work, these officers should work under the supervision of the Sylviculturist, in so far as investigations entered in the sanctioned programme of the Forest Research Institute are concerned, while remaining under the direct control of Chief Conservators or Conservators in departmental matters. Finally, the Board suggests that the following proposals should be accepted and recommended to Local Governments for adoption :—*

- (i) *An Imperial Service Officer should be put on special duty in each province to carry out sylvicultural research work.*

*The main duties of such officers would be :—*

- (a) *To lay out sample and experimental plots and to collect statistics in the forest in the manner in which this work is done at Forest Research Institute.*
- (b) *In provinces where it may be considered necessary to maintain experimental gardens and carry out experiments in them.*
- (c) *To collect and tabulate such statistical and sylvicultural information as may be available in the records of circles and divisions of the provinces concerned.*
- (ii) *The emoluments of these officers, together with those of any staff employed by them, as well as expenditure on research work, should be paid by the provinces concerned.*
- (iii) *The work of these officers should be confined to, and primarily in the interests of, their own provinces, special permission however being accorded to visit other provinces in the interests of the work on which they may be engaged.*
- (iv) *The programmes of work should be arranged by Chief Conservators or Conservators in consultation with the President, Forest Research Institute and College, so as to fit in with the programme of the Sylviculturist, whose lines of work and methods should be followed to such extent as may be feasible.*

*Note.—Local Officers will be at liberty to undertake local investigations not entered on the Research Institute programme.*

- (v) *Provincial Sylviculturists should have full use of the libraries, files, and other records, laboratories, photographic branch and other facilities at the Forest Research Institute and should be allowed to visit Dehra Dun from time to time.*

- (vi) *The results of local investigations should be reported from time to time through Chief Conservators or Conservators to the Sylviculturist for record. When the local officers and the Sylviculturist consider that the results of any investigation should be published, it will rest with the President, Forest Research Institute, in consultation with the Chief Conservator or Conservator concerned, to arrange for their publication in such manner as may be considered most suitable.*

#### V.—The collection and tabulation of statistical data.

A paper on this subject\* by the Sylviculturist was first considered by a sub-committee consisting of Messrs. Muriel and Carter, assisted by Mr. Troup. When the question came before the Board it was noted that the officers who had so far replied to the reference made by the President, approved generally of the methods adopted and of the forms used at the Research Institute, though in certain circles (it was considered that conditions did not warrant the carrying out of some of the complicated measurements indicated, while in others it would be impossible to do much unless a special officer were appointed. After a short discussion, the following resolution was passed :—

\* Not printed as already circulated by the President, Forest Research Institute, in sufficient numbers for distribution to all Divisional Forest Officers.

*That the methods and forms adopted by the Sylviculturist after practical trial are generally suitable for the whole of India and should be commended to the notice of the Chief Conservators and Conservators for use in their provinces, with such modifications as local conditions may demand, copies of the forms used at the Institute being supplied by the President if required. The Board considers that ordinarily the conduct of volume measurements of forest crops involves work of too complicated a nature to be carried out, except by the Sylviculturist or officers specially detailed to work in co-operation with him; but that on the other hand work such as that connected with the measurements of individual trees, or of felled material, or of girth increments obtained from ring countings on stumps can, as in the past, be carried out locally. It is very desirable that particulars of all useful statistics so collected, and not appearing in working plans and other publications, should be furnished to the Sylviculturist to supplement the data recorded by him.*

#### VI.—The position of the sleeper trade in India and the advisability of attempting to bring treated sleepers into more general use, thus extending the utilization of Indian timbers.

In addition to the members of the Board, the following officers were present and took part in the discussion :—

Sir Robert Carlyle, K.C.S.I., C.I.E., Member of Council, Department of Revenue and Agriculture.

Sir Edward Maclagan, K.C.I.E., C.S.I., Secretary to the Government of India, Department of Revenue and Agriculture.

Mr. R. C. Dyson, Chief Engineer to the Railway Board.

Mr. R. S. Pearson, Forest Economist.

Previous to the meeting of the Board efforts were made by the Inspector General of Forests to collect information regarding the species suitable for the

production of sleepers after treatment, the annual supply possible and the cost, apart from treatment, of placing sleepers on the line of rail; but owing to the short notice given satisfactory information on these points could not be furnished. The Board considered such information as was available including a short note by the Inspector General of Forests (Appendix C). The discussion which followed was of considerable interest. In the first place the opinion was recorded that various species, but more especially *Terminalia tomentosa* (*Sain or Sāj*), *Pinus longifolia* (*Chil or Chir*), *Pinus Excelsa* (*Kait*), *Dipterocarpus tuberculatus* (*In*), *Dipterocarpus alatus* (*Kanyin*), Spruce and Silver fir, were likely to prove suitable if treated antiseptically. Again it was soon apparent that the Board held strongly that the railway authorities were not according to the Forest Department the same treatment as to foreign and colonial suppliers. Mr. Pearson stated that untested foreign wood had been taken, but that 25,000 treated dipterocarp sleepers offered by an Indian firm, which were stronger and should be just as serviceable as Oregon pine and would not require bearing plates, had been refused. He instanced, also, the admitted failure of the Australian hard woods, which had been laid down in large quantities. Mr. Dyson did not agree that foreign and colonial suppliers had received preferential treatment, and said that the question of what sleepers were used was largely a matter of price. He would like the Forest Department to go into the matter as a business concern and thought that the Railway Board would take annually from the Forest Department several lakhs of treated sleepers, either of dipterocarps or of any other species competing in price and quality with sal and deodar. He expressed the opinion also that the Indian railway companies generally would follow if the Railway Board led the way, though he did not see how tenders for these treated sleepers could be invited until something more was known of them. He preferred that sleepers should be supplied departmentally on the ground that the results were likely to be more satisfactory, though, as pointed out by Sir Robert Carlyle, he appeared to have no objection to purchasing sleepers through firms outside India. The Board represented to Mr. Dyson that the Forest Department had no staff to carry out the conversion and treatment of sleepers on a large scale and, moreover, did not desire to interfere with private enterprise. The department might, perhaps, arrange to test sleepers supplied to the railway by private firms in India, as regards the treatment applied to them, though the necessity for this was not clear, since supplies from abroad had to be tested by the railway authorities themselves.

Mr. Dyson disagreed with the statement that iron sleepers were unsatisfactory, and read a letter from a high official of one of the railway companies in support of this view. At the same time he admitted that wooden sleepers would always be required in large quantities for certain purposes.

After some further discussion the following resolution, which Mr. Dyson promised to lay before the Railway Board, was passed:—

*That the Railway Board should be asked to place the purchase of Indian and Foreign sleepers on the same footing. The Board of Forestry believes that there are several kinds of Indian timbers which, if treated, would be eminently suitable for sleepers, even without the use of bearing plates. The Board therefore recommends that the Railway Board be asked to accept treated sleepers of seasoned Indian timbers, such timbers being certified by the Forest Research Institute as mechanically suitable and the sleepers being supplied by Indian firms, or by departmental agency as the case may be, under the proviso that the process of treatment is one approved by the Forest Research Institute and guaranteed to preserve the timber from attacks by white ants.*

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### VII.—Introduction on to the market of tan extracts.

Sir Robert Carlyle, Sir Edward Maclagan and Mr. Pearson were present when this subject was brought before the Board.

In opening the discussion Mr. Pearson referred to his note on this question, which had been previously circulated to the members of the Board, and to the fact that the Secretary of State had been asked for the services of an expert who was likely, he hoped, to arrive in India in October next. The Board noted that the necessary information was being collected by Local Governments, and expressed the opinion that the expert should start work in Burma and subsequently proceed to such other provinces as may desire his services. The discussion then closed without any resolution being put, as it was considered unnecessary to take further action until the expert had actually arrived.

### VIII.—Destructive distillation of wood.

Sir Robert Carlyle, Sir Edward Maclagan and Mr. Pearson again took part in this discussion.

Previous to the meeting of the Board efforts had been made to collect information regarding the quantities of unsaleable wood available near fixed centres, the cost of transport, and the demand and prices for the by-products of destructive distillation; but the statistics which could be placed before the Board were far from complete.

Mr. Lodge drew attention to the fact that this subject was prominently before the Government of Madras some years ago, but that it was not considered the duty of the Forest Department to take the matter up, though it seemed unlikely that private enterprise would do so. Mr. Lodge pointed out, also, that all the acetone now required for the manufacture of cordite in India, is imported, and that at present India is entirely dependent on oversea countries for its supplies. He was convinced that a factory would pay handsomely, and suggested the formation of plantations of Eucalyptus, which species, especially when young, had been proved to yield large quantities of acetates. In this connection Madras G. O. No. 1883 of 27th July 1907, (Establishment of Charcoal Factory) and No. 1742 of 1st July 1909, (destructive distillation of wood) may be referred to.

Mr. Hart, with whom Mr. Pearson agreed, considered that for coniferous woods, the methods described in the Supplement to the "Scientific American" of December 7th, 1912, held out the greatest promise of success, as the quality of the rosin and turpentine yielded is said to be equal to that obtained by distilling exuded resin. In this connection it was noted that enquiries are now being made in America as to the possibility of utilizing in this manner the twisted Chir pine which is now quite useless and which is found so abundantly in Almora. At the close of the discussion, in the course of which some dissatisfaction was expressed that nothing was known by the Forest Department in other provinces of the enquiries made and the action taken in Madras, the following resolution was passed:—

- (i) *That in the opinion of the Board destructive distillation should find a place in the Economist's programme and that he should collect information as to the cost of bringing unsaleable wood, and possibly bamboos, to given centres, and as to the demand for, and current prices of, the various products and by-products of the process. The Board also suggests that if the information collected appears to offer a promise of commercial success, definite proposals should be placed before the Government of India for consideration as to the advisability of employing an expert to start the industry on a small scale.*

- (ii) *That when special enquiries into subjects of this kind, which are of general interest to the Forest Department, are undertaken in any Province, the results should be communicated to the President of the Forest Research Institute, and to the Chief Conservators and Conservators of other Provinces.*

### IX.—Centralization of forest economic research.

Sir Robert Carlyle, Sir Edward Maclagan and Mr. Pearson, Forest Economist, took part in this discussion which centered on the note prepared by the Economist and reproduced as Appendix D to these Proceedings. It was considered by some members of the Board that, if local Sylviculturists could be appointed without any of the disadvantages enumerated by Mr. Pearson, local Economists could be appointed with equal advantage; but Mr. Mercer pointed out that the bulk of the Economist's work was with firms and persons unconnected with the department, and that in the case of the Sylviculturist, objection (iii) did not apply. Mr. Lodge however stated that if the suggested local Economist were appointed in the Madras Presidency, it was intended that he should work in collaboration with the Economist at the Research Institute, confining himself to enquiries connected with Madras products only. He thought that the appointment of a local Economist would afford many opportunities for enquiries which want of time would keep out of the Imperial Economist's programme. Mr. Beadon Bryant considered that the question was not urgent and that any action which would prevent a Local Government from appointing Special Research Officers, when there was so much to be done, was to be deprecated.

The following resolution was then passed :—

*That in the opinion of the Board it is premature to consider the advisability of centralising or decentralising Forest Economic Research, but that, in consideration of the great increase in the Economist's work and the enormous field to be covered, it is essential that adequate assistance should be given in the Economic Branch of the Research Institute, and that at least one Assistant Economist should be appointed at once.*

### X.—The utilization of forest grasses.

The discussion of this subject was of unusual interest and was attended by Sir Robert Carlyle, Sir Edward Maclagan, Colonel Hallows, Director of Farms, Mr. McKenna, Officiating Agricultural Advisor to the Government of India, and Mr. Shiam Sunder Lal, Extra Assistant Conservator of Forests, Indore State.

A sub-committee consisting of Messrs. Millett, Lovegrove and Hill previously considered a note drawn up in the office of the Inspector General of Forests\*

\*Inspector General of Forest's Circular No 1-1-1 of 3rd January 1913.

on the efforts hitherto made to utilize fodder grass from forest lands, and the subsidiary reports received from the various provinces.

The discussion opened with a statement by Mr. Hill who summarised the information given in these papers and who placed the views of the sub-committee before the Board. It was noted that the utilization of grass for fodder is of greater importance in Bombay, Madras, and the Central Provinces than elsewhere, and that in these provinces the subject has already received much attention. In Bombay the sole right to cut and collect grass from certain forests has been given to a contractor on the condition that he shall maintain for Government a supply of 25 lakhs of lbs. of baled grass from the 15th April to the 15th October of each year. In Madras the people are slowly learning the value of cut fodder, and in 1911-12 the right to cut grass in certain reserves, in which hay has been made by Government in previous years, was sold at the request of the villagers themselves. In the Central Provinces the policy adopted is to cheapen the cost of cut fodder and to raise the grazing fees. In Assam and Burma, where the rainfall is usually

ample, and where grazing is not, as a rule, excessive, the question is not of great importance. In other provinces there are special difficulties, such as almost unlimited rights to grazing, which greatly hamper progress.

The question whether the Military authorities could not assist the Forest Department in this matter having been raised, Colonel Hallows explained that the railway freight on all military stores was uniform and that as this rate was considerably in excess of the ordinary freight for baled hay, grass could only be purchased at a strictly limited distance from centres of consumption. Colonel Hallows informed the Board, also, that in the grass operations carried out by his department, scarcely any baling was done by hand power, the press most generally used being Howard's improved "Lion" steam press. He further noted the great saving effected by feeding animals with chaffed hay in preference to long hay, especially in time of famine, stating that a 12 lb. ration of chaff was equivalent to a 20 lb. ration of long hay.

In the course of a discussion on the merits of stall feeding as compared with grazing, Mr. McKenna remarked that, speaking as an Agriculturist, he was doubtful whether the general introduction of stall feeding would be to the benefit of Indian agriculture. He considered that feeding experiments would be necessary to prove this.

After further discussion the following resolution was recorded :—

- (i) *That selected correspondence resulting from the enquiries instituted by the Inspector General of Forests in his Circular No. 1-1-1 of the 3rd January 1913, together with any other information of importance available from Local Governments, should be printed and circulated.*
- (ii) *That a given area will supply fodder grass of better quality and in greater quantity, when cut than when continuously grazed.*
- (iii) *That private enterprise is more likely to effect the object in view than operations undertaken by Government; but that departmental operations may be necessary in places to give a lead to private enterprise and to show the financial results of working.*
- (iv) *That the policy of "cheap grass and dear grazing" as followed in the Central Provinces, but modified to suit local conditions, is likely to lead to the best utilization of fodder grasses.*
- (v) *That the incidence of grazing in open areas should be carefully regulated, and every encouragement given to the extension of the area closed to grazing. In closed areas, grass cutting should be permitted at such seasons as will ensure a maximum annual yield, such areas being situated as near as possible to the centres of consumption.*
- (vi) *That the grazing of nomadic cattle should be confined to certain fixed areas.*
- (vii) *That improved communications are likely to lead to the extension of grass cutting operations.*
- (viii) *That the substitution of stall feeding for grazing which, from the point of view of forest administration, is much to be desired, is extending slowly in Bombay, in the Central Provinces, and in other places where favourable conditions as to supply and market obtain; but that the villager is not likely to take generally to stall feeding until higher grazing fees are imposed.*

- (ix) *That the storage of grass by Government is not desirable, except when considered necessary to meet the initial demand at a time of fodder famine.*
- (x) *That the question of transport, in regard both to railway freights and the supply of railway wagons, is a real difficulty. To encourage a more general use of cut fodder, low rates of freight and a steady supply of wagons at grass exporting railway stations are necessary. In order to reduce the demand for wagons, steam baling presses should be used in places where the outturn is large (say 2,000 tons) since steam pressed bales are only half the size of those of equal weight pressed by hand.*
- (xi) *That the preparation of grass stock maps, and the general enquiry suggested by the Forest Botanist (vide the Inspector General of Forest's Circular No. 1-1-1 of 3rd January 1913), should be left to the discretion of Local Governments.*

#### XI.—The scale of forest maps.

Sir Robert Carlyle, Colonel S. G. Burrard, C.S.I., R.E., F.R.S., Surveyor-General, Lieutenant-Colonel G. P. Lenox-Conyngham, R.E., Superintendent, Trigonometrical Survey, Major C. L. Robertson, C.M.G., R.E., and Lieutenant F. J. M. King, R.E., assisted in the discussion of this subject.

Under the orders conveyed in Inspector General of Forest's Circular No.  $\frac{7}{150-7}$ , dated 29th April 1910, the standard scale adopted for forest maps is 2" to one mile and the object of this discussion was to place on record the experience gained in Burma and elsewhere that this scale is too small for the purposes of the department. It was suggested by the Survey Office that enlargement of the 2" maps to the 4" scale, which would cost little, might be sufficient; but it was pointed out that the main objection to 2" maps was the lack of topographical detail and that enlargement would not render the maps any more useful for locating positions. Again it was urged that in Burma many additions had been made to reserved forests originally surveyed on the 4" scale, and that it was very advisable that these extensions should be mapped on the same scale. On behalf of the Survey Department, Colonel Burrard, stated that 4" maps cost twice as much as those on the 2" scale, but that the present rules did not emanate from the Survey Department, which was prepared to make maps on any scale that may be required, provided that the department concerned paid the bill. It appeared, however, to the members of the Board that as the 4" maps are admitted to be of use in the preparation of the 2" topographical maps, it was unreasonable that the Forest Department should bear the whole cost of forest surveys on the larger scale.

After some further discussion Mr. Beadon Bryant suggested that Local Governments should be asked to state what forests they wished to have surveyed on the 4" and 2" scales, respectively, and the following resolution was then passed:—

*The Board considers that in many cases the scale of 2" to 1 mile, now generally adopted for forest maps, is too small for the purposes of the Forest Department, especially in connection with such matters as the preparation of working plans or the laying out of forest roads. It is suggested, therefore, that Local Governments be asked to prepare a list of forest areas which they wish to have surveyed on the 4" scale, distinguishing between unsurveyed areas and those already surveyed on the 2" scale, and stating whether they desire any areas to be taken up in advance of the*

*Survey Department programme. The Board notes that under the present rules surveys on the 4" scale are special surveys and that the whole cost is debitable to the Forest Department in the provinces concerned; but as such surveys may subsequently be utilized in the preparation of the ordinary topographical maps, it is suggested that some portion of the cost should be borne by the Survey Department. The Board trusts that measures will be undertaken to expedite the preparation of such 4" maps as Local Governments may require urgently. A statement of the cost rates of 4" surveys so far carried out in the various provinces is appended.*

Average cost rates of Forest Surveys.

Province.	4" detail survey per square mile.	Triangulation per square mile.	Traversing per linear mile.
	Rs.	Rs.	Rs.
Bengal ... ..	60.8	4.4	20.2
Central Provinces ... ..	28.9	2.4	5.9
Punjab ... ..	27.0	4.3	3.6
Assam ... ..	90.8	6.1	28.7
United Provinces ... ..	30.3	9.3	7.0
North-West Frontier Province ... ..	29.4	2.9	...
Burma ... ..	118.6	7.8	39.5
Madras ... ..	82.5	7.4	16.7
Bombay ... ..	68.5	13.1	8.8

**XII.—The work of Divisional Forest Officers.**

Sir Edward Maclagan was present at this discussion.

The members of the Board, while admitting some of the defects brought to notice in Mr. Milward's paper (Appendix E.), were almost unanimously opposed to his proposals for remedying them. It was observed that Burma was the province with the greatest experience of sub-divisions and that here it was generally recognised that the system is unsatisfactory and is merely a makeshift pending the splitting up of the present unwieldy divisional charges. Mr. Lace pointed out that many of the sub-divisions exist on paper only, and that the appointment of officers on general duty under the Divisional Officer had been found to be far preferable to the appointment of Sub-Divisional Officers, who require a separate office and a distinct office establishment. Further objections raised to sub-divisions were the lessening of direct control by the Divisional Forest Officer over his subordinates, the increase in clerical work and channels of communication, and the delay and inaccuracy that arises therefrom.

It was admitted that divisional charges are frequently held by junior and inexperienced Imperial Service Officers; but it was held that as the senior

members of the improved Provincial Service would be fit to hold charge of divisions, this defect in forest administration would be obviated gradually.

As regards the suggestion for the grouping of divisions under a senior Deputy Conservator, the Board considered that this project had already been discussed and disallowed, while the proposal that senior officers should tour in adjoining divisions held by inexperienced juniors was thought to be inadvisable as it would lead to divided responsibility and control.

The following resolution was passed :—

- (i) *That in the opinion of the Board the system of sub-divisions has proved to be so unsatisfactory, that its extension cannot be recommended under any circumstances.*
- (ii) *That the suggestion to group minor divisions held by junior Imperial, or recently promoted Provincial, Officers under senior Deputy Conservators is tantamount to the formation of sub-circles, which was proposed several years ago and after thorough consideration by all Local Governments, was rejected as impracticable by the Government of India.*
- (iii) *That the proposal that senior Deputy Conservators should tour in adjoining divisions held by inexperienced juniors and advise and report on their work in addition to their own duties is also generally impracticable. The Board is of opinion that senior Deputy Conservators should, as far as possible, be employed in charge of the most important forest divisions, or of divisions the administration of which has become temporarily disorganized, or presents peculiar difficulties.*
- (iv) *That the remedy for the too early appointment of junior Imperial Service Officers to the charge of divisions is the building up of an improved Provincial Service Staff, the possibility of doing which depends largely on the judicious selection of candidates for training at the Forest College. The training of young officers of the Imperial Service was fully considered a short time ago, and instructions were issued by the Government of India. The Board considers that if these instructions are carried out, there is no need for any further action at present.*

### **XIII.—Syllabus for the two years' Provincial Service Course at the Forest College.**

In putting forward the syllabus of studies for the Provincial Service Course, Mr. Mercer pointed out a few alterations he had made in the syllabus originally submitted to the Inspector General of Forests in July 1912. A discussion arose as to the instruction to be given in forest accounts, Mr. Mercer pointing out that the new Forest Code, to come into force on the 1st April 1913, by abolishing many of the forms and thus permitting Local Governments to introduce what forms they pleased, removed the basis on which to found an accounts course. Consequently he was in favour of abolishing the accounts course altogether, on the grounds that students would have ample opportunity to learn accounts in their own provinces, where moreover a compulsory departmental examination in the subject had to be passed. Other members considered it would be unwise at present to make any drastic changes, as it was probable that Local Governments would still retain many, if not all, of the old forms. It was finally decided on the proposal of Mr. Beadon Bryant that the present accounts course should be maintained, modified to such extent as may be necessitated by the introduction of the new code.

\* Not printed, as it will be published in the next issue of the Calendar of the Forest College. *It was then resolved that the syllabus of instruction for the Provincial Service Course, as proposed by the President, Forest Research Institute and College, and as modified by the Board is satisfactory and should be approved.*

**XIV.—The advisability of preparing local floras and the best way of getting this done.**

Previous to the meeting of the Board, all Local Governments (except Bombay) were addressed by the Government of India, regarding the preparation of forest floras and were asked to compile descriptive lists as a preliminary step. The Board considered the replies to this reference, and a note on the subject (Extract-Appendix F.), compiled by the Forest Botanist, who was present. In the discussion which took place, Mr. Lace and other members of the Board expressed the opinion that descriptive lists, such as those proposed, would ordinarily be sufficient and were certainly as much as a forest officer should be expected to prepare. The writing of a complete forest flora was, in their opinion, work for a specialist in Botany. It was agreed that descriptive lists were urgently required, but a considerable difference of opinion was shown as to the areas to which such lists should apply. It was held by some members that the multiplication of lists would lead to unnecessary duplication of work, which might be a greater disadvantage than the elaboration of the keys which would arise from the inclusion in a single list of a large number of species, but on the whole the desirability of preparing the lists with simple keys was admitted. The following resolution was recorded :—

*The Board considers :—*

- (i) *That detailed forest floras are useful for purposes of reference and that their ultimate publication is an object which should be kept steadily in view.*
- (ii) *That the preparation of detailed floras is not of such urgent importance at the present time as is the preparation of descriptive lists.*
- (iii) *That the scope and general character of the descriptive lists, as detailed in paragraph 2 of Mr. Hole's note and in Sub-Appendices I, II, IV and V with schedule thereto, are generally suitable.*
- (iv) *That the preparation of descriptive lists should be undertaken in the various provinces, as soon as circumstances permit.*
- (v) *That it is desirable that the preparation of the lists should, as far as possible, be undertaken on uniform lines in all provinces.*
- (vi) *That the precise area to which each list should apply should be decided by Chief Conservators and Conservators in consultation with the Forest Botanist, subject always to the approval of the Local Government.*
- (vii) *That specimens of all species collected by officers who work on these lists and floras should be placed permanently on record in the Dehra Dun herbarium.*

**XV.—The working of road trains and mechanical traction generally. The success that has been attained, and the desirability of a further advance in this direction.**

Mr. Shiam Sunder Lall, Extra Assistant Conservator of Forests, Indore State, whose experience of the working of Fowler's road trains is considerable,

attended this discussion at the invitation of the Board. He stated that the train of this class in use in Indore worked at a loss, though he considered that better results would be shown on metalled roads. In some cases the working of the train had been found to improve the condition of metalled or black cotton soil roads : but on the other hand ordinary " kacha " roads were, as a rule, cut to pieces, the resulting dust getting into the working parts of the engine and causing much expenditure on the re-placement of parts. Other experience quoted was that obtained in Travancore, the Central Provinces, and Bombay (Kanara) where it had been found that these trains could not be worked regularly on forest cart tracks or " murrum " roads, that their use entailed heavy expenditure on the maintenance of roads and bridges, that the full load could only be carried under the most favourable circumstances, and that the practical difficulties connected with such matters as establishment, the supply of fuel and water for the engine, etc., were considerable.

In view of the above information, the Board recorded the following resolution :—

*That in places where they have so far been tried for the transport of forest produce, Fowler's road trains have proved economically unsatisfactory and are not to be recommended for employment elsewhere, without further experience of the working of the trains already in use in Travancore, Indore, Mysore, Bombay, and the Central Provinces. For the present the extended use of narrow gauge forest tramways is advocated. The mono-rail system is not considered satisfactory, but any other means of mechanical transport which appears likely to cheapen the extraction of forest produce, should be experimented with. The Board considers that development in the matter of mechanical transport is most important, but that such development must, to a great extent, depend upon the appointment of a Forest Engineer as recommended by the Board of Forestry in 1910.*

#### **XVI.—The feasibility and desirability of eradicating lantana and prickly pear.**

This discussion was attended by Sir Robert Carlyle and Sir Edward Maclagan.

When the Board had noted that injury to forest growth by lantana and prickly pear was confined principally to southern India, Mr. Lodge read a paper in which he detailed the conditions prevailing in Madras (Appendix G.). On behalf of Bombay, Mr. Millett endorsed Mr. Lodge's statements and added that attempts to utilize prickly pear as cattle fodder had been unsuccessful, though the outer skin and spines had been removed and the material left had been cut into small pieces and mixed with salt to render it palatable : cattle fed on it did not thrive and as a rule suffered from diarrhoea. Mr. Millett stated, also, that in Bombay lantana was rarely an absolute pest, and he quoted the opinions of some Divisional Forest Officers that this species might sometimes be useful to check fires, protect young trees from cattle, and bind the soil on hill sides. The Board, however, agreed with the President who was unable to accept the view that lantana might be useful for fire protection, and who instanced the conditions prevailing in Coorg. Here the lantana not only tended to oust every other species, but was itself very inflammable and so injurious to forest growth generally, that its eradication had been commenced. The opinion of the Board was that lantana and prickly pear should, in no case, be encouraged, and should, wherever possible, be eradicated. The expense involved being very great, it was recognized as important that there should, if possible, be some immediate return for the money spent.



The following resolution was therefore put and carried :—

*The Board considers :—*

- (i) *That as a general rule both lantana and prickly pear must be considered as enemies to forest growth and to all classes of cultivation, and that their eradication deserves the attention of all who have the welfare of the country at heart.*
- (ii) *That with a view to reducing the cost of eradicating these pests, steps should be taken by the Research Institute to ascertain if products of economic value, such as pulp or acetone, are obtainable from them. It is also considered desirable that the Agricultural Department should be asked to continue experiments as to the possible utilization of prickly pear for fodder. In Government forests where lantana or prickly pear are obviously injurious to forest growth, provision for their extermination should be included in every working plan; while in all tracts, whether under forest or not, where these species are serious pests, measures for eradicating them should also be undertaken.*

#### **XVII.—Advisability of placing Revenue Officers on special duty in connection with the preparation of working plans.**

Full details as to the working and utility of the system under reference in the Central Provinces are given in Appendix H. The Board agreed that it might be useful if this system was generally known, but, recognising that conditions vary largely in the different provinces, did not consider it necessary to recommend its adoption throughout India. It was therefore resolved :—

*That the system which obtains in the Central Provinces of employing Revenue Officers in connection with the preparation of forest working plans, should be brought to the notice of other Local Governments.*

The proceedings of the Board terminated with votes of thanks to Mr. Beadon Bryant for presiding at the meetings, and to Sir Robert Carlyle and Sir Edward Maclagan for attending so many of the sittings and for the great interest shown in the work of the Forest Department.

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**APPENDICES.**

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## APPENDIX A.

Programme of work for the Forest Research Institute for the period 1913-14 to 1916-17.

### A.—PROGRAMME OF THE SYLVICULTURIST.

#### PART I.—Investigations in connection with Sal (*shorea robusta*).

Serial No.	Subjects and details of investigation.	Locality of investigation.	REMARKS.
1	<i>Sylvicultural Systems</i> .—The application of the Uniform or Group Systems or modifications of them, to <i>sāl</i> forest.	(1) Thano forest, Dehra Dun ... (2) Other <i>sāl</i> tracts in different provinces ...	(1) A Working-Plan for converting the Thano forest into a series of evenaged coupes has been prepared and the effects will be watched. (2) Similar experimental working will be applied, and the effects watched, in other localities under different conditions.
2	<i>Natural regeneration</i> .—Experiments to ascertain the best methods of ensuring natural regeneration of <i>sāl</i> under different conditions.	(1) Already in progress in parts of the United Provinces. (2) Will be extended to <i>sāl</i> tracts in other provinces.	(1) These experiments will be carried out on comparatively broad lines in order to test the general effect of operations employed in practical sylviculture: The investigation is being worked out by the Forest Botanist for seedlings up to 2 years of age with a view to ascertaining the effect of various factors in influencing development or mortality.
3	<i>Artificial regeneration</i> .—Methods of cultivating <i>sāl</i> artificially.	(1) Initial experiment in progress at Dehra Dun. (2) Will be extended to forest tracts when sufficient experience has been gained from initial experiments.	

4	<i>Seed and seed years.</i> —Effect of age of trees and environment on production of seed and on frequency of seed years. Fertility of <i>sâl</i> coppice seed and quality of resulting plants.	Various <i>sâl</i> tracts in different provinces	...	(1) Much information regarding seed years has already been collected. (2) The effect of age of trees and environment on seed production has been studied during the past three years, and a note embodying results so far obtained has been published.
5	<i>Coppice.</i> —Experiments to find out the best methods of cutting and working <i>sâl</i> coppice.	Experiments already in progress in the Siwalik and Gonda Divisions, United Provinces. Will be extended to other localities.	...	
6	<i>External dangers.</i> —Effects of drought, fire, frost, grazing, suppression and other dangers.	Investigations have been in progress in the United Provinces. Will be extended to other provinces.		As in Serial No. 2. A note on the effects of drought has been published.
7	<i>Rate of growth and volume of production.</i> —The establishment of sample plots in representative <i>sâl</i> crops. Classification of different qualities of locality.	The work has been progressing steadily for the past 2 years in the United Provinces and will be continued in other provinces as far as time and staff permit.		Imperial officers as assistants are much needed in each province concerned to carry on this important work.
8	<i>Thinnings.</i> —The execution of thinnings in sample plots with the object of ascertaining the optimum density of crop under different conditions.	Ditto ditto.		Ditto ditto.
9	<i>Physical conditions.</i> —The effect of geological formation, drainage, subterranean water level and other factors on <i>sâl</i> development.	Already in progress, chiefly in connection with sample-plot investigations.		As in Serial No. 2. The Botanist is studying the effect of soil moisture in the experimental garden. The Sylviculturist will prosecute investigations based as far as possible on the Botanist's results, in the forest, particularly with a view to ascertaining (1) the time taken for <i>sâl</i> reproduction to establish itself and (2) the rate of growth and development of <i>sâl</i> , under different physical conditions.
10	<i>Miscellaneous.</i> —The collection of information on various statistical and sylvicultural matters connected with the <i>sâl</i> including a study of its more important companions.	Already in progress in the United Provinces. Will be continued in other provinces.	...	

A.—SYLVICULTURIST PROGRAMME.—contd.

Part II.—Miscellaneous Investigations.

Serial No.	Subjects and details of investigation.	Locality of investigation.	REMARKS.
1	<i>Sylvicultural Systems.</i> —The uniform and group systems of working forests, or modifications of them as applied to Indian conditions, will be studied in respect of various important species adapted to these methods of treatment.	Investigations already in hand in respect to forests of <i>Pinus longifolia</i> , Deodar, and oaks in the United Provinces. Will be extended as far as possible to the same species in the Punjab, to teak and <i>In</i> forests in Burma, and to <i>Pinus Khasya</i> in Assam.	
2	<i>Plantations.</i> —Compilation of statistics of plantations of various species, with a view to framing financial forecasts: enquiries regarding the best methods, culturally and economically, of raising and working plantations.	Completed so far for the Eucalyptus plantations in the Nilgiris, and in part for the teak plantations of S. Malabar. Will be extended as far as possible to all important plantations.	This work is of great importance financially, and the want of an adequate staff to carry it on in each province is much felt.
3	<i>Bamboos.</i> —Investigations into the best methods of cutting and working bamboos.	In progress for <i>Dendrocalamus strictus</i> in the United Provinces; will be undertaken in other provinces and for other species as far as time and staff permit.	
4	<i>Pollarding for lac cultivation.</i> —The pollarding of trees for lac cultivation, with a view to working them in rotation for the production of the maximum yield of lac.	In progress in the United Provinces.	

5	<p><i>Miscellaneous silvicultural investigations.</i>—The silvicultural characters of different species of trees will be studied both in the forest and in the experimental gardens, among other questions investigated being the manner in which germination takes place, the conditions most favourable for germination and natural reproduction, artificial regeneration including nursery treatment and transplanting, seeding and seed years, fertility of seed, rate of growth and other statistical information, susceptibility to frost, suppression and other dangers, and silvicultural characteristics generally. A special study in these respects is being made of the important conifers and oaks of the Himalayas.</p>	<p>A large number of investigations of this nature are in progress in the experimental gardens at Dehra Dun and numerous observations have been recorded in the forest, where experimental plots have been established in various localities. The scope of these investigations will be enlarged as far as conditions permit.</p>	<p>Assistance is much needed to carry on this work under different climatic conditions, since the number of species which can be dealt with at Dehra Dun is limited.</p>
6	<p>*<i>Natural regeneration of teak.</i>—Best means of ensuring this successfully and cheaply under different conditions.</p>	<p>Will be undertaken as far as conditions will permit in Madras, Bombay, Central Provinces and Burma.</p>	<p>*Enquiry suggested by Conservator of Forests, Western Circle, Madras.</p>
7	<p>† <i>Regeneration of forests of Picea Morinda and Abies Pindrow.</i>—Experiments to find out the most satisfactory means of effecting it.</p>	<p>United Provinces and Punjab                    ...                    ...</p>	<p>†Enquiries suggested by Conservator of Forests, Western Circle, United Provinces.</p>
8	<p>† <i>Artificial regeneration of deodar.</i>—The best and cheapest means of effecting it.</p>	<p>Ditto.</p>	

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A.—SYLVICULTURIST PROGRAMME.—*concl.*

Part II.—*Miscellaneous Investigations—concl.*

Serial No.	Subjects and details of investigation.	Locality of investigation.	REMARKS.
9	*Fire in <i>Pinus longifolia</i> forests: its possible use and the means of applying it for effecting natural reproduction.	United Provinces and Punjab.	* Enquiries suggested by Conservator of Forests, Western Circle, United Provinces.
10	* <i>Coppice experiments</i> .—The best height for coppicing miscellaneous species.	United Provinces.	
11	† <i>Pterocarpus santalinus</i> .—Enquiries regarding— (1) Rate of growth. (2) Effect of soils on girth increment and the formation of red wood. (3) Periods at which red wood forms and reaches its greatest development. (4) Exploitable age. (5) Effect of coppicing on production of red wood.	N. and E. Cuddapah Divisions, Madras ...	† Enquiry suggested by Conservator of Forests, Central Circle, Madras: details of the investigation will be carried out by local officers.

B.—PROGRAMME OF THE FOREST BOTANIST.

Part I.—Investigations into certain matters connected with the *sāl* tree (*Shorea robusta*).

Serial No.	Subjects and details of investigation.	Locality of investigation.	REMARKS.
1	<p><i>Study of the Oecology and Physiology of Sāl</i> with the object of discovering (a) the intensity at which the factors of soil composition, soil moisture, soil-aeration, temperature, air-humidity and light suffice to cause disease or death in <i>sāl</i> seedlings and (b) which are the dominant, or limiting, factors chiefly affecting the healthy development of <i>sāl</i> seedlings and the distribution of the species in nature and how these factors can be controlled.</p>	<p>United Provinces, Bihar and Orissa, Bengal, Assam, Central Provinces and North Madras.</p>	<p>In hand and will be continued. So far as the investigation deals with soil characters, the co-operation of the Forest Chemist will be necessary.</p>
2	<p><i>Study of the most important grasses found in Sāl forests</i>, with the special object of :—</p> <p>(a) Facilitating the identification of, and focussing attention upon, those species of most economic value by the publication of descriptions and illustrations.</p> <p>(b) Determining the value of the various species as indicators of soils especially suitable for the growth of different forest trees.</p> <p>(c) Discovering the best treatment to apply to the grasslands with the object of obtaining the maximum economic return from the grasses. This necessitates a study of their life history, of the development of the culms and of the effect of different factors such as fire, grazing, etc., on their growth.</p>	<p>Ditto ditto.</p>	



B.—PROGRAMME OF THE FOREST BOTANIST—*contd.*

*Part I.—Investigations into certain matters connected with the sâl tree (Shorea robusta).*

Serial No	Subjects and details of investigation.	Loca'ity of investigation.	REMARKS.
	<p>(d) Determining the influence of these grasses on the development of sâl seedlings.</p> <p>(e) Determining, when necessary in collaboration with other specialists, the economic value of the different species in improving the soil, preventing erosion, as fodder, and in other ways.</p> <p>(f) Determining, so far as possible with the assistance of local forest officers, the distribution and local vernacular names of the different species.</p>		

B.—PROGRAMME OF THE FOREST BOTANIST—*contd.*

*Part II.—Miscellaneous Investigations.*

Serial No.	Subjects and details of investigation.	Locality of investigation.	REMARKS.
1	<i>Study of the most important forests grasses, so far as opportunity permits, on the lines adopted for the grasses of sal forests.</i>	Cannot be indicated at present ... ..	Identification of grasses from Burma and elsewhere already begun.
2	<p><i>Systematic Botany.</i>—This will be continued with special reference to—</p> <p>(a) the identification of specimens for Forest Officers;</p> <p>(b) the systematic study of species and larger groups of forest plants with the object of enabling Forest Officers to distinguish clearly those forms of most economic importance from others of little value with which they are at present confused. The study of the following genera is now in hand and will be continued until completed; <i>Grewia, Xylia, Terminalia, Iseilema, Saccharum, and Anogeissus.</i> The study of other genera will be taken up as occasion requires. A study of the forms of <i>Acacia arabica</i> and <i>Cymbopogon Martini</i> is also in hand and will be continued.</p>	At Dehra Dun in the Experimental Garden and Herbarium, to be extended on tours; as a rule undertaken primarily in connection with other subjects.	Study already in hand.

B.—PROGRAMME OF THE FOREST BOTANIST—concl'd.

Part II.—Miscellaneous Investigations.—concl'd.

Serial No.	Subjects and details of investigation.	Locality of investigation.	REMARKS.
	(c) the description and illustration of those exotics likely to be most valuable in Indian forests with details of the conditions under which they are known to thrive and with the object of preventing waste of money on the introduction of unsuitable species, or on the cultivation of valuable species in unsuitable localities.		
3	<i>Disease of Pinus excelsa caused by Trametes Pini...</i>	Punjab ... ..	Study already in hand.
4	<i>Spike disease of Sandal ... ..</i>	Coorg, Mysore and Madras ... ..	Ditto.
5	<i>Preparation of a revised Botany Manual (including detailed systematic botany) for the students of Dehra Forest College.</i>	Dehra Dun ... ..	Ditto.

**C.—Programme of the Forest Economist.**

Serial No.	Subjects and details of investigation	Locality of investigation.	REMARKS.
1	A full enquiry into the uses, outturn, market value and mechanical and physical properties of <i>Cedrus deodara</i> .	Punjab and United Provinces ... ..	If the enquiry is completed within three years <i>Dalbergia Sissoo</i> will be taken up on similar lines.
*2	Utilization of grasses for pulp.		
3	Observation and encouragement of the bamboo pulp industry in India and Burma.		Further inspection of bamboo areas may be necessary.
4	Observation and encouragement of the match industry in India and Burma.		
5	<p><i>Antiseptic treatment of timbers:—</i></p> <p>(a) Best methods of treating railway sleepers, constructional timber, telegraph poles, and bamboos.</p> <p>(b) The preservation of tea shooks from insect attack while stored in the sawmills or tea-garden godowns.</p> <p>(c) The preservation of timber from the attacks of marine borers.</p>	Assam and Bengal ... ..	So far the enquiry has been confined to railway sleepers.
*6	<i>Tanning products</i> —To ascertain the tanning value of certain mangrove and other barks.	India and Burma.	Enquiry already in hand.

\* Under this head the specific requests made by forest officers have been noted and are receiving careful attention.

C.—PROGRAMME OF THE FOREST ECONOMIST—*contd.*

Serial No.	Subjects and details of investigation.	Locality of investigation.	REMARKS.
*7	<i>Destructive distillation of wood.</i> —Enquiries in progress to continue and new enquiries to be made as regards the commercial possibilities of the industry.		The appointment of an expert will probably be necessary after figures of price and outturn for certain localities have been obtained.
8	<i>Investigation into the physical properties and seasoning power of various timbers.</i>  (a) <i>Sál.</i> —Mode of seasoning and relative strength of timber felled at different seasons of the year.  (b) <i>In</i> and <i>Kanyin.</i> —Discovery of a simple method of distinguishing the two timbers.  (c) The best methods of seasoning timber ...	Dehra Dun ... ..  Ditto.  Ditto.	Already in hand.
*9	The finding of markets and new uses for certain timbers.	.....	The issue of bulletins describing the uses and sources and supply of important timbers should be continued.
*10	The uses and possibility of putting on the market of certain gums, resins, and oleo-resins.	.....	With special reference to <i>Boswellia serrata</i> .
11	The suitability of certain woods for packing cases with special reference to the following:—  (a) Bengal and Assam timber suitable for three-ply veneers for tea-boxes ( <i>Venestas</i> .)	Assam.	

	(b) Enquiry into the best methods of packing rosin at the Bhowali and Lahore factories.					
	(c) Central Provinces woods suitable for packing cement.	Central Provinces	...	...	...	Required by a large Bombay firm.
	(d) The cause of cheesiness in certain timbers used for tea-boxes.	Dehra Dun	...	...	...	In conjunction with the Forest Chemist.
*12	General enquiry into fibres, their value, and uses					
*13	General enquiry into the uses and value of oils obtained from grass, seeds, leaves and woods.	Dehra Dun	...	...	...	In conjunction with the Forest Chemist.
14	Woods suitable for :— (a) Paving blocks. (b) Railway rolling stock. (c) Railway keys. (d) Harbour construction. (e) Other miscellaneous uses.					Several of these enquiries are already in hand.
15	The best methods of distillation of pine resins and the finding of new markets for and grading of the finished products.	Dehra Dun, Bhowali, and Lahore	...	...	...	In conjunction with the Forest Chemist.
16	Observation of the Andamans padauk market.					

\* Under this head the specific requests made by forest officers have been noted and are receiving careful attention.

D.—Programme of the Forest Zoologist.

Serial No.	Subjects and details of investigation.	Locality of investigation.	REMARKS.
*1	The study of all insects which cause serious damage, or which are beneficial, to the <i>Sal</i> tree or its timber.	United Provinces, Assam and Bengal ... ..	This investigation will be continued.
2	Preparation of a satisfactory reference collection of insects for the Research Institute.		Will be continued.
3	Investigations regarding Lac insects ... ..	United Provinces, Central Provinces and Bombay Presidency.	These investigations will be continued.
4	Study of the bee-hole borer and the means to prevent or minimize the damage done by it to teak in Burma.	Burma ... ..	This and Lac are the most important of all the subjects to be investigated. It will be dealt with as soon as opportunity offers.
5	Study of the life-history of <i>Hypsipyla robusta</i> attacking Toon trees.	Kangra Division, Punjab ... ..	Already in progress.
6	Scale insects attacking Chir seedlings in Taini Tal Forest Division.	Naini Tal Forest Division, United Provinces.	
7	Insects attacking Chir and Blue pine in the Chakrata Forest Division, United Provinces.	Chakrata Forest Division, United Provinces ... ..	A preliminary study of these insects has been made. The investigation will be taken up later on.

8	Sisoo and Khair defoliators in Jalpaiguri ...	Jalpaiguri Division, Bengal ...	...	...	There is already more than enough work on hand and for this reason this subject cannot be dealt with immediately.
9	Sundri borer in the Sunderbans ...	Sunderbans Division, Bengal ...	...	...	Already commenced.
10	Study of the life-history and best method of combating attacks of defoliating caterpillars which are the cause of considerable injury to the teak. Aini ( <i>Terminalia Tomentosa</i> ) and Dhaura ( <i>Anogeissus latifolia</i> ) in Central Provinces.				As for No. 8.
11	Collection of information annually from every province of India regarding insects attacking principal timber-yielding species of the Central Provinces.				Information bearing on the insects attacking the chief timber trees is gradually being obtained by the Forest Zoologist for all provinces. It is dependent very largely upon forest officers sending in material.
12	Study of the life-history and best method of combating attacks of the beetle ( <i>Coelosterna spinata</i> ) on Babul in Berar.	Berar Circle, Central Provinces ...	...	...	As for No. 8.
13	Measures connected with the boring of teak seed by insects when on the tree.	Bombay Presidency (Central Circle) ...	...	...	Ditto.
14	Methods of exterminating the defoliating caterpillars in the Nimalbur Teak plantations.				Ditto.
15	Spike disease in Sandal wood ...				In conjunction with the Botanist.
16	Protection of seeds from insects when stored or freshly sown.	Dehra Dun.			

\* Under this head the specific requests made by forest officers have been noted and are receiving careful attention.



**E.—Programme of the Forest Chemist.**

The Forest Chemist will assist members of the Research Institute and other officers asking for his co operation as may be approved by the President. He is not as a rule to initiate independent investigations.

## APPENDIX B.

*From the Sylviculturist, Dehra Dun, to the President, Forest Research Institute and College, No. 790-42, dated the 19th November 1912.*

I have the honour to draw your attention to Rule III-A-2 of the rules defining the scope of the work of Research Officers, communicated in Government of India, A, April 1910, Nos. 20-36, F. 190-10. Revenue and Agriculture Department, Circular Nos. \*7-190-24-F, dated 24th April 1911, in which the following procedure is laid down:—

“ One year prior to the commencement of every three years' period, each Research Officer will address all Conservators asking them if there is any investigation they wish him to make during the coming three years' period.”

2. As the communications addressed by Research Officers in this respect are practically identical, I beg to suggest, in order to avoid duplication of work, as well as unnecessary trouble to Conservators addressed, that the communication in question be issued by the President, Forest Research Institute, on behalf of all the branches of the Forest Research Institute together. One triennial printed circular would then suffice in place of several different circulars.

3. If this suggestion be agreed to, then all that is necessary is an alteration of the rule quoted to the following:—

“ One year prior to the commencement of every three years' period, the President, Forest Research Institute, will address all Conservators, etc.”

## APPENDIX C.

## Steps advisable in order to bring Indian woods more into general use as railway sleepers.

During the last 20 years or so the requirements of the Indian railways for sleepers have increased enormously, and owing to the fact that the railway authorities do not willingly accept sleepers of any woods indigenous to India, except the half a dozen or so

Teak.  
Sal.  
Deodar.  
Pyngado.  
Nahr.

which are known to be the most suitable, the demand has not, for many years past, been fully met by woods from Indian forests. The available supply of these woods is insufficient to yield the number of sleepers required at the price offered, and, moreover, for the most part these woods will fetch a higher price as timber for building purposes than they will for railway sleepers. Recourse has been had to iron or pot sleepers of which many hundreds of thousands are now in use. These are unsatisfactory in many ways forming a rough and jolting road, knocking the roadway quickly to pieces, and damaging the rolling stock. Attempts have also been made to meet the deficiency by purchasing imported sleepers such as Jarrah from Australia, and creosoted pine from Norway, and even redwood from America. It is understood that the Jarrah has, in many

places, proved unsatisfactory, being liable to attack by white ants, and there seems no reason why the Himalayan pines, if impregnated, should not prove as suitable for sleepers as, and cheaper than, similar wood from Norway.

During 1910-11 more than 6 lakhs of sleepers were imported into India from foreign countries.

On the one side, therefore, there is a shortage of satisfactory wooden sleepers available in India for the Indian railways at a reasonable cost, and on the other there are a large number of woods in the Indian forests which are believed to be more or less suitable for sleepers, but which are not used and are allowed to go to waste. The Indian railways are not making the use they might of the indigenous woods of India, and the Forest Department is not taking advantage of the market which lies at its door. The Board is asked to consider how this may best be remedied, and how the so-called inferior species may best be brought into general use as railway sleepers.

F. BEADON BRYANT,  
*Inspector General of Forests.*

## APPENDIX D.

**Note as to the advisability of Centralising as against Decentralising Forest Economic work.**

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Owing to the ever-increasing amount of work to be dealt with by the Economic Branch of the Forest Research Institute, due to enquiries from, and help given to, the Department, companies and private persons, the staff is already unable to cope with the business which comes to hand. During the last 4 or 5 years the work has doubled and trebled and each year it is certain to expand along normal lines. It has already been found necessary as a temporary measure to add an Imperial Assistant to the staff, but this is a makeshift only and this assistance may, at any moment, be withdrawn.

Under the circumstances it is necessary to consider along what lines it will be most advantageous to the department to move, in order to cope with the normal expansion of work. It must, when considering the question, be remembered that the work of the Economist is more of a commercial nature than true research, his duties being to keep in close touch with the trade and be personally acquainted with firms interested in forest products.

The two ways of dealing with the subject are either to keep the work in a central place and to increase the staff as requirements demand, or to decentralise the work and establish local Economic offices. Both methods of procedure have their advantages and disadvantages which will be discussed separately.

In favour of a central office, the following points present themselves as worthy of consideration:—

- (i) Many of the subjects under enquiry and about which references are continually being received apply to all parts or to at least several of the provinces of India and Burma. As instances of this may be cited the manufacture of cutch and katha, the question of preparing tan-extracts, the antiseptic treatment of timbers, the pulp, match, pencil and tea-box enquiries, the destructive distillation of wood and the preparation of charcoal, etc. Were the work decentralised there would necessarily be endless over-lapping and repetition of work, while references to various local centres might result in absolute want of uniformity in the replies given. One reply might even be entirely different from another. This would tend to discourage the public and induce want of confidence.
- (ii) Again, even in the case of a product which is of considerable local but not general importance, such as, for instance, the rosin and turpentine industry or the preparation of rosha oil, the markets for such products extend over several provinces, so that were one local official interested in the business he would have to go to several other provinces to find his markets and get into touch with people interested in that particular business and by doing so he might clash with another local officer's work. This has actually occurred in the case of the markets for rosin and turpentine produced in the Punjab and United Provinces.
- (iii) A most important point in favour of keeping the work in one place is that by creating several Economic offices and decentralising the work, firms and persons wishing to make enquiries will either get confused as to whom to address, or will write similar letters of enquiry to several of the local officers, thus duplicating the work. This was found not infrequently to be the case before the appointment of Reporter on Economic Products of India was abolished. Even now similar enquiries are often made by firms, of the President of the Forest Research Institute and of the Economist at the same time.
- (iv) Another point in favour of keeping the work in one office is that the ledgering of information is greatly simplified, and duplication of work avoided. This is an important point.
- (v) Lastly, the question of expense must be considered. It is thought that it would be cheaper to keep the work in one office and increase the staff as necessary, than to keep up several local offices.

Against the advantages of keeping the work in one office there are several strong points in favour of decentralisation, as for instance:—

- (i) The subject is a very large one and covers many widely different industrial concerns. It might be argued with considerable force that no one man could possibly deal with them all.

- (ii) By having several local branches the work would be intensified, and the officers in charge would get into closer touch with both the local officers and firms.
- (iii) A local Economist would acquire a better knowledge of the forests within his jurisdiction than an officer working all over India and Burma, and also have a better idea of which products to push forward.
- (iv) A local Economist would probably be appointed from the province in which he had to carry out his investigation and so know, and be friends with, most of the forest officers with whom he had to work. The personal equation in forwarding many enquiries is one which cannot be over-estimated.

The first mentioned objection appears to be the strongest against centralisation. To overcome this in the American Forest Research Institute they have one Director of Forest Products, and working in conjunction with this officer they have appointed Specialists in fibres, in the antiseptic treatment of timbers, in the mechanical and physical properties of timber, in paper-pulp and in distillation products.

So far the Chemist and Economist have worked together as well as a Specialist temporarily appointed for paper-pulp. It is understood that it is contemplated appointing temporarily a Specialist in tan-extracts. The system of appointing Specialists from time to time to carry out investigations required in special subjects is, without doubt, a sound measure, though it would be preferable to appoint them permanently as is done in America.

R. S. PEARSON.

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## APPENDIX E.

## A few remarks on the work and training of Divisional Forest Officers.

Within the last few years a good deal has been done, by placing scientific work and inquiry in the Department on an organized basis, to assure progress in that direction. It is open to discussion to what extent our administration rests on a sound foundation in regard to the training and work of Divisional Forest Officers and whether with changing conditions it would not be the better for alteration and extension. This seems to me a proper subject for consideration by a Board of Forestry representative of the Department.

In putting together a few notes on the subject, in which there is probably little that is new, I shall confine myself mainly to the work of Deputy and Assistant Conservators, but the subject naturally affects the duties of Conservators on the one side and of the Provincial Forest Service on the other.

2. Among the points which call for notice are the following :—

(1) that practically every officer now in the Imperial Service has been trained in Europe.

Those who joined the Department in the eighties and early nineties will readily appreciate the change in the situation now.

(2) Casualties :—

Taking the classified list of Forest Officers of 1st July 1912 for Bengal Presidency only, a summary of European-trained officers may be conveniently made thus :—

Year of recruitment.	Length of service in years.	No. of officers recruited.	Died in service.	Resigned or transferred to other services.	Retired on pension.	Still in service.	Present posts of those in service.	REMARKS.
1880 to 1888 ...	24 to 32 ...	37	7	5	8	17	1 Inspector General of Forests, 3 Chief Conservators and President, 13 Conservators.*	Add 1 Conservator untrained to complete staff.
1889 to 1892 ...	20 to 23 ...	22	6	1	3	12	Deputy and Assistant Conservators.	Add 5 Deputy Conservators untrained to complete staff.
1893 to 1902 ...	10 to 19 ...	58	5	2	0	51		Figures for 1912 not available.
1903 to 1912 ...	under 10 ...	90	3	2	0	85		
Total ...	...	170	14	5	3	148	...	...

\* 1 new Conservator's post not accounted for.

The number of casualties among officers of the years below 1892, at any rate, is very small. The promotion of normally placed officers, now in the Deputy and Assistants' grades, to Conservators' posts is certain to be much slower than formerly.

(3) Scarcity of special billets in the Forest Department.

Special billets are few and do not seem likely to increase much in the next twenty years. The ordinary round of a Divisional Forest Officer's work will continue to occupy the energies of the great majority of the members of the Imperial Forest Service.

(4) Conditions of work in other Departments similarly constituted and comparison with administrative work in the Forest Department.

For an outside department we need look no further than the Public Works Department. It may be said to cover the whole country with a complete organization and establishment, so much so that with a "Division" corresponding to our "Division" there is a complete series of sub-divisions underneath, in charge of officers of the assistant grades and the Provincial Service, and each division in the Buildings and Roads Branch in the United Provinces has on an average 4 sub-divisions either for ordinary or special administrative work. I extract the following from a note kindly drawn up by an Executive Engineer of the Irrigation Branch, United Provinces. "An Assistant Engineer gets charge of a sub-division from 3 to 6 months after joining. He often officiates in charge of a Division for short periods within 3 years. Under present conditions he gets charge of a Division after about 6 years and officiates fairly continuously with occasional reversions to sub-divisional charge. He gets acting allowance only for this until he reaches executive grade. He is supposed to reach Executive Engineer's grade in 11 years.

"As regards powers and scope of work, the Assistant Engineer has no powers to speak of, in a sub-division. He cannot sanction any estimates. His work is to prepare plans and estimates and to supervise the execution of work. He has a good deal of out-door work and not much office work. In the Irrigation Branch he is very little in a station.

"The Executive Engineer or Assistant Engineer in charge of a Division has much more scope than a sub-divisional officer. He has a large establishment and has considerable powers of appointment and dismissal. He can sanction estimates for small works and in the Irrigation Branch he has considerable powers under the Canal Act in revenue assessments. He has much more office work than the Assistant Engineer and is usually able to spend a good deal of time in the station. But he has to tour at intervals all through the hot weather and rains specially in irrigation.

"The period of service before a man reaches Superintending Engineer's rank varies considerably with his qualifications and the state of promotion. It is generally from 21 to 24 years in these Provinces but in Bombay and Bengal I have noticed that it is much less. The Superintending Engineer has large administrative powers and can sanction estimates up to Rs. 2,500. He is on tour the whole of the cold weather and can spend the greater part of the hot weather in the hills." Thus in the Assistant and Executive Engineer grades an officer holds a sub-division for the first 6 years of his service, during which time he may be supposed to be getting training and experience and during the succeeding 15 or 18 years in the United Provinces or less in other provinces, he is in charge of a division. In the Forest Department the sub-division is, to all intents and purposes wanting. There are a few sub-divisions in Burma but not in any other provinces, and there is no system of sub-divisions even in the former. In the Forest Department little or no attempt seems to be made to *train* Assistant Conservators or officers promoted from the Provincial Service to hold divisional charge, *in their duties as Divisional Forest Officers*. Nor is any special use made of the experience gained by senior Deputy Conservators in charge of Divisions.

\* Our methods seem wrong and antiquated. It is as if we had at a public school, a VI (highest) and IV forms and no V and III forms. I ask—can

Conservators train their young Divisional Forest Officers under present conditions, and, still more, will they be able to do so in future? If not how do these learn their work? Does not the want of training account for a lot of mediocre work? Is there any other department where the youngsters are pitchforked into responsible positions after so little drilling in their duties?

On the other hand to keep men at the same work with hardly any variety or increase of responsibility for 20 or 25 years must stale their energy and retard general progress. Besides, physical vigour deteriorates and senior Deputies cannot be expected to do the same amount of physical work as the juniors. It seems imperative to introduce a general policy for giving more variety to administrative work and also to give the youngsters a sounder introduction to it. This latter requires more time devoted to it than Conservators are able to give, while unless the juniors are in administrative charge they learn nothing of administrative duty.

For the senior Deputies—our conditions of service are assimilating themselves to those on the Continent. There will be many good men who cannot hope to reach Conservator's grade in the future; those are men whom the Government should strive to keep in its service and among them will be probably not a few who, being more or less independent of their pay, will be easily able to retire on a 20 years pension if they lose interest in the forest life.

I would suggest that, failing a general policy of sub-divisions to which we shall probably have to come later, it may be found possible now to group some of the minor Divisions, which are held by junior Imperial Officers or by recently promoted Provincial Service Officers, under senior Deputies and there would be the additional advantage in this that senior Deputies probably more readily appreciate deficiencies in the upper and lower subordinate staff and can more readily correct and keep the latter up to the mark even than Conservators. This is as it should be.

Secondly where such grouping is not possible I suggest that experienced Deputies of the same Circle should be called upon to tour in adjoining Divisions held by inexperienced juniors and to advise and report on their work—this being in addition to their own duties. Such a system would be quite easy in those provinces where hill—and plains—Divisions adjoin each other. Conservators would probably be the first to admit their inability to devote sufficient time to actual inspection under present conditions. An annual inspection is insufficient for the Divisions in view.

Other senior Deputies who may be experts in special branches of administration might well be asked to visit outside Divisions to give special advice, and men should be encouraged to specialize. The walls of the rigid divisional system by which practically all inter-communication between divisional officers is barred should be broken down.

We seem to have outgrown the system which was suitable to the Department in its infancy. An expanding Department must look forward to future conditions. We need a continuous but elastic policy and one which will enable us to get the best out of each member of the staff. We need new ideas, suggestions and experiments in administration, as well as in the other more purely scientific branches of forestry.

R. C. MILWARD,

*Deputy Conservator of Forests.*

*31st December 1912.*



## APPENDIX F.

## Forest Floras and Descriptive Lists.

1. The question of Indian Forest Floras has been greatly confused, and the preparation of suitable books has been considerably retarded in the past by the fact that no attempt has been made to clearly define the exact nature of the publications concerned. Thus it has been customary, hitherto, to use the term *Flora* in a loose sense for various publications which differ very widely in the essential particulars of scope, function, time and knowledge necessary for their preparations, and cost of production. Clear definition of the publications concerned, therefore, is an essential preliminary to any profitable discussion of the subject, and in the writer's opinion it is necessary, at the outset, to sharply distinguish between a true *Flora* and what may be conveniently described as a *Descriptive List*. \*

2. Turning first to the subject of *Descriptive Lists* it is necessary to lay great stress on the fact that their primary object, which must override all other considerations, is to render the identification of all important forest species easy for all officers of average intelligence who may have no special knowledge of botany. In order to facilitate identification, it is essential that these lists should include full details of all reliable vernacular names in use in each division and simple keys based, as far as possible, on characters which can be recognised in the forest and which will render identification possible at different seasons of the year. The information which in the writer's opinion ought to be included in these *Descriptive Lists*, when complete, is detailed below:

(a) *Species to be included.*

All species should be included which are of special importance for the forest officer and which a competent forest officer ought to know or be able to easily identify. These are all indigenous trees, shrubs, strong climbers, bamboos and herbs of special economic importance (including important grasses other than bamboos). In addition, the principal non-indigenous trees and shrubs which are commonly cultivated in local gardens and avenues, or which have run wild in the area, ought to be included, on account of their possible importance in afforestation schemes and plantations. The non-indigenous species, however, might, perhaps, be conveniently kept distinct and placed in an appendix.

(b) *Introduction.*

This should contain a brief account of the locality dealt with, its soils and underlying rock, climate, the principal types of forest vegetation, and past and present systems of management.

(c) *Keys to the species.*

This is a point of the greatest importance. So far as possible all the four classes of characters given below should be employed in the keys throughout.

- (1) Habit, dimensions, bark, blaze, twigs, juice, buds and periodicity.
- (2) Leaves.
- (3) Flower and inflorescence.
- (4) Fruit and seed.

It should then be possible to identify the species at different seasons of the year (a) when leafless; (b) when in leaf, (c) when in flower, and (d) when in fruit. The precise arrangement of these keys and the question as to whether a single key based on one class of characters will suffice to lead direct to the species, or whether such separate keys should be constructed to lead up only to the family or genus with a final key in the species based on more than one class of characters, must depend on the area dealt with, the number of species included, and their special characteristics. The important principle, however, should be accepted that detailed botanical descriptions of orders, families, genera and species are not required and must be replaced by simple keys leading to the species by means of characters which require no more than an ordinary pocket-lens for their recognition and which can be made out in the forest. It should also be accepted as the primary essential of an efficient list that it should be provided with not less than 2 simple keys to the species, based on different classes of characters, so that a reader failing to use one key may find it possible to get the species from another. Each key could, of course, include two classes of characters, *i. e.*, one key might be drawn for flowers and fruits and another for leaves and habit, etc. Keys of the kind now alluded to have been employed by Dr. H. Marshall Ward in his *Trees* (1904-1908) where he has dealt with all the trees and shrubs indigenous in Britain, together with those which are commonly cultivated there. Very similar keys are now employed in America and elsewhere, *e.g.*, in *Trees and Shrubs of Minnesota State*, United States of America, by F. E. Clements (1912). In Sub-Appendix I to this note, extracts from the key based on leaf-characters, taken from Dr. Ward's *Trees*,

\* The writer recognises that the distinction here drawn is more or less arbitrary but there is no doubt that some such distinction is essential.

are given as an example of the kind of key required. \* In addition to the characters there employed such characters as the taste of leaves, their colour at different seasons, their colour when dried and others are of value in India and could be utilised in the key.

(d) *Vernacular Names.*

In the majority of provinces the vernacular names are of very great value for the identification of species, provided they are carefully tested by competent inquirers and provided the area dealt with is limited. In dealing with large areas, it is frequently found that one and the same name is used for quite different species which is apt to lead to confusion. All reliable vernacular names must, therefore, be recorded for every species with a note indicating the divisions in which they are current. These names would be entered in the text under each species. The dialect when known should also be included.

(e) *Description of Species.*

It has been noted under (c) above that detailed botanical description of the species is not required, but it would be an advantage to enter in the body of the list under each species, a few of the more striking characters selected from those employed in the keys. The advantage of this is that when the reader is guided by the vernacular name to a particular plant, the brief characters given there will indicate whether this species is correct or not. The periodicity, *i.e.*, period of flowering, fruiting, coming into leaf, and leaf-shedding, should in any case be noted here.

(f) *Habitat and Distribution.*

In the body of the list under each species, its local distribution would be briefly noted, with type of forest, kind of soil, nature of locality in which it is usually found and its chief associates.

(g) *Economic Uses.*

The local economic uses would be entered briefly under each species. In addition, brief reference should be made to other uses taken advantage of in other localities. This is advisable as, occasionally, the true value of a plant is not known in certain localities.

(h) *References.*

Reference should be given to Brandis' *Indian Trees*, Gamble's *Manual*, any detailed Local Flora of importance, *e.g.*, *Bengal Plants* by Colonel Prain, *Duthie's Flora* or *Cooke's Flora* and *Watt's Commercial Products of India*. Such references will indicate to the reader where useful information regarding each species, which has not been included in the list, can be readily found.

(i) *Key to principal woods.*

This should be included and might be placed at the end of the list, following the account of the individual species. Mr. Gamble on pages XVII and XVIII of his *Manual* has given examples of such keys, as he there remarks "in order that forest officers who may desire to do it may utilize them in preparing local keys to the woods of their locality. After much consideration, I came to the conclusion that it would be useless to attempt to make a general key, not only because it would be an exceedingly difficult thing to do for so many species, but because when made it would be of little or no practical utility. A key, to be of use in any given locality, should not be complicated with references to numbers of kinds not found or likely to be found there, but should be short and refer only to those species of importance which are likely to be met with. Consequently, in my opinion, local keys would be much more useful than a general one, and need only take in a few kinds of wood."

(k) *Sylvicultural and Oecological Lists.*

Concise list of the principal species arranged in order of merit according to their relative capacity to:

- (a) endure shade;
- (b) resist frost;
- (c) coppice strongly;
- (d) reproduce vigorously by root-suckers;
- (e) thrive in very dry habitats, *e.g.*, bare rocky slopes and plateaus and very dry soil;

\* In this key the metrical system has been used but in India for the present it is advisable to keep to the English system.

- (f) thrive on water-logged soil;
- (g) thrive on land-slips and on shifting sands ;
- (h) grow rapidly during youth;
- (i) resist fire-damage ;
- (k) resist damage by grazing.

These lists are of great importance to the forester both in his every day routine work, and also in special schemes of afforestation and they should be included after the key to the woods. The number of lists which is advisable will naturally depend on the locality dealt with, thus (b) would not be required where frost is unknown, and (c) would be of little value in a circle where there is no coppice management. As an example of the kind of list which is here alluded to, a sample is included in Sub-Appendix II. This is a tentative list of species arranged according to their susceptibility to frost damage which was drawn up by the writer chiefly from observations made in the Jubbulpore Division of the Central Provinces. Such lists even when incomplete are of considerable practical value when drawn up for limited areas, and they can be easily and quickly prepared after a little careful and systematic study in the forest.

(l) *Glossary.*

A short glossary giving the meanings of the technical terms used in the list, should be included.

(m) *Index.*

There should be one index to scientific names and a separate index for vernacular names.

(n) *Maps.*

It would be an advantage if a map of the locality could be included showing, by colour washes, the distribution of the types of vegetation mentioned in the introduction as well as separate maps showing similarly the distribution of a few of the most important local species.

From what has been said above, therefore, it will be seen that the fully completed *Descriptive List* will form a convenient pocket-book which, by means of vernacular names and simple keys, will render easy the identification of all important species and which, by means of its introduction, sylvicultural lists and maps, will enable a forest officer new to the locality to rapidly obtain a knowledge of the nature and distribution of the local forest vegetation and of the chief characteristics of the principal species. In other words he will at once be able to start his work on a basis of knowledge which under present conditions can only be laboriously acquired after years of observation and study \*

3. If now it is accepted that we ought to aim at producing *Descriptive Lists* which shall contain the information detailed in the last para. it is clear that each list can only deal with a comparatively small area and, therefore, with relatively few species. With an increase in the number of species, the keys on which identification depends will become increasingly difficult to prepare and difficult to use. It should also be noted that, these lists being relatively small and cheap publications, overlap and duplication of work are of comparatively little importance in their case, and such considerations must not be allowed to override the primary essential of making each list efficient and easy to use for the identification of plants. In the writer's opinion, as a general rule, a list should not deal with a larger area than that of a single Conservator's Circle, and it may frequently be advisable to sub-divide a circle, e. g., in Bengal. The question has been raised as to whether such lists should deal with botanical or political and administrative areas. This has been fully discussed by Colonel Prain in *Bengal Plants* I. pp 1-5 where it is clearly shown that "the best system to adopt, because the most practicable, must be one that is based on a frank recognition of existing political frontiers, no matter how unscientific these may be." Where it is advisable, therefore, to sub-divide a circle, the area included in each list should be defined so far as possible by the boundaries of one or more Forest Divisions or Civil Districts.

4. As compared with a *Descriptive List*, a typical *Forest Flora* should include "all that is known regarding the internal structure, the marketable products, the mode and rate of growth, the biological features, the sylvicultural requirements, the treatment in the forest, and the insect and fungoid enemies of the different species." (See Brandis' *Indian Trees*, p. vii.) A *Flora*, therefore, should constitute a complete and detailed book of reference for forest officers, and in fact approximates in character to what would be produced by amalgamating in a single work such information as is contained in Brandis' *Indian Trees* and Gamble's *Manual of Indian Timbers*. The botanical descriptions in a *Flora* should be detailed and sufficient to distinguish each species from all other nearly-allied

\* Nothing said above is intended to prejudice the publication of a list in an incomplete preliminary form. Such will, indeed, usually be advisable, but it is necessary to bear the complete scheme in view so that the information required can be steadily and systematically collected.

plants, and should suffice for the identification of more or less incomplete material. These descriptions also should be supplemented by illustrations. The information under the other heads of diseases, silvicultural requirements and economic uses should similarly be complete. Owing to the detailed nature of a *Flora*, extensive expert knowledge, a relatively long period of time, and considerable expenditure are necessary for its production. In the case of such a work, therefore, it is advisable to deal with a fairly large area with the object of reducing overlap and duplication of work, as far as possible. As a general rule, such a book should probably not deal with a smaller area than that of a single province, and in some cases it may even be advisable to group together two or more provinces. The primary object of a *Flora* being to serve as a complete book of reference, its size is a question of minor importance. Owing to the large number of species dealt with in a *Flora* and to the quantity of detail which must be included in it, it is impossible to provide it with short and simple keys and it, therefore, becomes more difficult to use for the purpose of identifying species. Such a book, therefore, while being essential for reference purposes, only partly meets the urgent requirements of the Department in respect of a publication which shall render the identification of all important species easy for all officers of ordinary intelligence.

5. Finally, the preparation of such a book should not be undertaken until the material collected for it is sufficiently complete to justify the hope that the book will not become quickly out of date, thus necessitating early additional expenditure on a revised edition. It is not generally realised that our knowledge of Indian forest vegetation is still very incomplete, and that all detailed Floras published under existing conditions rapidly become out of date. In Sub-Appendix III\* to this note is given a list of all Indian species of trees, shrubs, strong climbers and bamboos (exclusive of grasses) either new to science, or at all events new to India or Burma, which have been published up to date since the appearance of Brandis' *Indian Trees* in 1906. This list is probably by no means complete, but it shows that roughly 100 species of importance to the Indian forest officer have been published in the short period of 6 years, the descriptions of which are not to be found, at present, in any existing Indian *Flora*, and that *Indian Trees* is thus already becoming out of date. It must be remembered, also, that this considerable addition of knowledge to Indian Forest Botany has taken place at a time when, in the majority of forest circles, no systematic collection or study of forest vegetation has been carried out, and it is certain that, if such systematic study is now undertaken in all circles, a considerable number of new species will be discovered, even in regions which, at present, are regarded as comparatively well-known botanically. Thus, the systematic study of comparatively small areas, which is essential for the preparation of the *Descriptive Lists* mentioned above, will serve a double purpose, inasmuch as it will provide the material which is essential for the preparation of complete and efficient *Floras* which will not rapidly become out of date. With reference to the utility of, and necessity for, a book of this description, it may be noted that Mr. Gamble, in 1910, referring to the question of issuing another edition of his manual, wrote that in his opinion "the really useful work would be a combination of a *Flora* (e.g., Brandis' *Indian Trees*) with the manual." This opinion was discussed and endorsed by the Board of Control which met at Dehra Dun in 1911. The necessity of having *Floras* of this type was also recognised by the Government of India in its recent Circular <sup>20-F</sup>/<sub>105-6</sub>, dated 30th September 1912. In Sub-Appendix No. IV to this note, the scope and function of a typical *Descriptive List and Flora*, as described above, are respectively summarised, while Sub-Appendix V gives a summary of the detailed information which it is proposed to include in the *Descriptive Lists*.

Summary of characteristics of list and Flora.

Lines on which work can be at once commenced.

6. The next question to be considered is the extent to which, and lines on which, this work of preparing *Descriptive Lists* can now be undertaken, under the conditions at present existing in the various provinces. With reference to this question it is in the first place desirable to deal with the following points, regarding which there has been a good deal of misunderstanding:—

(1) The opinion has been expressed that this work cannot be undertaken, unless there are trained Botanists available and unless their Local Governments are willing to place them on special duty for the purpose. Even under the most unfavourable conditions, however, in the case of a province possessing no officers with special botanical knowledge, and in which it is impossible to place a selected officer on special duty, it is quite possible to make a useful beginning. In the first place, for instance, it is clearly not necessary to delay publication, until the list can be produced in its completed form, with all the keys, ecological lists, maps, etc. A list can be first issued in a preliminary shape after say 2 years' work, and if it is provided with the chief reliable vernacular names of the most important species and especially if it is possible to provide it with one simple key to the species (the preparation of which is certainly not beyond the powers of a trained forest officer of average intelligence), the list, even in its incomplete form, at once becomes of great value to local officers in helping them to identify their species. In the second place, a divisional officer can, as a rule, be found who would be willing for a small honorarium to undertake the work in addition to his own duties. Such an officer would receive specimens from the other divisional officers of the circle, would send them for identification to Dehra or Calcutta, and would compile the information obtained. After the preliminary

publication, arrangements could be made to issue an annual *addendum-corrigendum*. An improved and revised edition would naturally follow in due course, and in this way the list could be gradually perfected and good results obtained even in those circles in which the most unfavourable conditions prevail. Conditions of this class are believed to obtain more or less in Bengal, yet the Conservator of that province has written that he anticipates no difficulty in carrying out the work. At the other end of the scale we have those provinces which not only possess thoroughly competent Botanists, but are, in addition, willing to place them on special duty for this work. These are the most favourable possible conditions and obtain in the Punjab and Assam. In these cases it should be possible to issue the complete lists, and possibly also concise *Floras* within a comparatively short period of years. All other provinces may be said to lie between these two extremes.

(2) The next point regarding which misunderstanding appears to exist is, with regard to the idea that the task of preparing the lists must necessarily depend entirely on the efforts of a single individual, and that the help of other divisional officers cannot be depended on. In the writer's opinion, the publication of *Descriptive Lists* with one or two simple keys and vernacular names, even in an incomplete form will, to a very large extent, remove this difficulty and help to stimulate the interest of local officers. If this is not the case, and if the majority of forest officers are found to be unable or unwilling to utilise the simple lists for the study of their forest vegetation, it is most improbable that they will subsequently derive much advantage from the more detailed *Floras* which are naturally more difficult to use. Thus, if these lists prove to be of no value, the entire case made out for this work of Forest *Floras* obviously falls to the ground. The writer, however, is convinced that if these lists are properly prepared, they will greatly facilitate identification-work and that local officers will, therefore, tend to make use of them to try and identify their local species, to collect notes regarding them and to send in specimens of doubtful plants for identification. Especially will this be the case if the local Conservator himself takes an interest in the matter, and by punctually publishing periodic *corrigenda-addenda* does not allow the subject to drop out of sight. The possibility of securing this active co-operation of local officers is a point of the greatest importance, and supplies a strong argument for insisting on the early publication of lists in all circles, even in an incomplete and preliminary form.

(3) The opinion has been expressed that a *Descriptive List* for a province, would often be of more value than a such a list for each circle. A decision on this point necessarily turns partly on the question of the species which should be included. If only a few selected species of important trees, shrubs and climbers are dealt with, it would undoubtedly be possible to produce a useful list with keys for an entire province, but its utility would be restricted by its limited scope. In the writer's opinion, however, the view expressed by Sir Dietrich Brandis on this point, should be accepted. He writes "it may possibly be said that the present work, as well as the Local Forest *Floras* of the future should be limited to the more important trees.....I came to the conclusion that the usefulness of the book would be greatly impaired by such limitation..... My ambition has been to publish a path-finder through the bewildering variety of trees, shrubs, climbers, bamboos and palms, which constitute the forests in the different provinces of India. I do not maintain that foresters ought to know them all, but they ought to have the means of making themselves acquainted with them without undue loss of time." (vide *Indian Trees*, p ix). In addition, the writer thinks that all herbaceous plants of known economic importance found in our forests ought to be included, e.g., valuable drugs, edible products, fibres, dyes, etc., (such as *Podophyllum*, *Saussurea*, *Aconite*, *Chiretta* and other *Gentianaceæ*, *Elettaria*, *Amomum*, *Dioscorea*, many *Curcubitaceæ*, *Curcuma*, several *Araceæ*, *Gerardinia*, *Rubia*) the more important grasses (apart from bamboos), and also the chief non-indigenous trees and shrubs which are commonly cultivated or which have run wild. This view has been accepted by Mr. Haines in his *Forest Flora of Chota Nagpur* (1910). If this view is adopted, it will almost certainly be found that a province is, as a rule, far too large an area to deal with in a single list and that a single book dealing with a Province will usually rather approximate in character to a typical *Flora*, in which there are fewer keys to the species and which the non-botanist finds more difficult to use for identification purposes.

7. Finally, the writer would urge the necessity of a specimen of all species collected by officers who work on these *Lists and Floras*, being placed permanently on record in the Dehra Dun herbarium. The officers who prepare these books will be obliged to come to Dehra, not only to consult the herbarium, but also to make use of the sylvicultural and economic information available in the files of the institute, and it is most necessary that the botanical specimens supporting the records in the *Lists and Floras* should always be available at Dehra for reference. The proposal has been made that the local collections should be lodged in the local Conservators' offices. Past experience, however, has shown that suitable local arrangements for the permanent security of botanical collections from damp, fungi, vermin and neglect are rarely possible.

Necessity of placing the botanical collections on record in Dehra Herbarium.

R, S. HOLE,  
*Forest Botanist.*

## Sub-Appendix I.

Ward's Key to British Trees, based on leaf-characters.

## I. Leaves, compound.

A.—Leaves opposite and on erect shoots usually decussate.

(1) Leaves imparipinnate.

(a) Leaflets broad more or less ovate on long petiolules, some of which twine as tendrils, shoots, slender. Clematis Vitalba L.

(b) Leaflets more or less lanceolate on very short petiolules or sessile, never twining, shoots, stout.

(i) Stipules represented by a thin interpetiolar ledge or line. Petiolules short. Venation reticulate with large meshes. Sambucus nigra L.

(ii) Leaf exstipulate. Leaflets sessile or subsessile, venation pinnate. Fraxinus excelsior L.  
Aesculus Hippocastanum L.

(2) Leaves palmately compound, digitate, exstipulate.

B.—Leaves alternate and spirally inserted on erect shoots.

(1) Leaves imparipinnate.

(a) Leaves trifoliolate.

(i) Leaves and shoots devoid of prickles or glandular hairs, leaflets small and delicate, entire, silky pubescent beneath.

(a) Leaflets 3-8 cm. long, silky pubescent beneath, as are also the young shoots: the latter not angular or furrowed. Stipules evident and persistent. Cytisus Laburnum L.

(b) Leaflets not more than 1-2 cm. long. Shoots angular and furrowed glabrous. Stipules minute. Sarothamnus Scoparius

(ii) Leaves not silky with prickles on the petioles and ribs; leaflets large coarse and irregularly serrate. Koch.

(a) Prickles setaceous, deflexed but unequal, and not curved and claw-like shoots glaucous, leaflets pale green on both sides. Rubus Caesius L.

(b) Prickles usually recurved, shoots not glaucous, leaflets dark green above and pale or white beneath, sometimes glandular. Rubus fruticosus L.

(b) Pinnate leaves with at least 5 leaflets.

(i) Leaves exstipulate.

(a) Leaves hard and very dark polished, evergreen. Leaflets spinose-toothed. Small bush. Berberis Aquifolium Ph.

(b) Leaves neither hard and polished nor evergreen; leaflets not spinose-toothed. Large trees, with stout shoots and broad leaf-scars

\*Leaflet 5-13, oblong-lanceolate, entire or sinuate, fragrant:

Twigs smooth, pith chambered. Juglans regia L.

\*\*Leaflets 15-25 ovate-lanceolate

glandular-serrate at base, not scented, shoots pubescent, pith continuous. Ailanthus glandulosa Desf.

(ii) Leaves stipulate

(a) Stipules usually as lateral spines, buds buried in base of petiole, leaflets entire ... .. Robinia pseud-acacia L.

(b) Stipules not spinose and buds not buried, leaflets serrate or bi-serrate ... ..

(2) Leaves palmate, digitately 3-foliolate with tendrils opposed to some of them ... Ampelopsis hederacea M. chx.

## II. Leaves simple—

A.—Leaves opposite or rarely in whorls of 3-4;

(1) Leaves stipulate

(a) Leaves, 3-5 lobed, broad obovate—rhomboid with sessile glands on the top of the petiole and linear fringe-like stipules below ... .. Viburnum Opulus L.

- (b) Leaves not lobed, ovate or lanceolate; petioles eglandular, stipules very minute or half-ovate, caducous or obsolete

(2) Leaves† stipulate

- (a) Leaves lobed, palmatifid and with palmate venation. Petioles long.

- (i) Leaves large, 10-20 cm. or more in diameter ... ..

- (a) Lobes more or less ovate, sinus between any two narrow and acute, *Acer pseudop-*  
coarsely and irregularly cut into blunt teeth or lobules, apex bluntly latans L.  
acuminate, sap watery ... ..

- (b) Lobes angular, apex and teeth drawn out into long acuminate points, *Acer platanoi-*  
sinus wide and hardly acute. Latex white ... .. des L.

- (ii) Leaves small 6-12 cm. in diameter Latex white ... .. *Acer campestre*  
L.

(b) Leaves not lobed

- (i) Leaf-margin serrate or dentate

- (a) Leaves lanceolate, polished, evergreen, coriaceous ... .. *Aucuba japonica*  
Thunb.

- (b) Leaves ovate or elliptic, not polished or evergreen nor coriaceous

- \* Leaves and shoots greyish mealy with stellate hairs; margins dentate *Viburnum Lan-*  
serrate, venation pinnate with numerous forked secondaries ... .. tana L.

- \*\* Leaves glabrous or nearly so, matt green, finely serrate.

- Venation pinnate with few arched secondaries... .. *Rhamnus cathar-*  
ticus L.

*B.—Leaves alternate.*

(1) Leaves lobed

- (a) Lobing and venation pinnate

- (b) Lobing and venation palmate

- (i) Leaves exstipulate

- (a) Leaves dark green, shining, coriaceous and evergreen.

- Shoots climbing by adventitious roots ... .. *Hedera Helix* L.

- (b) Leaves not dark, shining, coriaceous or evergreen, shoots not climbing

- \* Pulvinus armed with single or triple spines. Leaves 3-6 cm. in *Ribes grossularia*  
diameter ... .. L.

- \*\* Shoots and pulvini devoid of spines. Leaves 6-12 cm. broad

- † Leaves strongly aromatic when bruised, owing to

- yellow glandular hairs beneath ... .. *Ribes nigrum* L.

- †† Leaves devoid of glands and strong odour ... .. *Ribes rubrum* L.

(2) Leaves not lobed

- (a) Leaves serrate, dentate or crenate

- (i) Leaves stipulate

- (a) Leaves distichous on long lateral shoots

- \* Leaves more or less lanceolate

- † Leaves coriaceous, polished above, evergreen, glandular serrate,  
venation pinnate, reticulate and looped, obscure

- § Shoots and petioles green, leaves oblanceolate, secondaries slightly  
prominent beneath with circular glands at the base beneath on  
each side of the mid-rib ... .. *Prunus Lauro*  
*cerasus* L.

- §§ Shoots and petioles reddish to purple, leaves ovate lanceolate, venation  
less prominent, no glands ... .. *Prunus Lausitani-*  
ca L.

## Sub-Appendix II.

List of species arranged according to susceptibility to Frost-Damage.

## Class I. Frost-hardy.

- |                        |                               |
|------------------------|-------------------------------|
| 1. Phœnix acaulis.     | 2. Phœnix sylvestris.         |
| 3. Zizyphus Jujuba.    | 4. Acacia Catechu.            |
| 5. Acacia leucophlœa.  | 6. Gardenia turgida.          |
| 7. Limonia acidissima. | 8. Carissa spinarum.          |
| 9. Acacia pennata.     | 10. Acacia cacesia.           |
| 11. Salix tetrasperma. | 12. Dendrocalamus strictus.   |
| 13. Aegle Marmelos.    | 14. Stereospermum suaveolens. |

## Class II. Less hardy.

- |                             |                              |
|-----------------------------|------------------------------|
| 15. Ougeinia dalbergioides. | 16. Elacœodendron glaucum.   |
| 17. Eugenia operculata.     | 18. Grewia vestita.          |
| 19. Shorea robusta.         | 20. Mallotus philippinensis. |
| 21. Woodfordia floribunda.  | 22. Ficus glomerata.         |
| 23. Terminalia Arjuna.      | 24. Terminalia tomentosa.    |
| 25. Terminalia Chebula.     | 26. Mangifera indica.        |
| 27. Butea frondosa.         |                              |

## Class III. Frost-tender.

- |                              |                                 |
|------------------------------|---------------------------------|
| 28. Lagerstrœmia parviflora. | 29. Anogeissus latifolia.       |
| 30. Ficus bengalensis.       | 31. Holarrhena antidysenterica. |
| 32. Tectona grandis.         | 33. Terminalia beleřica.        |
| 34. Miliusa velutina.        | 35. Schrebera swietenoides.     |
| 36. Diospyros tomentosa.     | 37. Bauhinia racemosa.          |
| 38. Phyllanthus Emblica.     | 39. Buchanania latifolia.       |
| 40. Flacourtia Ramontchi.    | 41. Zizyphus Oenoplia.          |
| 42. Zizyphus xylopyra.       | 43. Odina Wodier.               |
| 44. Dalbergia paniculata.    | 45. Helicteres Isora.           |
| 46. Millettia auriculata.    | 47. Ehretia lævis.              |
-



## Sub-Appendix IV.

## Scope and function of a Descriptive List and Flora, respectively.

*Flora.*

1. Primary object is to serve as a book of reference for forest officers.
2. Size of the book is a minor consideration, as it is not especially intended for use in the field.
3. Owing to the detailed nature of the book, extensive knowledge, a long period of time and considerable expenditure are necessary for its production.
4. It is advisable to reduce overlap and duplication of work so far as possible.
5. It is advisable to deal with a large area and a considerable number of species. As a general rule, it will probably be advisable not to deal with an area of less than that of a single province.
6. Simple keys will, as a rule, be impossible, and all that can be done will probably consist in giving a brief synopsis of the botanical characters of the families and then a single botanical key under each family to the genus and again under each genus to the species, similar to those given in Brandis' *Flora of N.-W. and Central India*.
7. Probably advisable to limit the vernacular names to a selection of those most widely used.
8. Should be illustrated.
9. Should not be undertaken until the material collected for it is considered to be sufficiently complete, to obviate the necessity for an early revision.

*Descriptive List.*

1. Primary object is to facilitate identification of all important species by those who have no special knowledge of botany and so far as possible at different seasons of the year.
2. The book must be sufficiently small to serve as a convenient pocket-companion for use in the field, say 6½" x 4½".
3. The book is a relatively small publication which can be quickly, easily, and cheaply produced.
4. Duplication of work and overlap are considerations of minor importance.
5. It is advisable to deal with a small area and relatively few species. As a general rule it will probably be advisable not to deal with an area larger than that of a single circle, and in some cases the area should be smaller still.
6. At least two simple keys leading to the species and based on characters which can be recognised in the forest with not more than the aid of a pocket-lens are absolutely essential. Detailed botanical descriptions of orders, families, genera and species are not required.
7. All reliable vernacular names current in every division must be included.
8. Illustrations not required.
9. Must be published quickly to supply the urgent need of a publication calculated to facilitate wide-spread identification work.
10. The preparation of these books will necessitate the careful study of the vegetation over small areas, and will thus aid the collection of the information which is essential for the preparation of the *Floras*.
11. The preparation of these books and of periodic *addenda-corrigenda* to them, will indicate the areas which have been sufficiently studied to justify the preparation of *Floras* and will also indicate the areas which should be dealt with in the *Floras* in order to avoid undue overlap and duplication of work.
12. The preparation of these books will train and bring forward those men who, in the future, should be entrusted with the preparation of the *Floras*.

## Sub-Appendix V. • •

Summary of information which it is proposed to include in the Descriptive Lists.

## I.—Introduction.

II.—*Keys to the species* based on the following 4 classes of characters and not requiring more than a pocket-lens for their recognition :

- (a) Habit, dimensions, bark, blaze, twigs, juice, buds, and periodicity.
- (b) Leaves.
- (c) Flower and inflorescence.
- (d) Fruit and seed.

III.—*A short account of each species* arranged in order under the correct families and genera of which the following is given as a sample :

TECTONA GRANDIS, Linn.—(The Teak tree). \*Br. 505; \*G. 526. Vern. Sagon (general) H.;\* teka (Man);\* Gondi; sipna (Mel.\*)

Deciduous trees, locally \*  $\frac{20}{8}$ , bark peeling in long thin flakes, twigs quadrangular. L. simple, opp., length often exceeding 12 in., stellate tomentose below. Fls. small white in large panicles. Fr. hard, 4-celled, enclosed in spongy pericarp and surrounded by inflated bladderly calyx.

Fls. July-August; fr. November-January; leaves fall November-February; leaves renewed May-July.

In deciduous forest in all divisions up to 2,000 ft., occasionally gregarious on alluvial flats and rocky ground.

Most valuable local timber. Wood yields an aromatic oil used medicinally, as a substitute for linseed oil and as a varnish. Leaves contain a red dye and are used as plates, umbrellas, for packing and thatching. Flowers and young fruit said to be diuretic.

## IV.—Key to principal woods.

V.—*Sylvicultural and Oecological Lists* of chief species arranged according to their relative capacity to :

- (a) endure shade.
- (b) resist frost.
- (c) coppice strongly.
- (d) reproduce vigorously by root-suckers.
- (e) thrive in very dry habitats.
- (f) thrive on water-logged soil.
- (g) thrive on land-slips and shifting sands.
- (h) grow rapidly during youth.
- (i) resist fire-damage.
- (j) resist damage by grazing.

## VI.—Glossary.

VII.—*Indexes* to vernacular and scientific names.

VIII.—*Distribution—Maps.*

\* Br. = Brandis' *Indian Trees*, G. = Gamble's *Manual of Indian Timbers*, H. = Hindi Man. = Mandla Division, Mel = Melghat Division.

$\frac{20}{8}$  = attaining a height of 60 ft. and girth of 6 ft. All such abbreviations would naturally be explained in the introduction.

\* \* The schedule which accompanies this Appendix may be found useful for collecting, from local forest officers, the information required for the *Descriptive Lists*. The schedules could be conveniently printed in books each of 50 or 100 forms, and space would be economised by using abbreviations so far as possible, when making the entries; thus T for tree, S. for shrub and so on. The duplicate could be torn off and sent with the specimen, while the counterfoil would remain on record in the book.

**SCHEDULE**  
FOR COLLECTION OF INFORMATION REQUIRED  
FOR DESCRIPTIVE LISTS.

		(1)	(2)
NUMBER OR NAME OF SPECIMEN			
VERNACULAR NAME AND DIALECT			
HABIT	{ Tree, shrub, herb. Erect, climbing, prostrate, etc. Gregarious, sporadic.		
DIMENSIONS IN FEET	{ Maximum Girth ... G. " Height ... H.		
PERIOD OF	{ Flowering ... Fl. Fruiting ... Fr. Leaf-fall ... F. Leaf-renewal ... R.		
HABITAT	{ Class of Forest Elevation Soil Chief Associates		
ECONOMIC USES.			
USEFUL FOREST CHARACTERS OF	Trunk and branches.		
	Crown		
	Twigs		
	Wood		
	Bark		
	Blaze		
	Juice		
	Buds		
	Leaves and stipules		
	Flowers and inflorescence.		
	Fruit		
	Seed		
	Stand shade		
CAPACITY TO	Resist frost		
	Coppice		
	Reproduce by root-suckers		
	Thrive on dry soil		
	Thrive on water-logged soil		
	Thrive on land-slips and shifting sands		
	Grow rapidly during youth		
	Resist fire-damage.		
	Resist grazing damage.		

## APPENDIX G.

## Note on the feasibility and advisability of eradicating prickly pear and lantana.

There are three kinds of growth which no forest officer likes to see in his forests; they are (1) prickly pear, (2) lantana, (3) loranthus; of these the last is an enemy to be eradicated in all places and under all circumstances; I can imagine no condition of forest growth in which the varieties of loranthus would be welcomed as an ally.

But in the case of prickly pear and lantana there are circumstances under which the forest officer may welcome them as allies. In forests which have been over-felled, over-grazed and over-browsed till the growth is reduced to the condition of poor scrub jungle, thickets of prickly pear protect young trees from men and beasts and enable them to get a fair start in life. In abandoned coffee plantations, areas once covered with luxuriant evergreen forests, felled to make room for coffee, are left denuded and uncared for; the soil is soon washed off the slopes, and the land reverts to Government unfit to carry any heavy vegetation. Here the lantana establishes itself, forming dense impenetrable thickets, and annually adding a small contribution to enrich the soil, helping to render it once more fit to carry forest growth when the forest officer has the time, the men, and the money to devote to it.

These two instances are given in order to show that even our enemies may sometime perform friendly duties, but are not intended as an argument in favour of encouraging the growth of either prickly pear or lantana. The circumstances under which they assist are exceptional, evidently no forest should be allowed to be so hacked and grazed and browsed over that it deteriorates to poor open scrub, and no evergreen forest should be allowed to be swept off the face of the earth for the temporary benefit of any class of cultivators. As a general rule both the species in question must be considered as enemies to forest growth and to all classes of cultivation, and the question of their removal is one deserving the attention of all who have the improvement of the country at heart. The following paragraphs deal principally with the conditions of the Madras Presidency.

2. Prickly pear (the name includes several varieties of opuntia) is said to have been introduced into Madras less than a hundred years ago; I have heard it stated that the Madras Railway introduced it into Madras as a fence for their lines; it was used for that purpose for a time, and eventually, because it was so difficult to keep under control, it was eradicated and thrown into the borrowpits along the sides of the railway where it promptly established itself and whence it spread in all directions aided by the ryots who welcomed it as an easy growing impenetrable hedge to their fields. The fruit is eaten by men, animals, and birds, and as the seed does not lose its germinating power in passing through the intestines, the pest spreads rapidly in every direction. It at present exists in every district of the Madras Presidency with which I am acquainted; it encroaches on cultivated fields, over-runs waste lands, and forms dense thickets in the neighbourhood of villages; it has penetrated deep into many of the forests and is found on hill tops far removed from any cultivated land. In parts of Salem, Madura, and Coimbatore it is so plentiful in the fuel working circles that the trees to be felled can only be reached by cutting lanes through it, thereby enormously increasing the cost of working, and although it may have done some good in guarding the few trees which exist, it monopolises fully 75 per cent of the ground which should be covered with tree growth. In other words we get (say) 3 tons fuel per acre, where we ought to be getting 12 tons.

3. I am not aware of any experiments having been made to determine how much of its moisture it derives from the air, and how much from the soil; it flourishes on old fort walls which contain no moisture, and in such cases must derive practically all its moisture from the air; but when it has its roots in the soil it is certain that it takes toll on the moisture it finds there, and diminishes the supply available for the tree growth in its neighbourhood.

4. The uses of prickly pear are so few, that they form no argument against its extermination; it makes a magnificent hedge, but cannot be kept within bounds; its fruit is eaten by the poorer classes, especially in times of famine, but the amount of nourishment it contains must be very small; it supplies, with difficulty, a limited amount of cattle food in famine years, but infinitely better fodder could be grown on the area it occupies.

Prickly pear may, therefore, be declared a pest which occupies large areas to the exclusion of infinitely more valuable vegetation; and, considering the extensive areas which it covers, and the facility with which it spreads, its extermination is a work which should be undertaken in the interests of the country.

5. There are two methods of exterminating prickly pear; namely, (1) eradication; (2) introduction of an enemy fatal to prickly pear.

Eradication pure and simple is a costly affair, for the prickly pear must not only be eradicated but also destroyed.

In parts of Coimbatore two methods of destruction have been tried (1) burying in pits, (2) stacking on brushwood and burning; the first of these is the more expensive, and has cost as much as Rs. 10 per acre for the main clearing; pits from 3 to 5 feet in depth were dug and filled with prickly pear which was then covered with earth; the layer of earth was only about one foot in thickness, and this was insufficient to prevent the prickly pear from growing up through it, consequently the surface of every pit became a mass of young prickly pear.

Stacking on brushwood and burning was more successful; the stacks were left to dry for a few months and then burned; a few young plants came up again but were easily dug out; the operation cost from Rs. 3-6 to Rs. 8 per acre.

In Salem some years ago, I tried poisoning the prickly pear; it was first cut down and slashed to pieces then watered with a weak solution of arseniate of soda; the effect was excellent; the leaves turned black and shrivelled up, and where the watering was properly done there was no regeneration, but this operation was expensive, and the use of a deadly poison necessitated constant careful supervision by a responsible officer.

6. In order to diminish the cost to eradicating prickly pear in the forests, and to make its extermination popular outside the forests, it would be necessary to discover a means whereby the operation would be remunerative. A few years ago the Collector of Coimbatore made an attempt to induce the ryots to convert prickly pear into manure for their fields, but with only moderate success, which lasted just as long as that particular Collector was in the district. The expense of cutting the prickly pear, the need for pits in which to bury it, and the fact that even after being buried for a season the thorns did not dissolve, were sufficient reasons for the ryots abandoning the attempt.

In the year 1884, attempts were made to utilize prickly pear in the form of silage, large rectangular pits, six to eight feet deep, were filled with alternate two foot layers of grass and prickly pear and then covered with a thick and heavy layer of earth. A year later the pits were opened, and I remember the ranger who opened the first pit reporting that as soon as his pony smelt the silage it broke loose and ran away for twenty miles. It certainly did smell strong at first, but the prickly pear, compressed to a layer of a few inches in thickness, was easily separated from the grass which had absorbed all its moisture; the grass was spread out and aired, and a pair of bullocks (being deprived of other diet) were induced to take to it, and after a day or two appeared to enjoy it. Ryots, however, would not make silos on the chance of a fodder famine occurring in the following year. About the same time a thornless variety was introduced in the Kamalpuram plantation, Cuddapah district; the fruit was said to be larger and more nutritious than that of the indigenous plant, and it was hoped to propagate by grafting and distributing the new variety in order to provide a food for times of famine. Some years later I enquired what had become of the thornless prickly pear, and found that its very existence was unknown. This is only too often the result of small isolated experiments.

Efforts have also been made to utilize prickly pear as cattle fodder in times of scarcity. Some years ago tweezers were distributed to cattle owners, with instructions how to pull the thorns out of the leaves, so as to make the leaves edible without danger to the cattle; possibly some cattle were kept alive by this means, but the labour involved rendered it impossible to adopt this substitute for fodder in the case of large herds. An American gentleman whom I met in the train one day informed me that in America they had regular machines for dealing with prickly pear, machines which turned it out fit for fodder, and that the cattle took to it easily; he gave me the address of a firm supplying these machines and I wrote over for details, but after a long interval my letter was returned through the dead letter office.

7. Manure and fodder appear to be the best lines for possible utilization, as the demand for both these commodities is universal, but there are other lines which need investigation, for instance, paper pulp and alcohol; one great difficulty in establishing any form of manufacture is the cost of transport, but it seems possible to devise some simple portable presses or other machines which would enormously diminish the bulk and weight of the material to be transported, by removing the useless portions within a very short distance of the areas to be cleared.

8. The only experiments which I can trace in the matter of extermination by introduction of enemies are recorded in the *Indian Forester* for 1897, and the conclusions arrived at are not encouraging; Dr. Borne writes: "The *Coccus* belongs to an extremely obnoxious group of insects—the plant bugs and supposing a *wild* variety were to spread all over the country and to have eaten up all the prickly pear, I think it is possible I cannot say probable—that it or some other species, which might have spread with it, would turn to some other plant for food and become an infinitely greater pest than the prickly pear. This argument applies with great force to a mycelial growth or other parasite which might prove less selective with regard to its food than the cochineal insect has."

It, therefore, appears that research must be principally devoted to the eradication of prickly pear by providing for its utilization in some remunerative manner; a stimulus to

research was given in 1901 by the offer of £5,000 by the Australian Government for the discovery of an economical method of eradicating the pest (*vide* Tropical Agriculturist for January 1902); this prize is apparently still waiting to be claimed.

9. The other pest with which I have to deal is lantana. Introduced originally as a garden plant it has beaten rabbits in Australia by many lengths. From the coast in Canara to the summit of the Shevarayen hill in Salem (over 5,000 feet) it exists and is seldom content with mere existence; it smothers teak in the Wynad and in the Anamalai hills, it overruns grass land and exterminates pasture, it forms impenetrable thickets almost everywhere where it can get sufficient light, and it establishes itself faster than any other weed on the fire lines cut through fairly dense forest. Possibly in nature's rotation of crops it will eventually disappear and give way to good forest growth on the land which it has successfully protected from man and beast for a term of years, but in the meantime it suppresses all other growth and occupies areas which ought to be carrying remunerative wood crops or supplying pasture for the cattle of the country.

Except as a cover for bare ground it is useless; the stems are too small for fuel, and there is no demand for the leaf or the fruit.

10. Lantana is not difficult to eradicate; the chief point to remember is that it is worse than useless to cut it back, for it is hydra-headed; its root system does not, as a rule, penetrate deep into the soil, and most plants can be pulled up without difficulty after the monsoon when the ground is soft. The small thorns on the stem do not prevent hand-pulling provided that the labourers can be taught to grasp the stem firmly and fearlessly.

For stems which cannot be hand-pulled, a pickaxe with one end converted into a V-shaped fork will be found effective. In parts of the Western Circle, Madras, elephants have been trained to pull up lantana; the full grown elephants curl their trunks round a mass of the shrub and pull it out by the roots, the young elephants under training pull on a chain which has a hook at its free end caught into the roots of a shrub; by these means the ground is cleared of the heavy growth, but such clearing is useless unless it is followed by systematic gleanings, one immediately after the removal of the heavy growth, a second one a month later and others at intervals which depend partly on the number of seedlings and root-suckers which appear, and partly on the condition of the soil; it is useless trying to uproot lantana in stony ground in the hot weather.

11. The cost of eradicating lantana has not been clearly recorded in any of the Madras districts in which the work has been undertaken; either the area cleared has not been recorded, or the value of the time of elephants employed has been omitted, or the work done by gangs of subordinates has not been taken into consideration. In Berar, eradication of dense growth cost Rs. 7,800 per sq. mile or Rs. 12-3-6 per acre; an account of the work will be found in the *Indian Forester* for January 1901, and from the figures there given it appears that the average cost of clearing a tract of country one-third covered with dense growth of lantana, one-third containing numerous patches of dense growth, and one-third containing scattered growth would amount to Rs. 2,854 per sq. mile or Rs. 4-7-4 per acre. It may be asked whether it is financially sound to incur such heavy expenditure; the results to be obtained are the reclamation of areas already submerged by lantana, the rescue of areas already in the grip of the tentacles of the octopus, and the insurance against invasion of areas still free from the pest.

The value of reclaimed and rescued areas can be measured in rupees, annas, and pies; but the value due to insurance is more difficult to calculate.

In forest tracts a reclaimed or rescued area would yield at least a fuel crop thirty years after clearing; in that period the average cost of clearing (Rs. 4-7-4) put out at 3½ per cent would amount to Rs. 12-8-3, and if the value of the standing crop nearly approached that sum, the original expenditure would be justified on financial grounds alone.

In cultivated and cultivable lands the expenditure of Rs. 4-7-4 may be treated as capital expenditure ensuring a return of the annual assessment, and an assessment of less than three annas per acre would pay 4 per cent on the capital.

Apart from purely financial considerations, the benefits to the country must be considered, among them the increased area made available for extension of cultivation, for pasture or for forest growth, the improvement in sanitation of villages now surrounded with lantana, the removal of shelter for animals, noxious to crops or to human beings.

12. Eradication by utilization has still to be attempted, and in this direction the assistance of Research Officers is needed. I am informed that the essential oil of lantana can be used for scenting soaps; but that a similar scent is procured from other sources at a price with which lantana oil cannot at present compete. Here is a field for research; reduce the cost of extracting the oil, find other uses for it; it is not necessary that the removal of lantana should be a profitable undertaking; if by the sale of its products the cost of its extermination can be materially reduced, Government will be in a better position for undertaking this work of amelioration.

13. Eradication by introduction of enemies is dealt with in the article in the *Indian Forester* already referred to; the danger of the cure being worse than the disease has to be reckoned with.

Lantana is a light lover and may be killed out by dense shade, but it is difficult to find anything which will grow through lantana and form dense shade over it. In the Wynad lines were cut through lantana and cuttings of *Ficus elastica* put down; unfortunately very few of the cuttings struck, and the experiment was abandoned.

The compound of the Chedleth bungalow in the Wynad has recently been cleared of lantana and sown with castor; it is believed that lantana will not grow under the shade of the castor oil plant; the experiment has only recently been commenced, and no results are as yet available.

14. At the present moment prickly pear and lantana cover thousands, if not millions, of acres of land which might be carrying remunerative crops, and these pests are spreading and invading larger areas every year; they begin on waste land and in poor forest and spread until they surround every cultivated area from which they are only excluded by constant warfare on the part of the occupiers.

Their extermination would, therefore, be welcomed by all classes, but owing to natural indolence aided by few; the work of extermination must be carried out by Government, and must be persevered with for many years.

It is easy enough to clear a small area of either prickly pear or lantana, and not difficult to keep a small area cleared, but so long as the pest to be exterminated exists anywhere near the cleared area, it will sooner or later re-establish itself; for extermination to be thorough it must be universal though evidently it cannot be effected simultaneously throughout the length and breadth of India.

In every unit of area in which work can be supervised by a reliable officer, a centre should be fixed from which extermination should proceed in ever widening circles, and the greatest care must be taken to ensure the cleared area being gone over at such intervals as may be found necessary to remove any seedlings or root-suckers which may have come up since the passage of the main process of eradication. Success depends, not on the original clearing, but on keeping the cleared area clear for a period of two or three years, that is to say, until there are no more live roots or seeds left in the soil.

F. A. LODGE,  
*Conservator of Forests,*  
*Madras Presidency.*

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## APPENDIX. H.

**The advisability of placing Revenue Officers on special duty in connection with the preparation of working plans.**

As there are no rights in the reserved forests of the Central Provinces, as forest concessions are numerous and to some extent unrestricted, and as the administration of the forests is intimately connected with the daily life of a very large proportion of the population, it will readily be understood that the regulation of forest concessions has always given rise to much discussion.

The practice of employing Revenue Officers to work in conjunction with Working Plans Officers arose out of the recommendation made by Sir S. Eardley-Wilmot in 1906 that regular forest settlements should be undertaken in the Central Provinces. An abstract of the discussion to which this recommendation gave rise and a statement of the conclusions arrived at by the Chief Commissioner are given in Central Provinces Secretariat (Forest Department) letter No. 1118-XIV-1-58 of the 12th September 1907. The case may be summarized briefly by saying that the policy of the Central Provinces Government with reference to concessions to forest produce is adverse to restriction, or to the crystallization of such concessions into rights by means of settlements. It aims at leading the people to rely on the open markets, as represented by the contractors who purchase the annual coupes, rather than to cut their requirements themselves at privileged rates. At the same time it is recognized that the people must be safeguarded against prohibitive rates due to unusual competition and experience has proved that the practice under reference is the best means of securing this protection and of ensuring that the conflicting interests of forest protection and grazing facilities receive proper consideration.

2. The procedure which regulates the respective duties of the Revenue and Working Plans Officers is as follows :—

- (1) Before the prescribed enquiry by a Revenue Officer can take place usefully, it is necessary that the fieldwork in connection with a working plan shall have been completed in so far as the division of the forests into working circles, of the latter into felling series, of the series into coupes, or compartments, and of the order in which it is proposed to cut over these coupes, are concerned.
- (2) The Working Plans Officer shall have prepared also—
  - (a) Tracings of the forests to show the above details, and, where the working plan concerned is a revision, other tracings showing the similar provisions of the old plan.
  - (b) A statement showing for each felling series the proposed closures to grazing during the period covered by the working plan. To such an extent as he is able to collect the information this statement shall show the villages which rely on each felling series for the ordinary daily grazing of their cattle, the number of such cattle grazed during recent years, and the portion of the series in which the grazing is heaviest; also it shall give the outside villages which have been accustomed to send their cattle to the series for pasturage during the rainy season together with the approximate number of such cattle.
  - (c) A statement of his opinion as to the necessity of limiting the grazing in any felling series, and, if so, the extent to which the grazing should be limited and the manner in which the excluded grazing can be provided for in other areas in which the demand for grazing is light.
  - (d) A note regarding the extent of the demand for forest produce, both local and for export, in the various circles or series, with special reference to localities where there is any shortage in meeting the demand of the surrounding agricultural population for fuel, fodder grass, bamboos, wood for ploughs, *satkatha* poles and building wood; this note should refer to the general policy now followed and to be followed under the provisions of the new plan regarding the extraction of produce with the object of meeting shortage in any of the forms of produce mentioned above.
- (3) When the work referred to above has been completed the Conservator will address Government (through the Chief Conservator), asking that a Revenue Officer may be deputed to carry out the prescribed enquiry.



- (4) The Revenue Officer will conduct his enquiry in accordance with the standing orders and such special orders as may be given to him in each case. He will submit his report to Government through the Conservator and the Commissioner, the former of whom will transmit it with a note referring to the instances in which he considers that the interests of forest conservancy make it undesirable, or impossible, to adopt the suggestions put forward by the Revenue Officer.
- (5) When the Chief Commissioner has passed orders on the Revenue Officer's proposals, the Working Plans Officer will complete the working plan report which will be dealt with in accordance with the standing orders, being forwarded in print by the Conservator to the Chief Conservator for submission to Government. The Report of the Revenue Officer and the orders passed thereon by the Chief Commissioner will be included among the appendices to the working plan.

3. The Revenue Officer tours through the forest division with the Working Plans Officer. His main duties are :—

- (1) To satisfy himself that the prices at which the people can obtain forest produce from the coupe contractors have not reached prohibitive limits, or, if they have, to make suggestion for the exclusion of contractors from certain areas.
- (2) To see that the sequence of fellings and subsequent closures is arranged so that as little inconvenience as possible is caused to the villagers who depend on the forests for the daily grazing of their agricultural cattle.
- (3) To check the proposed division of the forests into grazing units and, where forests are suffering from overgrazing, to arrange for such limitation, or redistribution, of grazing as is necessary.
- (4) To criticize the existing grazing rates and the rates charged for produce such as grass, dry fuel, dry timber, bamboos, other minor produce, etc., which the agriculturists extract for themselves on licenses.

4. The enquiries which have been made so far by Revenue Officers have proved most useful. For some time past the Forest Department in the Central Provinces has been engaged in a struggle to restrict grazing and at the same time to raise the grazing rates from the extremely low level at which they have stood for many years past. It is not too much to say that without the results of the careful study of the grazing question made by these Revenue Officers in various districts, the department would not have obtained the measure of success in dealing with these problems which has now been secured. Again the reports of these Revenue Officers have drawn prominent attention to the fact, well known to forest officers, that the concession of grazing cattle at privileged rates is uniformly abused, the result being that in orders passed on a recent report the Chief Commissioner has recognized the ultimate necessity of confining this privilege to villages so situated that cattle can be taken daily to and from the forests.

I do not propose that this system should be adopted in all provinces but I think that the experience of the Central Provinces as to its utility would probably be reproduced in other provinces where the forest administration is intimately connected with the supply of its requirements to an agricultural population.

27th January 1913.

}

G. S. HART,

Chief Conservator of Forests, Central Provinces.

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PROCEEDINGS

OF THE

BOARD OF FORESTRY,

S1835

AT MEETINGS HELD AT

DEHRA DUN

BETWEEN THE

13

23RD AND 30TH MARCH 1916,

WITH

APPENDICES.



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*Proceedings of the Board of Forestry, March 1916.*

The following correction should be made in Resolution No. IX (ii) on page 11.

In line 8 for "staff of Zoologists" read "staff of the Zoologist."

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**Proceedings of the Board of Forestry at meetings held at Dehra Dun  
between the 23rd and 30th March 1916.**

*Introduction.*—This was the third meeting of the Board, which was constituted as follows :—

- Mr. G. S. Hart, C.I.E., Inspector-General of Forests, *President*.  
„ T. R. D. Bell, Conservator of Forests, Southern Circle, Bombay.  
„ P. M. Lushington, Conservator of Forests, Southern Circle, Madras.  
„ C. G. Rogers, Chief Conservator of Forests, Burma.  
„ M. Hill, C.I.E., Chief Conservator of Forests, Central Provinces.  
„ B. B. Osmaston, President, Forest Research Institute and College.  
„ P. H. Clutterbuck, Chief Conservator of Forests, United Provinces.  
„ H. H. Haines, Conservator of Forests, Bihar and Orissa.  
„ A. W. Blunt, Conservator of Forests, Western Circle, Assam.  
„ R. McIntosh, Conservator of Forests, Punjab.  
Sir Henry Farrington, Bart., Officiating Conservator of Forests,  
Bengal.

Mr. R. S. Troup, Assistant Inspector General of Forests, *Secretary*.

In addition Mr. H. Tireman, Deputy Conservator of Forests, Coorg, and Rao Bahadur S. Srinivasalu Naidu, Extra Deputy Conservator of Forests, Central Provinces, attended in connection with their papers on "Lantana in the forests of Coorg" and "Proposals for the training and improvement of the position of forest guards," respectively.

The proceedings commenced with an opening address by the Inspector General of Forests in which after expressing regret at the unavoidable absence of the Hon'ble Mr. C. H. A. Hill, C.S.I., C.I.E., Member of Council, Department of Revenue and Agriculture, and of the Hon'ble Mr. R. A. Mant, Secretary to the Government of India in that Department, he referred to the action taken on the resolutions passed at the last meeting of the Board and to the progress made in research and other matters during the past three years, and to the main lines of future development. The address is given in full in Appendix A.

This meeting of the Board was the first held since the completion of the new Forest Research Institute buildings, and the members inspected the various museums and laboratories and the grounds of the Institute as well as the new mess house and quarters for the students of the Provincial Service classes.

With the previous sanction of the Government of India, the following subjects were discussed by the Board :—

- I. The triennial programme of work of the Forest Research Institute for the period 1916-19.
- II. Rules for the Provincial Service course.
- III. Amendments to the syllabus and allotment of marks for the Provincial Service course.
- IV. Educational staff required for the Provincial Service course.
- V. The preparation and control of forest working plans.
- VI. The development of forest engineering.
- VII. Lantana in the forests of Coorg.
- VIII. The necessity for a systematic study of Indian forest seedlings.

- IX. The need for systematic record of insect damage and the experimental introduction of control measures.
- X. The promotion of Rangers to the Provincial Forest Service.
- XI. Proposals for the training and improvement of the position of forest guards.
- XII. Classification of forest revenue and expenditure.
- XIII. Suggested modification of the form of the Annual Forest Administration Report.
- XIV. Amendments suggested for the forms attached to the Annual Forest Administration Report.
- XV. Place of meeting of the Board of Forestry.

In addition an interesting paper on the development of sal seedlings was read by Mr. R. S. Hole, Forest Botanist.

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## I.—The Triennial Programme of Work of the Forest Research Institute for the Period 1916-19.

The programme, as submitted by the President, Forest Research Institute and College, was first considered by a sub-committee consisting of Messrs. Lushington and Clutterbuck and Sir Henry Farrington with the assistance of Mr. Osmaston, President of the Research Institute, and of the Research officers concerned. The proposals of the sub-committee were then considered by the Board, who finally approved of the programme given in Appendix B and passed the following resolution:—

- (i) *That the triennial programmes of research work of the Botanist, Economist, Sylviculturist, Zoologist and Chemical Adviser as passed by the Board be approved.*
- (ii) *That with reference to the resolution to item No. 1 of the subjects considered by the Board in 1913, it is now recognised that the absence of a separate programme for the Chemical Adviser is not conducive to the best work, and that this officer should have his own programme as in the case of other research officers, it being understood that the Chemical Adviser will at all times assist other research officers under the general control of the President.*
- (iii) *The Board suggests that in future the programmes of all research officers should, if possible, be arranged in two parts, as in the case of the Sylviculturist's programme (i) special and (ii) miscellaneous.*

## II.— Rules for the Provincial Service Course.

The draft rules for the Provincial Service course, compiled in the office of the Inspector General of Forests after consultation with the President, Forest Research Institute, were first considered by a sub-committee consisting of Messrs. Hill, Blunt and McIntosh assisted by Mr. Osmaston, President, Forest Research Institute and College, and the Instructors to the Provincial Service classes. A note by Mr. Cowley-Brown, late Principal, Madras Forest College, entitled *Suggestions for Future Forest Colleges*,\* was also considered by the sub-committee. The Board discussed the sub-committee's recommendations in detail and passed the following resolution:—

*The Board accepts the rules as amended† and recommends that they be brought into force with effect from the 1st April 1917, the class for 1917-19 assembling on that date.*

- (ii) *That with reference to rule 5, students to the number of not more than 20 per annum be admitted during the three years commencing 1st April 1917.*
- (iii) *That in view of the fact that the Provincial Service students tour in all parts of India, the Board considers that actual travelling expenses should be paid by the Local Governments or other authorities by whom the students are deputed. It is understood that at present the practice in this respect is not uniform, this concession being granted by some provinces in differing degrees and not at all by others. This naturally gives rise to discontent, and the Board is strongly of opinion that these expenses should be granted on the same scale for all students, viz:—*
  - (a) *Single second class fare to Dehra Dun on joining the Institute.*
  - (b) *Actual expenses on tour as passed by the President of the Forest Research Institute, including single second class fare by rail or steamer for the student, fare of one servant and freight of a bicycle where necessary.*
  - (c) *Single second class fare to destination on satisfactory completion of the course of training.*

*It is estimated that the average cost of this concession will not exceed Rs. 15 per mensem for the whole period of the course.*

\* Not printed in these proceedings.  
† Printed in Appendix C.

### III.—Amendments to the Syllabus and Allotment of Marks for the Provincial Service Course.

The question of amending the syllabus and altering the present allotment of marks for the Provincial Service course was first considered by a sub-committee consisting of Messrs. Rogers, Bell and Haines with the assistance of the President, Forest Research Institute and College, the Instructors and the Research officers.

*Amendments to the syllabus.*—Apart from certain minor changes in the syllabus the sub-committee was called upon to consider four important alterations.

- A. The elimination from the Physical Science course of three heads, *viz.*, (1) Physiography (2) Geology and Minerology and (3) Soils.
- B. The abolition of the entire course of Forest Accounts and Procedure.
- C. The abolition of the Final Survey Plate.
- D. The inclusion of Photography as a subject of instruction.

*Allotment of marks.*—The proposals under consideration comprised re-allotment consequent on changes in the syllabus, increases or decreases in existing marks in accordance with the relative importance of the subjects concerned, and an alteration in the percentage of marks allotted to the periodical and final examinations, respectively.

The recommendations of the sub-committee were considered in detail by the Board, and after discussion the following resolution was passed :—

- (i) *That Geology should form an essential part of the training of Provincial Service officers, but that the other subjects under reference should be discontinued as being partly unnecessary and partly dealt with in the courses of lectures on Sylviculture, Botany and Geology.*
- (ii) *That the course of Forest Accounts and Procedure should be abolished, partly to allow of more time being given to more important subjects, partly because Provincial Service officers are in any case required to pass in the subjects in question after taking up their appointments, and partly as procedure and accounts are now so decentralized that the practical value of a general course of lectures would be incommensurate with the time devoted to it.*
- (iii) *That the final survey plate should be abolished and its place taken by a searching practical examination, conducted in part at least, by an officer of the Survey of India.*
- (iv) *That photography should not be included in the course of instruction, since students who desire to learn photography may be expected to do so whether there is a course or not, and since it is undesirable to make any additions to the number of subjects taught.*
- (v) *That the revised syllabus \* as approved by the Board should be adopted.*
- (vi) *That as long as the periodical and final examinations are conducted by the same agency the ratio of periodical to final marks be fixed at 60 : 40 in place of 50 : 50 as at present, it being understood that for the purpose of this allotment marks given for Botanical, Entomological and Economic collections will not be considered as part of the final examination.*
- (vii) *That after due consideration of the relative importance of the various subjects in so far as they concern the course of study, the Board*

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\*Appendix D.



holds that it is desirable to amend the present allotment of marks and to adopt the following revised scale:—

<i>Forestry—</i>					
<i>Sylviculture</i>	...	...	...	...	150
<i>Utilization (including economic products collection)</i>	...	...	...	...	500
<i>Working plans</i>	...	...	...	...	350
					1,200
<b>Total Forestry</b>					
<i>Auxiliary subjects—</i>					
<i>Surveying and drawing</i>	...	...	...	...	450
<i>Engineering</i>	...	...	...	...	500
<i>Botany (including botanical collection)</i>	...	...	...	...	450
<i>Law</i>	...	...	...	...	250
<i>Physical Science—</i>					
(a) <i>Chemistry and physics</i>	...	...	...	...	280
(b) <i>Geology</i>	...	...	...	...	300
<i>Zoology</i>	...	...	...	...	320
<i>Conduct discipline and physical training</i>	...	...	...	...	250
					2,800
					1,200
					4,000
<b>Grand total</b>					

#### IV.—Educational Staff required for the Provincial Service Course.

In considering this question the opinions of the Research officers and the two Instructors to the Provincial Service classes were invited. The Research officers laid stress on the inconvenience caused by the present practice, under which they deliver regular courses of lectures in their own subjects during the rains term and which results, more particularly as regards the Botanist and Zoologist, in the practical cessation of research work during the only season of the year in which certain forms of work can be carried out in the forests. The Instructors stated that it was impossible for them to give proper instruction to the students in all the subjects prescribed in the syllabus.

The Board accepted these opinions, and while agreeing that it is advisable and even necessary for Research officers to deliver occasional special lectures in their own subjects, held that any undue interference with the progress of research work was much to be deprecated. As regards the educational staff necessary for the Provincial Service classes, the Board was of opinion that the present staff, which is actually weaker than that of any Ranger school or college in India,\* is quite inadequate for the efficient instruction of the students.

The following resolution was passed:—

*The Board ventures to record its opinion that it is no longer possible to maintain the principle originally accepted that research work at the Institute should be subordinated to education. The Board considers that apart from giving occasional lectures on special subjects the research officers should confine themselves almost entirely to research work, the instructors being responsible for the*

\*The instructional staff of the Burma Forest School consists of 5 officers, that of the Coimbatore Forest College of 4 officers and that of the Dehra Dun Forest College of 4 officers.

actual course of instruction prescribed. The Board understands that the instruction given to the Provincial Service students is intended to be the highest class of training in Forestry obtainable in India. It considers that the attainment of this end is out of the question with only two Instructors and therefore it recommends that the instructional staff of the Research Institute be increased as soon as possible by the appointment of two Assistant Instructors. In view of the class of training necessary, the Board is of opinion that these Instructors should be taken from the Imperial Service.

#### V.—The Preparation and Control of Forest Working Plans.

This subject was put before the Board in the form of a memorandum, printed as Appendix E to these proceedings. After a full discussion of the proposals contained therein the following resolution was passed :—

- (i) *The Board recognizes that the progress made during the quinquennium ending 30th June 1914 in new working plans and in the revisions of plans sanctioned previously is unsatisfactory and that this state of affairs is due chiefly to want of staff.*
- (ii) *The Board is of opinion that the present procedure, by which an outside opinion on working plans can be obtained in provinces in which there are Chief Conservators and must be obtained in other provinces, is necessary. In provinces where there are Chief Conservators the Board agrees that no change is desirable in the existing procedure whereby Chief Conservators have the option of consulting the Inspector-General of Forests and that officer has the power to bring defects in sanctioned plans to the notice of the Local Governments concerned. At the same time the Board holds that in all important cases where Chief Conservators consult the Inspector-General of Forests, as well as in other provinces directly under that officer's control as regards the preparation of working plans, the outside opinion should be based on a personal knowledge of the locality and discussion with the local officers on the spot either by the Inspector-General of Forests or by some other specially qualified officer deputed by him.*

*The Board recognizes that under existing conditions it is impossible for the Inspector-General of Forests to do this work to the extent that is desirable, and therefore urges that a special appointment of Superintendent of Working Plans should be created to assist the Inspector-General of Forests in these inspections and in his general control of working plans.*

- (iii) *In order to ensure adequate future progress in the preparation and revision of working plans, the Board considers that in all provinces a regular working plans branch should be established, a sufficient number of additional posts being provided on the cadres concerned. The Board learns with satisfaction that steps to this end have already been taken in the United Provinces where five special posts have been provided in the recently sanctioned re-organization.*
- (iv) *The Board accepts generally the views set forth in paragraph 8 of the memorandum and recommends that Article 52 (i) of the Forest Department Code, 7th edition, should be amended as proposed in paragraph 10 of the memorandum, subject to the alteration in (c) of the words "forest products" to "timber and other forest produce."*
- (v) *The Board approves of the suggestion to delete Article 57 (iii) of the Code as proposed in the first section of paragraph 11 of the memorandum.*
- (vi) *The Board also considers that the proposal to abolish prescribed forms 2, 3 and 4 should be adopted. It holds, however, that sample forms*

for each of the principal methods of treatment should be compiled in the office of the Inspector-General of Forests, after consultation with Chief Conservators and Conservators. The Board is of opinion that these sample forms should not be definitely prescribed for use in all cases. It holds that these should be subject to minor alterations by Chief Conservators and Conservators designed to meet particular requirements, but that in cases where such alterations are made the forms adopted should be printed as appendices to the working plans concerned.

- (vii) The Board recommends that the following amendments in modification of those proposed in paragraph 12 of the memorandum, be made to Articles 54 and 57 (i) of the Forest Department Code, 7th edition :—

Page 27.

For existing Article 54 substitute the following:—

- (i) For the control of the working of all forests under working-plans, the following control records will be kept up :—
- Control of working of forests for which working plans exist.
- (1) A Control Book.
  - (2) A Record of Works.
  - (3) A Forest Journal.
  - (4) Control maps.
- (ii) Control Books and Records of Works should ordinarily be kept up separately for each working circle for the year for which operations are prescribed in the working plan. Where one or other of the suggested forms of Control Book and Record of Works are not adopted, samples of the special forms prescribed will be printed as appendices to the plan. In devising the forms in question the following general instructions should be observed :—

**Control Book.**—The objects of the Control Book are—

- (a) To compare the actual exploitation of the year (such as felling, girdling, extraction of minor produce and grazing) with the prescriptions of the working-plan.
- (b) To record the yield of timber and other produce and the revenue derived therefrom.
- (c) In the event of the area or quantity of material exploited in any year being less than that prescribed in the working-plan, to provide for the bringing forward year by year of the balance still available for exploitation, until it is exploited or written off under competent authority.
- (d) In the event of any exploitation in excess (whether of material or area) of the prescriptions of the plan, to provide that such excess shall, unless orders to the contrary are issued by competent authority, be deducted from the quantity prescribed for exploitation in future years.

[NOTE.—When the prescriptions of the working-plan are by sub-periods and not by years, these instructions should be applied accordingly.]

**Record of Works.**—This will be a brief record of all works carried out in connection with the construction and repair of communications and buildings, wells, tanks, etc., demarcation, sowing and planting, cultural operations, protection from fire, climber cutting; also improvement fellings, thinnings, cleanings and other tending operations when these are distinct from the main exploitations prescribed, provided that expenditure under A VIII b and c will not be shown in this form.

To provide for a record of operations not definitely prescribed in the working-plan the Record of Works should, when necessary, be divided in the following manner and kept up accordingly :—

I.—Prescriptions of the working-plan.

II.—Suggested measures of the working-plan.

III.—Measures neither prescribed nor suggested in the working-plan, but carried out during the year.

(iii) *Add.*—“ The main object of the Journal should be to record observations made on the spot and information not obtainable from prescribed forms.”

(iv) *Substitute* the following revised sub-paragraph :—

*Control Maps.*—A map showing the results of fire-protection will be prepared and maintained in such manner as the Local Government may direct. In this connection attention is invited to the Inspector-General of Forests' Circular No. 5, dated the 14th July 1887. In addition, maps showing the progress of fellings or girdlings, of reproduction, both artificial and natural, and of sylvicultural operations will be maintained where considered necessary.

Page 29.

Entries made in Control Book and Record of Works to be submitted to the Conservator.

*Article 57 (i).*—*Substitute* the following :—

57 (i).—Divisional officers will, not later than the 15th August in each year, submit to the Conservator copies of the Control Book and Record of Works for the previous forest year. In provinces where there is a Chief Conservator, the Conservator will forward the forms to the Chief Conservator not later than the 1st November in each year.

*Delete.*—Article 57 (iii).

(viii) *The Board desires that the upkeep of Forest Journals should be one of the subjects for consideration at its next meeting.*

## VI.—The Development of Forest Engineering.

Notes on this subject by the Inspector-General of Forests (Appendix F) and by Messrs. J. W. A. Grieve, Deputy Conservator of Forests, Andamans, and J. Dodgson, Deputy Conservator of Forests, Kanara, Northern Division, Bombay,\* were put before the Board. Mr. H. Tireman, Deputy Conservator of Forests, attended in connection with engineering proposals in Coorg. The subject was discussed at length, and the following opinions were recorded by the representatives of the various provinces :—

*Central Provinces.*—Ordinarily there is not much scope for a special Forest Engineer. For works of more than usual magnitude assistance is obtained from the Public Works Department : otherwise ordinary engineering work is carried out by the Forest Department. In the event of special works (*e.g.*, steam tramways, ropeways, etc.) having to be carried out, it would be necessary to engage temporarily the services of an expert.

*Assam.*—Conditions are much the same as in the Central Provinces.

*Bihar and Orissa.*—At present there is no necessity for a special Forest Engineer, but with the introduction of the new Singhbhum working-plan it is possible that a special engineer will be required for sawmills as well as tramways and other export works.

\* Not printed in these proceedings.

*Punjab.*—At present a general Forest Engineer is not necessary, but experts for particular projects may be required from time to time in the future. If the project for the supply of spruce and fir sleepers to the Railways materialises on a large scale, a special engineer will almost certainly be required.

*United Provinces.*—The services of a Forest Engineer have already been secured for 3 years, and he is likely to be required permanently for special works such as tramways, light railways, ropeways, pulp factory, etc. : at the same time it may be possible to spare his services occasionally for short periods if he is required elsewhere.

*Bengal.*—The services of a Forest Engineer will almost certainly be required shortly for ropeways in the lower hills, tramways mechanical means of extraction, and possibly roads in Chittagong.

*Coorg.*—The province is too small to employ a whole-time Forest Engineer. Mr. Underhill, Forest Engineer, United Provinces, has recently paid a visit to Coorg and advised on tramways, for the running of which special establishment will be required.

*Madras.*—The past experience of special engineering works carried out by the Forest Department has been unfortunate. Two temporary engineers obtained through and working under the Public Works Department have been employed recently : this has proved of considerable advantage in getting work done which could not have been carried out otherwise, but the officers employed have no real experience of Forest Engineering, and consequently their work has been slow and expensive. It is considered that a staff of 3 or 4 Forest Engineers working under the control of the Forest Department is actually required in Madras.

*Bombay*—After many efforts an engineer has been employed temporarily in blasting and training floating streams and in constructing bridges. There is ample scope in the Bombay Presidency for the permanent and continuous employment of one well trained Forest Engineer, and possibly later for a second for such works as well as for sawmills and tramways.

*Burma.*—The main points affecting this question in Burma are (1) the development of road systems for local demand and export and (2) Forest Engineering proper, such as the replacement of the elephant by mechanical means of extraction, the conversion and seasoning of timber, sawmills, etc. As regards (1) owing to the enormous size of the Divisions it is impossible to make satisfactory progress in the development of the forests under existing conditions by the agency of the ordinary forest staff. It could, however, be carried out by the employment on the temporary establishment of men with ordinary engineering experience recruited locally. As regards (2) the best expert advice is required. It is believed that an expert with the necessary qualifications can be obtained from Canada or the United States.

After further discussion the Board passed the following resolution :—

- (i) *The Board agrees that while conditions vary considerably in different provinces it is quite clear from the experience gained so far that requirements cannot be met by the employment of one or two Forest Engineers for the whole of India.*
- (ii) *The Board considers that in many provinces increase in the revenue must depend largely on Local Governments employing their own Forest Engineers to assist in the development of means of extraction, export and utilisation. It thinks that in addition to the*

*usual training in ordinary civil engineering these men should be specially trained in Forest Engineering, this latter training being acquired subsequent to engagement if necessary.*

- (iii) *In view of the difficulty which has been experienced in obtaining men with the requisite knowledge, and of the certainty that such men will be required shortly, the Board recommends that four young engineers be attached to the Research Institute for special training in Forest Engineering, both in India and elsewhere.*

#### VII.—Lantana in the Forests of Coorg.

Mr. Tireman's paper on this subject (Appendix G) was considered by the Board, and the representatives of the various provinces were asked to state how the lantana question affected their provinces and what action was being taken to deal with this pest. With reference to *Madras*, the question was dealt with at length by Mr. Lodge in his paper printed as Appendix G to the Proceedings of the Board of Forestry, 1913. As regards present action, Mr. Lushington informed the Board that work had been undertaken only on a limited scale, that the amount spent had been small and that the work had been confined almost entirely to sandal-bearing areas, where eradication had to be effected by uprooting only without burning. The cost of the work varied from as little as Rs. 2-8-0 to as much as Rs. 56 per acre. He considered that it was advisable to extend the work of eradication in future. As regards *Bombay*, Mr. Bell stated that eradication was only of local importance and was being carried out where necessary in coppice-with-standards coupes.

As regards *Burma*, Mr. Rogers mentioned that lantana was becoming a menace in certain localities, for example in North and South Toungoo, where it had escaped from the railway and was spreading down the streams; in Aracan it was spreading from Peletwa up and down the Kaledan river, while at Ani Sakan near Maymyo it was also becoming invasive. Mr. Rogers considered that it was most important that the weed should be eradicated before it spreads further. Mr. Hill mentioned that painting a mixture of quicklime and sulphur on the cut stems of the Ironi climber (*Zizyphus Enoplia*) promised to be successful as a means of eradicating this pest in the Central Provinces, and suggested that this treatment might be tried for lantana. In this connection the Chemical Adviser to the Research Institute informed the Board that he proposed to experiment with substances likely to prove useful in destroying plant pests. The following resolution was passed :—

- (i) *The Board recommends that the measures described in Mr. Tireman's paper be brought to the notice of officers who may have to deal with the lantana pest and that the paper, with illustrations, be published in the "Indian Forester". It recognises, also, that in areas where lantana and prickly pear threaten to become a serious pest it may be necessary to introduce legislation more or less on the lines of the Coorg Noxious Weeds Regulation, 1914, at any rate to the extent of prohibiting the use of these plants for hedges.*
- (ii) *Although admitting that in the first instance artificial eradication is necessary wherever lantana has thoroughly established itself, the Board considers that it is essential to ascertain the natural conditions which prevent lantana from again taking possession of the ground, once eradication has been completed. That such conditions do exist is beyond question, and it is obvious that constantly recurring expenditure on artificial eradication would be prohibitive. From this point of view the Board suggests that it may be found desirable to limit eradication to areas the regeneration of which is under contemplation.*

### VIII.—The Necessity for a systematic Study of Indian Forest Seedlings.

A note on this subject by Mr. R. S. Hole, Forest Botanist (Appendix H) was considered by the Board. Since the subject has been included in the Botanist's triennial programme, no further action was considered necessary.

### IX.—The Need for systematic Record of Insect Damage and the experimental Introduction of Control Measures.

A note (Appendix J) by Mr. C. F. C. Beeson, Forest Zoologist, was discussed and the following resolution was passed :—

- (i) *The Board admits that insufficient attention is paid to the introduction of control measures for insect pests and considers that work on the lines proposed in the Forest Zoologist's paper is desirable, viz., a system of special reports on local insect damage accompanied by specimens and organized efforts at control. It recognizes, however, that under present conditions little more than the submission of reports and specimens can be done by Divisional Forest Officers except in a few cases in which the matter is of special interest to the officer concerned.*
- (ii) *The Board also considers that control measures to be of any use must be carried out continuously on a large scale and must be of a preventive rather than a remedial nature. As the necessary staff for such operations does not at present exist, the Board desires to point out that progress must depend largely, if not entirely, on the appointment of provincial research officers working in connection with, and with assistance from, the Zoologist. In addition the Board considers that the staff of zoologists should be increased by the appointment of field assistants who would be employed in investigational work where prolonged local study is required and who would initiate and carry out control measures : also that as these assistants would require special training by the Zoologist, their appointment is desirable as early as possible.*
- (iii) *In the meantime, with a view to enlisting the help of the subordinate forest staff throughout India, the Board suggests that copies of the Instructions for the collection, etc., of insects be sent to all Chief Conservators and Conservators of Forests for favour of translation into the vernacular and distribution to the staff under their control.*

### X.—The Promotion of Rangers to the Provincial Forest Service.

The note on the subject, printed as Appendix K, was discussed by the Board. It was held that while as a general rule recruitment for the Provincial Service should be confined to direct appointment after the special training provided at the Research Institute, it was at the same time desirable in the interests of the efficiency of the Ranger class to make it plain that the door of advancement to the Provincial Service is not entirely closed to Rangers of exceptional merit. Although it was not desired to limit the discretion of Local Governments in any way it was thought that a general minimum limit of 65 per

cent. of the appointments available should be allotted to men recruited by direct appointment after the prescribed special course of training. The majority of the members were further of opinion that no Ranger should be promoted to the Provincial Service until he has completed at least 10 years of exceptionally meritorious service.

At the conclusion of the discussion the following resolution was passed :—

*That the proposed amendments to Article 15 of the Forest Department Code,\* 7th edition, be accepted with the modification that 10 years instead of 8 years be fixed as the minimum term of service required for a Ranger to be eligible for promotion to the Provincial Service.*

### XI. Proposals for the training and improvement of the position of forest guards.

A note (Appendix L) by Rao Bahadur S. Srinivasulu Naidu, Extra Deputy Conservator of Forests, Central Provinces, was put before the Board. The author of the note, who was present, explained that the form of training advocated was in no way connected with the course of instruction given in training classes for foresters, for whereas these classes aimed at training for promotion, the instruction of guards advocated in the present proposals did not necessarily do so, but aimed rather at keeping the men as guards, making use of indigenous inhabitants in place of outsiders and endeavouring by improving their welfare to keep them in the service and by training them to increase their efficiency. After considering the proposals the Board passed the following resolution :—

*The Board recognizes that the general principles enunciated are of much importance and that any measures are to be commended which aim at improving the quality of the work done by Forest Guards and inducing these men to value their appointments more highly than they do at present owing to the generally low rate of their initial pay. While recognizing also that the scope of the proposed training is perhaps too ambitious and that other objections exist, and while not prepared to recommend the general adoption of the actual measures proposed without putting them to the test of practical experience, the Board desires to draw the attention of Local Governments to the proposals made and suggests for consideration that they be tried experimentally in provinces where conditions are suitable.*

### XII. Classification of Forest Revenue and Expenditure.

A note† on this subject by Mr. G. R. Long, Conservator of Forests, Burma, was considered first by a sub-committee consisting of Messrs. Rogers, Bell and Haines, and afterwards by the full Board. The following resolution was passed :—

*While recognizing that the classification proposed by Mr. Long may be more logical than that which has been in use for many years, the Board considers that no direct advantage will be gained by substituting it for the system at present in use.*

\*Para. 4, Appendix K.

†Not printed in these Proceedings.



### XIII.—Suggested Modification of the Form of the Annual Forest Administration Report.

A note \* by Mr. G. R. Long, Conservator of Forests, Burma, on the above subject was considered first by a sub-committee consisting of Messrs. Rogers, Bell and Haines and afterwards by the Board. The following resolution was passed :—

*The Board is of opinion that with the exception of the following amendment no change should be made in the form of the Annual Forest Administration report :—*

*Forest Department Code, 7th edition, Article 77 (ii), p. 39.*

(1) Chapter II, Section 4.—*Delete sub-section (d) Experiments.*

(2) *For Chapter IV.—Administration.*

*Chapter V.—General.*

*read Chapter IV.—Research and Experiments.*

*Chapter V.—Administration.*

*Chapter VI.—General.*

### XIV.—Amendments suggested for the Forms attached to the Annual Forest Administration Report.

A note\* on this subject by Mr. G. R. Long, Conservator of Forests, Burma, was considered first by a sub-committee consisting of Messrs. Rogers, Bell and Haines and afterwards by the Board. The following resolution was passed :—

*The Board recommends the acceptance of the following amendments to the prescribed forms :—*

*Forest Department Code, 7th edition.*

*Form No. 8, page 73.—For the existing form substitute the following :—*

#### FORM NO. 8.

*Progress made in Forest Settlements during the year 19 -19 .*

Forest Division.	Civil District or Territory.	Name of Forest.	AREA IN SQUARE MILES.			COST DURING YEAR.		Entire cost per square mile of areas finally settled.	Government Notification of Settlement.	
			Finally settled during year.	In hand at commencement of year.	Taken in hand during year.	In Forest Accounts.	In other Accounts		No.	Date.

\* Not printed in these Proceedings.

Form No. 12, page 79.—For the existing form substitute the following:—

FORM

Statement showing Communications

Division.	New works undertaken during the year.														Total expenditure on new works.
	Buildings.					Roads and paths.							Other works.		
	Expenditure on				Total expenditure incurred.	Cart-roads.		Bridle-paths.		Others.		Total length of paths or roads.		Total expenditure incurred.	
	Head-quarter houses.	Rest-houses.	Houses for subordi- nate estab- lishment.	Others.		Length.	Cost.	Length.	Cost.	Length.	Cost.				
1	2(a)	2(b)	2(c)	2(d)	3	4(a)	4(b)	4(c)	4(d)	4(e)	4(f)	5	6	7	8

Form No. 13, page 80.—For the existing form substitute the following:—

FORM

Statement showing register of breaches of Forest

Forest Division.	Cases pending from 1913-14.			New cases of the year.															Total cases.				
				Injury to forest by fire.			Unauthorized felling.			Unauthorized grazing.			Other offences.			Total.							
	A	B	All	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	All				
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24

No. 12.

and Buildings during the year 191 -1 .

Repairs executed during the year.															Remarks.
Buildings.					Roads and paths.							Other works.	Total expenditure incurred.		
Expenditure on				Total expenditure incurred.	Cart-roads.		Bridle-paths.		Others.		Total length of paths or roads.	Total expenditure incurred.		Expenditure incurred.	
Head-quarter houses.	Rest-houses.	Houses for subordi-nate establishments.	Others.		Length.	Cost.	Length.	Cost.	Length.	Cost.					
9(a)	9(b)	9(c)	9(d)		10	11(a)	11(b)	11(c)	11(d)	11(e)					11(f)

No. 13.

Rules during the year 191 -1 .

Disposed of during the year.													Cases pending at close of year.			Remarks.	
Convictions.				Acquittals.				Total.									
Cases.		Persons.		Cases.		Persons.		Cases.			Persons.						
A	B	A	B	A	B	A	B	A	B	All	A	B	All	A	B		All
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41

Form No. 16, page 84.—For the existing form substitute the following:—

FORM NO. 16.

Area closed and open to grazing during 19 - 19 .

Area in square miles.

Division.	CLOSED TO ALL ANIMALS.		OPEN TO GRAZING.			
			Of all animals.		Closed to browsers only (camels, goats and sheep)	
	Whole year.	Part of year.	Whole year.	Part of year.	Whole year.	Part of year.

Form No. 19, pages 88-89.—For the words "cubic feet" or "cubic feet solid" where they occur, substitute "thousands of cubic feet" or "thousands of cubic feet solid."

XV.—Place of Meeting of the Board of Forestry.

The following note was before the Board for consideration:—

"The attention of the Board is drawn to the marginal extract from Government of India, Revenue and Agriculture Department, Circular No. 2-F, 177-16, dated 13th January 1910: "The first meeting of the Board will be held at Dehra Dun, but it will not necessarily meet there every time, and it will be convened on each occasion at such time and place as may be fixed by the Inspector General of Forests with the approval of the Government of India. After a time and place for holding a meeting has been fixed, the Inspector General will make the necessary arrangements directly in consultation with Local Governments."

Paragraph 5 of Government of India, Revenue and Agriculture Department, Circular No. 2-F, 177-16, dated 13th January 1910: "The first meeting of the Board will be held at Dehra Dun, but it will not necessarily meet there every time, and it will be convened on each occasion at such time and place as may be fixed by the Inspector General of Forests with the approval of the Government of India. After a time and place for holding a meeting has been fixed, the Inspector General will make the necessary arrangements directly in consultation with Local Governments."

ability of holding meetings from time to time at centres other than Dehra Dun. One of the main duties of the Board is to settle the triennial programmes of the research officers. As this necessitates the presence of these officers and as Dehra Dun is likely to remain the centre of forest research in India and of the training of candidates for the Provincial Service, it is thought that while there might be some advantage in occasional meetings elsewhere, the Board should assemble at Dehra Dun on every alternate occasion at the least."

After consideration the following resolution was passed:—

*The Board is unanimously of opinion that its triennial meetings should continue to be held at Dehra Dun, and that since March is the most convenient month for the majority of officers the meetings should, as hitherto, be held in that month.*

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APPENDICES.

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## APPENDIX A.

## The Inspector-General of Forests' opening address.

The first thing I have to say is to express my sense of the honour that has fallen to my lot in presiding at the third meeting of the Board of Forestry. These triennial meetings of the Board bring together senior officers of the service from all over India and apart altogether from formal discussions and resolutions the personal exchange of ideas between these officers is bound to be beneficial. I need fear no contradiction, therefore, if I say that the previous meetings of the Board have helped to promote the progress of Forestry in India, and if I express the hope that our present gathering and those which follow from time to time will have equally good results.

Next I have to state the regret which I am sure we all feel that the Hon'ble Mr. Claude Hill, Member in charge of the Department of Revenue and Agriculture, is unable to attend any of our meetings on this occasion. Mr. Hill has asked me to tell you that he would certainly have been here to-day had it not been impossible for him to leave Delhi at present. The Hon'ble Mr. Mant, Secretary to the Department, could not get away from Delhi either; but I hope he will be able to attend one of our meetings before we finish our work.

I turn now, Gentlemen, to a brief statement of the action taken on the resolutions passed at the last meeting of the Board. But as the orders of the Government of India on each of these resolutions were circulated and are known to all of us, I propose to refer only to the most important of the subjects dealt with. For the rest it will be sufficient to say that with small modifications the resolutions were generally accepted by the Government of India and have been acted on as far as possible.

The recommendations made in favour of extending silvicultural research were cordially commended by the Government of India to the consideration of Local Governments. It is understood that the principle of appointing provincial research officers has been accepted by all the major Local Governments, while in certain cases definite action has already been taken. In Burma a local research officer has been employed for some time past, this appointment being filled from the existing cadre pending proposals for the reorganization of the controlling staff in which, it is understood, provision will be made for more than one appointment of this class. In the United Provinces an appointment has actually been sanctioned and although so far it has not been definitely filled, arrangements have been made for the remeasurement of the sample plots established by the Research Institute, thus relieving the Sylviculturist of this work and making it possible for him to devote himself to other investigations. In Assam the recently sanctioned reorganization includes a research appointment, while in the similar scheme for the province of Bihar and Orissa provision for a combined post for research and working plans has been accepted. It is understood that the reorganization schemes under consideration for Madras and the Punjab will include research posts, and there can be little question that the remaining provinces will follow this excellent lead as soon as it is possible for them to do so.

A great deal of work has been done during the last three years in connection with bringing treated sleepers of Indian timbers into more general use on the railways of India. First and foremost an agreement has been entered into between the United Provinces Government and the Railway Board by which some 10½ lakhs of treated chir sleepers (*Pinus longifolia*) will be supplied to the North-Western and the Oudh and Rohilkhand State Railways. Naturally the Department has met with some difficulties in working a new business on such an extensive scale as this; but I believe that most of these difficulties are now in a fair way of solution and that apart altogether from the great influence this project may have in generally pushing the utilization of our so called inferior timbers for railway sleepers after impregnation, it is probable that it will be advantageous to the United Provinces in helping to dispose of the outturn of large areas of forests which it might not have been possible to get rid of otherwise, at any rate for a long time to come. Progress in other provinces has been hampered by the effects of the war, but although no definite agreements have been made as yet it is more than probable that the re-establishment of normal conditions will be followed by the commencement of supplies of treated sleepers from the Dipterocarp forests of Assam, from the Andamans, and from the spruce and silver fir forests of the Himalayas.

Unfortunately, it has not been possible to make such progress as regards the introduction on the market of tan extracts. But the Government of India have now at last succeeded in obtaining the services of an expert from England and this officer will very shortly commence his work on the manufacture of tan extracts on a commercial scale in the mangrove forests of Burma. It is hoped that when this work is completed the expert, who is bringing a portable plant from England, will be able to turn his attention to the manufacture of extracts from myrobalans, babul bark and other raw products which occur commonly in Indian forests.

Again no definite action has been taken regarding the destructive distillation of wood. The Forest Economist has been unable to devote much attention to this subject and the

information which we have regarding it does not yet seem to justify our asking the Government of India to employ an expert with the object of making a start on a commercial scale. No doubt this industry will come into being in the course of time, but owing to the great difficulty of disposing profitably of some of the products, more specially of the charcoal, I am afraid that it is not possible for the Forest Department to do very much in this matter at present.

As regards the preparation of local forest floras, the Government of India accepted generally the resolution passed by the last Board and expressed a hope that Local Governments would undertake the preparation of descriptive lists on the lines laid down by the Forest Botanist. It is satisfactory to be able to state that work in connection with this important matter is in progress in most provinces, in one or more of which special officers have been employed in their preparation.

These are only a few of the many directions in which the officers of the Research Institute have been active. Time prevents me from giving you many details, but I can assure you that much of the work done cannot fail to have considerable influence on commercial development in India. We have heard a good deal lately on the subject of capturing trade which has until recently been largely or entirely in the hands of our enemies. In this connection I may mention two important products with the experimental preparation of which the Chemical Adviser to the Institute has been intimately concerned, namely thymol and salicylic acid. The manufacture of these products, which, as you know, are of great importance in medicine, has hitherto been almost exclusively in the hands of the Germans. Preliminary experiments in the manufacture of thymol carried out in February 1915 in the chemical laboratory of the Forest Research Institute demonstrated the practicability of undertaking its manufacture on a commercial scale, and two months later the Dixon Chemical Company established a factory at Dehra Dun which is now turning out regular supplies of thymol of excellent quality from *ajowan* seeds. This Company is now not only supplying the Indian demand, but is exporting large quantities of thymol to England and America. The preparation of oil of wintergreen and salicylic acid from the leaves of *Gaultheria fragrantissima* has also been taken up experimentally at the Institute; from the oil of wintergreen natural salicylic acid, natural sodium salicylate and aspirin have been made and so favourably reported on that the Dixon Chemical Company has decided to undertake the manufacture of these drugs on a commercial scale. It is of great interest, not only to ourselves but to the general public, that the Forest Research Institute is thus doing its share in turning out important products hitherto almost exclusively of German manufacture and in promoting self-support within the British Empire.

Practical measures in connection with the eradication of lantana have now been carried out to a considerable extent in Coorg where special legislation in the form of the Coorg Noxious Weeds Regulation has been enacted, where a scheme has been prepared to cover all the forests affected and where some 70,000 rupees have been spent in the eradication of this pest over approximately 15,000 acres of forest. This scheme has not yet been finally sanctioned, but I think it may be taken for granted that there is no intention of dropping this work and that it will be steadily prosecuted until all the forest areas in this small province have been freed. When we come to the discussion of Mr. Tireman's paper on this subject our friends from Bombay and Madras will be able to tell us what action has been taken in their provinces to deal with the lantana and prickly pear problems.

Outside the subjects referred to in the resolutions passed by the last Board of Forestry there are a few other matters on which action has been taken during the last three years to which I may make a brief reference. Firstly, there is the question of strengthening the staff of the Imperial and Provincial Service officers. Reorganizations have been sanctioned for the United Provinces, for Assam and for Bihar and Orissa; these with the creation of Chief Conservatorships for Bombay and the United Provinces, with the addition, either permanently or temporarily, of a fourth Conservator for Madras and a third Conservator for the United Provinces and with the sanctioning of posts of Assistants to the Botanist and Economist at the Research Institute, have resulted in raising the strength of the Imperial and Provincial Services from 213 and 207 on the 31st March 1913, to 237 and 231 at the present time. It is known, too, that the Governments of Burma, Madras and the Punjab have reorganization schemes under consideration, which may result in further additions to the number of Conservators and in a considerable increase to the strength of the Imperial and Provincial Services. It is hoped that Madras, also, will soon have a Chief Conservator, while in addition to the provinces I have just mentioned it is possible that at least one other Local Government will soon have to consider a scheme for the reorganization of its forest staff. It is probable, therefore, that the next three years will show still greater progress in this matter than has been achieved since the Board met last. I mention this subject because we all know how woefully under-staffed the Department really is and how extremely important accessions to our strength are for future progress.

In the second place, I should like to say a few words about the Research Institute and the Provincial Service class. The main buildings of the Institute have now been finished and though there is still some work to be done in completing the exhibits in the museums,

I am sure we all agree that we now have a well equipped Institute with all the necessary laboratories and appliances. Apart from the buildings actually connected with the Institute, we have now in course of erection five fine blocks of quarters and a mess house for the Provincial Service students, all located in an estate adjoining the Institute which has been purchased by the Government of India and which contains ample space for playing fields and for such further extension as may hereafter be necessary.

Closely connected with this is the question of decentralizing the training of forest rangers. This question was reopened in 1914, as it was found that the classes in the Rangers' College were too large for really efficient training by the present staff and as it was held that matters had advanced to a stage at which the Government of India ought to confine itself to the training of candidates for the Provincial Forest Service, leaving the training of ranger students to the Local Governments concerned. A final decision on this question has not yet been arrived at: but I think it is probable that when the Board of Forestry next meets the Rangers' College at Dehra Dun will have closed, or at any rate be on the point of closing as an Imperial institution, its place being taken by provincial colleges.

Another important matter to which much attention has been devoted and which has recently come into prominent notice in the press, is the manufacture of paper pulp in India from bamboos, forest grasses and timber. Much work in this connection has been done by Mr. Raitt, who is still retained as an adviser to the Research Institute, and by the Forest Economist. The war has prevented operations being actually started, but several concessions have been granted by Local Governments and I think there is little or no doubt that this industry, which may ultimately attain very large proportions, will be commenced as soon as trade conditions render this possible.

This brief sketch of our work during the past three years is sufficient to show that we have made some little progress. I regard the advance made towards the institution of sylvicultural research in the major provinces as particularly gratifying, for I am sure this will have far-reaching effects on the development of Forestry in India and on the general status and importance of the Forest Department. Though the Department is now in a very different position to that which it occupied thirty years ago, I am convinced that we are still hardly more than just past the beginning and that the Forest service in India has a very great future ahead of it. Apart from the development of new industries, I believe that this future must be closely connected with the introduction of improved systems of management, based on the results of scientific research, both botanical and sylvicultural, and aided by the extended use of mechanical means of transporting and handling forest produce. We cannot perhaps expect that the surplus revenue which the service makes for the State will continue to increase in the same proportion as it has in the past, for in the last 50 years this surplus has risen by no less than 1,000 per cent. But we can at least be certain of two things. One, that a decade or two hence the forests of India will have proved themselves of far greater value as producers of revenue than they are at present. The other, that the rate at which this progress takes place will depend almost entirely on the extent to which the Government of India and the various Local Governments are willing to incur expenditure on improvements in communications, on special means for the extraction, conversion and transport of forest produce, on the commencement of new forest industries, and last, but by no means least, on the expansion of the trained staff.

Gentlemen, I cannot close these remarks without expressing my regret that Mr. Mercer was unable to postpone his departure on leave until after the close of this meeting of the Board of Forestry. Throughout the 8 years which he spent as President of the Research Institute and College Mr. Mercer made the interests of these institutions his special care and the many improvements which have taken place during this period are largely due to his energy and foresight: but during the last year or two his health has been far from good and this, combined with the pressure of personal business, compelled him to go on leave in the early portion of this month. As his successor we welcome Mr. Osmaston whose experience of forest work in many parts of India and whose well known interest in the scientific side of our profession are guarantees of future progress.



## APPENDIX B.

Triennial Programme of Work of the Forest Research Institute for the period 1916-17 to 1918-19.

### (a).—PROGRAMME OF THE SYLVICULTURIST.

#### *Part I.—Investigations in connection with Sal (Shorea robusta).*

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	REMARKS.
1	<i>Sylvicultural System.</i> —The application of an approximately even-aged system of Sál forest.	In progress at Thano, Siwaliks Division. Elsewhere this problem has been taken up by Working Plan officers, and the function of the Sylviculturist will be limited to observation.	Except at Thano the Sylviculturist will investigate only by means of sample and experimental plots. It is not possible for him to control the whole management of a working section.
2	<i>Natural Regeneration.</i> —Experiments to ascertain the best methods of ensuring natural regeneration of Sál under forest conditions in various localities.	(1) Experimental plots have been laid out in the United Provinces. (2) Experimental plots will be laid out in the Sál forests of other provinces.	These plots are intended to test on a small scale ideas which have been suggested by observation or otherwise as practically applicable under forest conditions.
3	<i>Artificial Regeneration.</i> —Methods of sewing or planting Sál, with a view to the formation of forests or to filling up gaps in natural regeneration.	Various methods of propagating Sál have been tried in the experimental garden at Kaunli and are in progress there. As experience accumulates, these will be extended to application in the forest, perhaps first at Dhano.	
4	<i>Seed and seed years.</i> —Effect of age of trees and of environment on production of seed and on frequency of seed years. Fertility of Sál coppice seed and quality of resulting plants.	Sál tracts in various provinces     ...     ...	Much information has been collected. Observations and experiments will be continued.

(a).—PROGRAMME OF THE SYLVICULTURIST—*contd.*

Part I.—Investigations in connection with *Sal* (*Shorea robusta*)—concl'd.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	REMARKS.
5	<i>Coppice</i> .—Experiments to find out the best methods of cutting and working <i>Sál</i> coppice.	Siwaliks and Gonda Divisions. To be extended to other localities.	
6	<i>External dangers</i> .—Effects of drought, fire, frost, grazing, suppression and other dangers.	In progress in the United Provinces. Will be extended to other localities.	
7	<i>Rate of growth and volume increment</i> .—The establishment of sample plots in representative <i>Sál</i> crops. Determination of quality classes..	Plots have been made in the United Provinces, Bengal, and Central Provinces. To be extended to other localities as time and staff allow.	Eighty-six permanent sample plots in <i>Sál</i> forest have been laid out.
8	<i>Thinnings</i> .—The execution of thinnings in sample plots with the object of ascertaining the optimum density under different conditions.	Ditto ditto.	
9	<i>Physical conditions</i> .—The effect of climate, shelter, soil, sub-soil, topography, aeration, drainage, ground fires, subterranean water-level, soil-preparation and other factors on development of <i>Sál</i> .	In progress, chiefly in connection with sample and experimental plots.	The Forest Botanist is studying some of these factors in the experimental garden. The Sylviculturist will prosecute in the forest investigations based on the Botanist's results with special reference to (1) conditions favouring the establishment of <i>Sál</i> seedlings, (2) conditions favouring the growth of established <i>Sál</i> trees.
10	<i>Miscellaneous</i> .—The collection of information on various statistical and sylvicultural matters connected with <i>Sál</i> , including a study of its more important companions.	In progress. Information is being collected on tour and from experiments in the sylvicultural garden, as well as from published articles, and from Reserve Journals, and Divisional Officers' sample plots.	
11	The causes of the death of large tracts of <i>Sál</i> forests, the supposed cause being drought.	Haldwani, Chakrata Range, United Provinces ...	In collaboration with Forest Botanist.
12	The establishment period of <i>Sál</i> seedlings ...	Any <i>Sál</i> Division ... ..	Already under study.

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(a).—PROGRAMME OF THE SYLVICULTURIST—*contd.*  
 Part II.—*Miscellaneous Investigations.*

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	REMARKS.
1	<i>Sylvicultural Systems.</i> —The special conditions obtaining in different localities will be studied with the object of devising systems adapted to the sylvicultural character of the prevailing species and to the quality of the climate and soil.	Investigations already in hand for <i>Pinus longifolia</i> , Deodar, and Oaks in the Punjab and the United Provinces; also for <i>Picea Morinda</i> and <i>Abies Pindrow</i> in the United Provinces. Will be extended to other localities and species as time and staff allow.	<i>Pinus, excelsa</i> in the Himalayas, and Teak in South India, demand early attention.
2	<i>Plantations.</i> —Compilation of statistics from existing plantations with a view to framing financial forecasts: determination of the best methods of artificial regeneration to be applied to different species, and of the financial prospects of plantations.	Any plantations seen while on tour will be measured up, and all statistics available will be collected. Experiments are in progress at the experimental garden in the artificial regeneration of several species and will be continued.	<i>Eucalyptus</i> in the Nilgiris and Teak in South Malabar have been dealt with.
3	<i>Bamboos.</i> —Investigation into the best method of cutting and working bamboos.	In progress for <i>Dendrocalamus strictus</i> in the United Provinces.	
4	<i>Miscellaneous sylvicultural investigations.</i> —The sylviculture of various trees will be studied not only in the forest but especially in the experimental garden. The investigations include the method of germination, conditions favouring germination and natural reproduction, tending in early youth, artificial regeneration, nursery treatment, methods of propagation and transplanting, seeding and seed years, fertility of seed, development as a crop, susceptibility to external dangers, and formation of crop.	In progress for Deodar, and other species. To be continued and extended.	
5	<i>Regeneration of Picea Morinda and Abies Pindrow.</i> —Determination of the best method.	Experimental plots have been laid out in the United Provinces.	

(a).—PROGRAMME OF THE SYLVICULTURIST—concl'd.

Part II.—Miscellaneous Investigations—concl'd.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	REMARKS.
6	<i>Coppice experiments.</i> —The best height for coppicing different species and the effect of tending.	In progress in the United Provinces. To be taken up in Madras for <i>albizzia amara</i> .	
7	Enquiry into the history of Deodar seedlings grown under various conditions met with in nature, during the first few years of their life.	Punjab and United Provinces.	
8	The cause or causes of the absence of satisfactory Oak regeneration.	United Provinces.	
9	Some practicable means of killing climbers in Sál forests, principally <i>Bauhinea Vahlii</i> .	Ditto.	
10	The best method of eradicating Ironi ( <i>Zisypbus Oenoplia</i> ): and determination of factors influencing its growth.	Bhandara, Central Provinces.	
11	Cause of twisted fibre in <i>Pinus longifolia</i> . Cause or causes and remedial measures.	Naini Tal Division, Kumaon Circle, United Provinces.	In collaboration with Forest Botanist.
12	Investigations relating to <i>Pterocarpus santalinus</i> :— (a) The effect of different soils on the girth increment and the proportionate formation of heartwood. (b) The period in the life of the tree at which the greatest proportion of heartwood is formed if the rate of formation is not uniform throughout. (c) The rate of girth and height increment. (d) The dying back of seedlings and its causes. Does it induce decay in the mature stem?	East Cuddapah, Madras.	
13	The most effective way of eradicating prickly pear ...	Bombay and Madras.	

(b)—PROGRAMME OF THE FOREST BOTANINIST.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	REMARKS.
1	<i>Oecology of Sál.</i> —To be continued on lines already sanctioned in previous programme.	United Provinces, Behar, Bengal, Assam, Central Provinces, and Northern Madras.	Already in hand.
2	<i>Oecology of Teak.</i> —To be studied on lines similar to those already adopted in the case of Sál and with special reference to the factors influencing the healthy development and dying back of seedlings.		
3	<i>Study of the most important forest grasses.</i> —To be continued on lines already sanctioned in previous programme.	United Provinces, Behar, Bengal, Assam and the Central Provinces.	Already in hand.
4	<i>Systematic Botany.</i> —To be continued on lines already sanctioned in previous programme and with special reference to the genus <i>Dipterocarpus</i> .	At Dehra Dun and on tours as opportunity offers ...	Already in hand.
5	Spike disease of Sandal and dying back of Sandal from other causes.	Coorg and Madras.	
6	Root disease of Sál ... ..	Assam, Bengal, United Provinces and Central Provinces.	
7	Root disease of <i>Dalbergia Sissoo</i> ... ..	Changa Manga plantation, Punjab.	
8	Systematic description and illustration of the seed, process of germination and the seedling of important forest species.	Dehra Dun ... ..	To be undertaken only to such extent as may be possible without interfering with the other sanctioned items of work.

(b).—PROGRAMME OF THE FOREST BOTANIST.—*concl'd.*

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand	REMARKS.
9	Preparation of a revised Botany Manual.—Work to be completed.	Dehra Dun ... ..	Already in hand.
10	The causes of the death of large tracts of Sál forests, the supposed cause being drought.	Haldwani, Chakrata Range, United Provinces ...	In collaboration with Syiviculturist.
11	Cause or causes of twisted fibre in <i>Pinus longifolia</i> and remedial measures.	Naini Tal Division, Kumaon Circle, United Provinces	Ditto ditto.
12	Identification of Dipterocarp timbers ... ..	.....	In collaboration with Forest Economist.

(c).—PROGRAMME OF THE FOREST ECONOMIST.

Serial No.	Subjects and details of investigations.	Localities in which the investigations will first be taken in hand.	REMARKS.
1	Completion of the enquiry into <i>Cedrus Deodara</i> ...	Punjab and the United Provinces ...	Nearly all the necessary data have been collected and it is proposed to write the note as soon as time is available.
2	A full enquiry into the uses, outturn, market value and mechanical properties of <i>Dalbergia Sissoo</i> .	Ditto ditto ...	When the note on Deodar is completed it is proposed to start the <i>Dalbergia Sissoo</i> enquiry.
3	Utilization of grasses for pulp ...	United Provinces, Assam and Bengal ...	Preliminary enquiries are already in hand, a full enquiry is contemplated.
4	Observation and encouragement of the Bamboo pulp Industry in India and Burma.		
5	Observation and encouragement of the Match Industry in India and Burma.		
6	Antiseptic treatment of timbers. This enquiry to be continued on the present lines and further tests to be carried out in pressure plants.		
7	To render assistance to the Tan Expert, especially in connection with ascertaining outturn of raw materials.	Burma, Central Provinces and Bombay.	
8	Investigation into the physical properties and seasoning power of various timbers :—  (i) Mechanical tests to be carried out in workshops, especially in connection with sleeper woods, and <i>Dalbergia Sissoo</i> . (For latter see serial No. 2)	Dehra Dun ... ..	A good deal of work has been carried out and further tests are contemplated.

(c).—PROGRAMME OF THE FOREST ECONOMIST—*contd.*

Serial No.	Subjects and details of investigations.	Localities in which the investigations will first be taken in hand.	REMARKS.
	<p>(ii) To carry out seasoning experiments :—</p> <p>(a) naturally, and</p> <p>(b) in artificial plants.</p>	<p>(ii) (a) Bombay, United Provinces, Central Provinces, Punjab, Bengal, Bihar and Orissa.</p> <p>(ii) (b) Dehra Dun ... ..</p>	<p>A very large number of logs of various species have been laid down to season in different parts of India.</p> <p>Under this head it is proposed to carry out experiments in connection with sleeper woods which it is proposed to treat in Assam and the Andamans.</p>
9	The finding of markets and new uses for Indian timbers, including the issue of Bulletins.	Dehra Dun ... ..	The issue of bulletins describing the uses, sources and supply of important timbers should be continued. Up to date 15 bulletins have been published in this connection and 3 others are in hand. It is proposed to take up 6 further species as time allows.
10	<p>The uses and possibility of putting on the market certain gums, resins and oleo-resins.</p> <p>(I) The best method of tapping—</p> <p>(i) <i>Boswellia serrata</i> ... ..</p> <p>(ii) <i>Canarium strictum</i> and <i>Vateria indica</i> ...</p> <p>(II) Utilization of gums of <i>Anogeissus latifolia</i>, <i>Sterculia urens</i>, <i>Acacia sp.</i>, etc.</p>	<p>Bombay Central Provinces and Madras ...</p> <p>Madras.</p> <p>.....</p>	<p>A commencement has already been made in this connection.</p>



10	(iii) <i>Cordia Myxa</i> extract ... ..	Bombay ... ..	In collaboration with Chemical Adviser.
	(iv) Utilization of resin of <i>Canarium</i> and <i>Sterculia</i> spp.	Andamans, etc.	
11	General enquiry into fibres, their uses and value—		
	(i) <i>Helicteres Isora</i> fibre ... ..	Central Provinces ... ..	Much work has been carried out in this connection, especially in connection with <i>Helicteres Isora</i> fibre.
	(ii) Nettle fibres ... ..	Darjeeling District, Bengal.	
	(iii) Other fibres.		
12	Woods suitable for —	.....	
	(i) Paving blocks ... ..	Calcutta and Bombay.	
	(ii) Jute bobbins ... ..	} Calcutta.	
	(iii) Picking arms .. ..		
	(iv) Casks (a) Rum casks ... ..	Poona, Bombay.	
	(b) Whisky casks ... ..	.....	Samples of timber have already been sent for trial. The enquiry as regards tea-boxes and cement barrels is practically complete, though further enquiries are received from time to time.
	(v) Packing cases ... ..	.....	
	(vi) Rifle stocks ... ..	.....	
	(vii) Veneers (burrs) ... ..	.....	
	(viii) Wood wool ... ..	.....	
13	A full enquiry into the best and most suitable methods of manufacturing charcoal in India, with a view of improving the present methods of preparation.	.....	

(c).—PROGRAMME OF THE FOREST ECONOMIST—concl'd.

Serial No.	Subjects and details of investigations.	Localities in which the investigations will first be taken in hand.	REMARKS.
14	Estimating outturn of raw material for destructive distillation and finding markets for the manufactured products of the same.	.....	In collaboration with Chemical Adviser.
15	Identification of <i>Dipterocarp</i> timbers ... ..	.. ...	In collaboration with Forest Botanist.
16	Commercial possibilities of improving the manufacture of Cutch.	.....	

(d).—PROGRAMME OF THE FOREST ZOOLOGIST.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	REMARKS.
	<p>The life histories, distribution and economic importance of the principal insect pests of the Sál (<i>Shorea robusta</i>) with special reference to the following:—</p> <p>(a) <i>Hoplocerambyx spinicornis</i>, the heart-wood borer.</p> <p>(b) <i>Aeolesthes holosericea</i> ... ..</p> <p>(c) Shot-hole borers and ambrosia beetles of the genera <i>Xyleborus</i>, <i>Platypus</i>, <i>Diapus</i> and <i>Crossotarsus</i>.</p> <p>(d) <i>Pammene theristis</i>, the seedling root-borer ...</p> <p>(e) <i>Ingura subapicalis</i>, <i>Suna concolor</i> and other defoliators.</p> <p>(f) Other pests (including an unidentified shoot borer), as met with on tour.</p>	<p>(a) Insectary, Dehra Dun and Siwalik Division, United Provinces.</p> <p>(b) Ditto.</p> <p>(c) United Provinces, Central Provinces, Bengal, Bihar and Orissa and Assam.</p> <p>(d) Siwalik and Ramnagar Divisions, United Provinces.</p> <p>.....</p> <p>.....</p>	<p>Already in progress.</p> <p>.....</p> <p>In progress. In collaboration with Divisional Forest Officers of all Sál Divisions in the United Provinces, Central Provinces, Bengal, Bihar and Orissa and Assam.</p> <p>.....</p> <p>Already in progress.</p> <p>.....</p> <p>Investigation of defoliators in Bengal or the Central Provinces will be commenced, if Divisional Officers locate and report the occurrence of attacks.</p>

(d).—PROGRAMME OF THE FOREST ZOOLOGIST.—*contd.*

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	REMARKS.
2	<p>The life histories, distribution and economic importance of the principal pests of teak (<i>Tectona grandis</i>) with special reference to the following:—</p> <p>(a) <i>Duomitus ceramicus</i>, the bee-hole borer ...</p> <p>(b) <i>Haplohammus cervinus</i>, the longicorn borer ...</p> <p>(c) <i>Phassus signifer</i>, the sapling moth-borer ...</p> <p>(d) <i>Hyblaea puera</i> and <i>Pyrausta nuchezralis</i> ...</p>	<p>Burma ... ..</p> <p>Burma and Assam,</p> <p>Burma and Madras,</p> <p>.....</p> <p>.....</p>	<p>In progress. In collaboration with Forest Research Officer, Burma, with assistance of Divisional Officers, -</p> <p>The possibility of starting a special enquiry depends on the preliminary determination by local officers of the range, recurrence and period of attack of these defoliators.</p>
3	<p>The life history, economic importance and control measures of certain pests of chir (<i>Pinus longifolia</i>.)</p> <p>(a) <i>Rippersia resinophila</i>, the Chir scale insect ...</p> <p>(b) <i>Cryptorrhynchus brandisi</i>, the Chir weevil ...</p>	<p>Naini Tal Division, United Provinces ...</p> <p>South Garhwal Division, United Provinces</p>	<p>Already in progress.</p> <p>Control measures will be carried out in infested plantations at an early date.</p>
4	<p>The life history, economic importance and control measures of <i>Hypsipyla robusta</i>, M.O., the Toon shoot and fruit borer.</p>	<p>Insectary, Debra Dun and District ...</p>	<p>Already in progress.</p>

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5	The parasites of the lac insect and methods of eliminating them.	...	Intermittent cultivation in experimental areas, with the object of determining its effect in parasitism.
6	Defoliators of <i>Dalbergia Sissoo</i> , <i>Acacia arabica</i> and <i>Terminalia tomentosa</i> .		
7	The life history of the borer of Dhaura ( <i>Anogeissus latifolia</i> ), and the influence of red sanders in mixture with Dhaura, on the incidence of the pest.		
8	Systematic entomology :— (a) General expansion of the reference collection ... (b) Revision of the Forest <i>Ipiidae</i> and <i>Platypodidae</i> .	India and Burma.	
9	Determination of the toxic properties of essential oils for use as insecticides.	Dehra Dun ... ..	In connection with the Chemical Adviser.

(e).—PROGRAMME OF THE CHEMICAL ADVISER.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	REMARKS.
1.	<p><i>Destructive Distillation—</i></p> <p>(a) The dry distillation of rosin and its bye-products—to work out commercial figures experimentally.</p> <p>(b) Destructive distillation of wood.</p>	<p>.....</p> <p>.....</p>	<p>Requires a special plant.</p> <p>In collaboration, with Forest Economist, vide item 14 of latter programme.</p>
2.	<p><i>Tannins—</i></p> <p>(a) A study of the tanning materials from leaves, barks, and fruits, in co-operation with a tannery, with a view to issuing a treatise on Indian tanning materials, the preliminary information about which is given in Agricultural Ledger No. 1 of 1902.</p>	<p>Dehra Dun with occasional visits to localities where the materials may occur.</p>	
3.	<p><i>Gums, Résins, Oleo-resins, and Essential Oils.—</i></p> <p>(a) Distillation of Sandalwood oil.</p> <p>(b) The economic value and commercial possibilities of the gum of <i>Boswellia serrata</i>.</p> <p>(c) The distillation of essential oil from the leaves of <i>Gaultheria fragrantissima</i>.</p> <p>(d) The distillation of <i>Cymbopogon</i> spp. from Burma.</p>	<p>Assam ... ..</p>	<p>In progress.</p>

*Medical Products.—*

- |   |  |  |
|---|--|--|
| 4 | (a) The general preliminary study of Indian Medical Drugs that grow wild in our forests with a view to arriving at a more accurate judgment of their value and thus opening up new fields for more extended chemical research. | Dehra Dun with occasional visits to localities where they are produced or used.                            |
|   | (b) The study of the prospects of the industrial manufacture of <i>Strychnine, Brucine, Hysoyamine, Atropine, Berberine, Santonine</i> and <i>Digitaline</i> in India.   | Dehra Dun with occasional visits to localities where the herbs yielding their alkaloids grow in abundance. |

*Miscellaneous Enquiries.—*

- |   |  |       |
|---|--|-------|
| 5 | (a) Prevention of deterioration of turpentine oil on storage, in points of colour and light fractions. |       |
|   | (b) The prevention of emulsification of essential oils during distillation.                            |       |
|   | (c) <i>Cordia myxa</i> extract           ...           ...   | ..... |
- In collaboration with Forest Economist, *vide* item 10 (iii) of latter's programme.

## APPENDIX C.

## Rules for the Provincial Service Course.

## SECTION I.

## CONSTITUTION.

1. The Institute is under the administrative control of the Inspector General of Forests, who is assisted by the Board of Forestry.
2. The Superior Staff of the Institute consists of:—
  - (1) The President.
  - (2) The Research Staff, *viz.*,
    - (i) The Forest Botanist,
    - (ii) The Sylviculturist,
    - (iii) The Forest Economist,
    - (iv) The Forest Zoologist,
    - (v) The Chemical Adviser to the Institute,
    - (vi) The Assistant to the Forest Botanist,
    - (vii) The Assistant to the Forest Economist.
  - (3) The Instructors and Assistant Instructors to the Provincial Service Class.
3. The President is charged with (1) general administration, including the regulation of the course of study under the arrangements prescribed by the Board of Forestry, subject to the sanction of the Government of India; (2) the supervision of the buildings, quarters and gardens; (3) the control of the accounts and the conduct of correspondence.

## THE COURSE.

4. The course of study at the Forest Research Institute is designed primarily to fit selected students for appointment to the Provincial Forest Service, and to afford a higher class education in Forestry to students deputed from Native States and elsewhere.

## SECTION II.

## ADMISSION RULES.

5. *Allotment of studentships.*—The maximum number of students to be admitted annually during each succeeding period of three years will be decided by the Board of Forestry at its triennial meetings. Within this number studentships will be assigned to the various provinces by the President who, after satisfying their requirements, may also assign vacancies to British possessions, Native States, etc. The President is empowered to refuse an application for a studentship without assigning any reason.

In April of the year preceding that in which the course will commence the President will enquire of Local Governments and States the number of vacancies they desire, and all applications for nominations must be communicated to the President by the 1st July of that year. All nominations will be allotted and communicated to Local Governments and States concerned by the 15th July. Should any nomination not be accepted, the President should be informed by as early a date as possible so as to permit of his transferring the nomination elsewhere.

6. *Qualifications.*—Local Governments may prescribe such educational qualifications as they please for candidates whom they propose to depute to the Provincial Service course, subject to the condition that only those who are in all respects qualified by previous education, more especially in English and mathematics, thoroughly to follow and profit by the course of instruction should be nominated. It should also be noted that a substantial knowledge of one or more branches of natural science is very desirable.

7. *Physical test.*—It is left to Local Governments to prescribe any physical test they please. Should a student at any time during the course be found to be physically unfit, the President may remove him from the Institute.

8. *Qualifying entrance examination.—English.*—The test in this subject is left to Local Governments: it might suitably consist of précis writing, dictation and conversation.



*Mathematics.*—The examination will consist of two papers, one in Arithmetic and Algebra and the other in Geometry and Trigonometry to each of which three hours will be allowed. The papers will be sent under sealed cover to Local Governments. After the examination has been held on the date fixed answers will be forwarded under sealed cover to the President, Forest Research Institute, direct.

The standard in mathematics is a practical knowledge of Arithmetic, Algebra, up to and including quadratic equations and simple problems, Mensuration, Geometry (including the first 3 books of Euclid) and elementary Trigonometry including the solution of triangles and the use of logarithms. No candidate who fails to obtain half the full marks in each paper will be considered to have passed.

The examination will be held in July at Dehra Dun and other centres to suit the convenience of Local Governments, the date fixed being communicated by the President in June.

With the permission of the Local Governments concerned candidates from Native States and private students will be examined at these Centres.

A successful candidate will not without re-examination be eligible for admission to any course save that immediately following the examination at which he has qualified, provided that for special reasons this rule may be relaxed under the orders of the Inspector-General of Forests.

There is no restriction to the number of candidates who may be permitted to appear at this examination by Local Governments and Native States to whom nominations have been allotted by the President, Forest Research Institute. Local Governments and Native States to whom nominations have not been allotted are also permitted to send candidates, to this examination, but these candidates, even if they qualify, will be admitted to the Institute only provided that a sufficient number of qualified candidates is not available from Provinces and States to whom nominations have been allotted.

Local Governments and Native States should inform the President by the 1st June in each year of the number of candidates they desire should appear for this examination in order that the requisite number of examination papers should be supplied.

9. *Categories of students.*—There are four categories of students:—

- (a) Government probationary students, stipendiary or non-stipendiary.
- (b) Students deputed by Native States and British Colonies, etc.
- (c) Students already in Government service.
- (d) Private students.

(a) Government probationary students are those nominated by a Local Government as probationers for the Provincial Service.

(c) Students already in Government service may be deputed at the discretion of Local Governments, provided that they pass the examination prescribed in rule 8.

(d) Private students can be admitted only if there are vacancies after the demands of (a), (b) and (c) above have been satisfied. Their chief *raison d'être* is to meet a possible demand on the part of large landowners who may wish to place their forest areas under professional management.

10. *Submission of applications.*—In the case of *Government probationary students*, applications must be made to the Chief Conservator, or Senior Conservator or Conservator of the Province concerned, or in the manner prescribed by the Local Government; in the case of students from *Native States* and *British Colonies* they should be made in the manner prescribed by the State Durbar or the Governor of the Colony concerned. As a rule those who have already been through the *Rangers' course* at the Forest College will not be accepted.

In the case of *private students* applications for nominations must be made to the President direct; they should be supported by the certificates detailed in rule 12 and by the production of evidence to show that the candidate possesses a good general education.

11. *Age.*—Except for special reasons and under the special orders of the Local Government in each case, candidates must be between the ages of 18 and 25 on the 1st April in the year in which the course begins.

The Inspector General of Forests has the power to relax this rule.

12. *Certificates.*—With their applications candidates must furnish the following certificates (this does not apply to those already in Government service):—

- (a) A certificate that the candidate is a "Native of India" within the meaning\* assigned to those words by section 6 of 33 Vict., Cap. 3.

*N.B.*—This certificate may be omitted in the case of private students and of students deputed by British Colonies.

- (b) A certificate of age.  
 (c) A health certificate in the form prescribed by Article 49 of the Civil Service Regulations, 5th edition, signed by a Civil Surgeon and testifying to the candidate's sound constitution, good vision† and hearing, and general physical fitness for a rough outdoor life in the Forest Department, and to the fact that he bears on his body marks of successful vaccination or of small-pox.  
 (d) A certificate showing that the candidate is of good social standing and good moral character, and is likely to make a good executive Forest Officer.

Certificates (c) and (d) must bear date not later than the 1st April of the year previous to that in which the candidate desires admission to the Forest Research Institute: the latter certificate must be signed by a Conservator of Forests, District Officer, Political Agent, or a British Government gazetted officer of high standing.

The Inspector General of Forests may, should he consider it desirable, relax any of the conditions imposed under the foregoing portions of this rule.

In the case of candidates included in categories (b) and (d), rule 9, the above certificates should be forwarded to the President when the names of candidates are communicated to him.

13. *Preliminary training.*—It is left to the discretion of Local Governments, etc., to test the suitability of their candidates for a forest career by a period of practical training in the forests before they enter the Institute, special attention being paid to physical fitness.

During such training candidates will receive such consolidated allowance as may be ordered by the Local Governments, etc.

#### 14. *Stipends.*—

- (1) *Government probationary students.*—It is left to Local Governments to award stipends in such manner as they please, provided that the total for the 24 months' course does not exceed 2,400 rupees, *i.e.*, does not exceed an average rate of Rs. 100 per mensem. In the event of a stipend being awarded it will ordinarily consist of—

- (a) a sum not exceeding Rs. 100 per mensem for the duration of the course or portion thereof;  
 (b) in lieu of the above, a lump sum to be paid on a candidate successfully obtaining such certificate as may have been agreed upon;  
 (c) partly the one, partly the other of the above.

(2) *Students already in Government Service.*—Such officers will, while at the Institute, draw the pay and the travelling allowances of their grade in the service, or a stipend not exceeding Rs. 100 per mensem in place thereof, as the Local Government may decide.

It must be clearly understood that there is no guarantee that a stipend will cover the whole cost of living, etc., at the Institute.

\* "Native of India" means any person born and domiciled within the dominions of His Majesty in India, or within the territories of Indian Princes tributary to or in alliance with His Majesty, of parents habitually resident in India and not established here for temporary purposes only. (Article 37, Civil Service Regulations, 1915.)

† Standard of Vision required for the Provincial Forest Service.

1. If myopia in one or both eyes exists, candidate may be passed, provided the ametropia does not exceed 2.5 D, and if with correcting glasses, not exceeding 2.5 D, the acuteness of vision in one eye equals  $\frac{5}{8}$  and in the other  $\frac{5}{8}$ , there being normal range of accommodation with the glasses.

2. Myopic astigmatism does not disqualify a candidate for service, provided the lens or the combined spherical and cylindrical lenses required to correct the error of refraction do not exceed—2.5 D, the acuteness of vision in one eye, when corrected, being equal to  $\frac{5}{8}$ , and in the other eye  $\frac{5}{8}$ , together with normal range of accommodation with the correcting glasses, there being no evidence of progressive disease in the choroid or retina.

3. A candidate having total hypermetropia not exceeding 4 D is not disqualified, provided the sight in one eye (when under the influence of atropine) equals  $\frac{5}{8}$ , and in the other eye equal  $\frac{5}{8}$  with + 4 D or any lower power.

4. Hypermetropic astigmatism does not disqualify a candidate for the service, provided the lens or combined lenses required to cover the error of refraction do not exceed 4 D, and that the sight of one eye equals  $\frac{5}{8}$  and of the other  $\frac{5}{8}$ , with or without such lens or lenses.

5. A candidate having a defect of vision arising from nebula of the cornea is disqualified if the sight of one eye be less than  $\frac{4}{8}$ . In such a case the better eye must be emmetropic. Defects of vision arising from pathological or other changes in the deeper structures of either eye, which are not referred to in the above rules, may exclude a candidate for admission into the service.

6. Squint, or any morbid condition, subject to the risk of aggravation or recurrence, in either eye, may cause the rejection of a candidate. The existence of imperfection of colour sense will be noted on the candidate's papers.

## SECTION III.

## STUDIES.

15. *Subjects.*—The subjects taught during the Provincial Service course are the following :—

- (1) Forestry, including Sylviculture, Utilization and Forest Working-Plans, both theoretical and practical, and Forest Mensuration.
- (2) Physical Science, including Chemistry, Physics and Geology.
- (3) Botany, both theoretical and practical, including the collection and preservation of plants.
- (4) Zoology, including the classification of animals, the study of useful and dangerous species, especially of insects, and the collection and preservation of specimens.
- (5) Drawing and Surveying.
- (6) Forest Engineering and Estimating, theoretical and practical.
- (7) Forest Law, the elements of Criminal Law, and Departmental organization.

16. *Terms.*—The terms of study are approximately as follows :—

1st year	...	}	Preliminary term—April 10th to June 30th, in camp or at Dehra Dun.
			Rains terms—July 1st to October 31st, in Dehra Dun.
			Winter term—November 1st to December 22nd, in camp.
			Vacation—December 23rd to January 2nd.
			Spring term—January 3rd to March 31st, in camp
2nd year	...	}	Hill tour term—April 1st to May 31st.
			Vacation—June 1st to June 30th.
			Rains term—July 1st to October 31st, in Dehra Dun.
			Winter term—November 1st to December 22nd, in camp.
			Vacation—December 23rd to January 2nd.
			Spring term—January 3rd to February 28th, in camp.
			Examinations—March 1st to March 31st.

17. *Examinations.*—The Examinations are :—

- (1) Periodical, to test progress and application.
- (2) Final.

The *Periodical Examinations* are held from time to time, as the President may order.

The *Final Examinations* are held in March of the 2nd year. The final oral examinations will be conducted in respect of each subject by not less than two examiners acting conjointly of whom at least one will be an instructor.

*Marks.*—The following will be the scale of marks in the various subjects :—

					Marks.
<b>FORESTRY.—</b>					
<i>Sylviculture.</i> —					
Periodical	...	...	...	...	330
Finals	{	Written	...	...	110
		Oral	...	...	110
					550
<i>Utilization.</i> —					
Periodical	...	...	...	...	150
Finals	{	Written	...	...	50
		Oral	...	...	50
Economic Products Collection	...	...	...	...	50
					300
<i>Working Plans.</i> —					
Periodical	...	...	...	...	210
Finals	{	Written	...	...	70
		Oral	...	...	70
					350
<b>Total Forestry</b>					... 1,200

## AUXILIARY SUBJECTS.—

*Surveying and Drawing.*—

Periodical	...	...	...	...	270	
Finals	{	Written	...	...	70	
		Oral and practical	...	...	110	
						450

*Engineering.*—

Periodical	...	...	...	...	300	
Finals	{	Written	...	...	100	
		Oral	...	...	100	
						500

*Botany.*—

Periodical	...	...	...	...	240	
Finals	{	Written	...	...	80	
		Oral and practical	...	...	80	
Botanical collection	..	...	...	...	50	
						450

*Law.*—

Periodical	...	...	...	...	150	
Finals	{	Written	...	...	50	
		Oral	...	...	50	
						250

*Physical Science.*—*(a) Chemistry and Physics.*—

Periodical	...	...	...	...	170	
Finals	{	Written	...	...	55	
		Oral	...	...	55	
						280

*(b) Geology.*—

Periodical	...	...	...	...	180	
Finals	{	Written	...	...	60	
		Oral	...	...	60	
						300

*Zoology.*—

Periodical	...	...	...	...	160	
Finals	{	Written	...	...	55	
		Oral	...	...	55	
Zoological collection	...	...	...	...	50	
						320
Conduct, discipline and physical training	...	...	...	...	250	

GRAND TOTAL	...	...	...	...	4,000	
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18. *Certificates.*—There are two certificates granted at the Institute after completion of the two years' training :—

(i) *Honours.*—A minimum of 70 per cent of the marks given in each of the major subjects and 80 per cent of the total number of marks.

(ii) *Pass.*—A minimum of 60 per cent of the marks given in each of the major subjects and 60 per cent of the total number of marks.

The major subjects are Forestry, Botany, Surveying and Engineering.

The President has authority to exercise his discretion as regards the issue of pass certificates in doubtful cases, provided that this discretionary power shall not be exercised with reference to students who have failed to obtain the prescribed minimum in Forestry or in more than one of the three other major subjects or in the total number of marks.

These certificates will qualify a student for direct appointment to the Provincial Service, after such period of probationary service as may be prescribed by the Local Government.

19. *Prizes.*—A gold medal will be awarded annually to the student who obtains the highest aggregate of marks provided he has secured an Honours certificate, and silver medals will be awarded to the students who obtain the highest marks in (i) Forestry, (ii) Botany, (iii) Surveying, (iv) Engineering, respectively.

All medals and prizes, whether given by the Government or by other donors, will be awarded by the President, who is at liberty to exercise his discretion in withholding any medal or other prize offered for competition should the attainments of the students in his opinion not justify any award.

20. *Failure to obtain a certificate.*—Should any student be unable to appear at the Final Examinations, he will not be permitted to attend any subsequent Final Examination unless allowed by the President to follow the second year's course over again.

The Inspector-General may relax this rule should he deem it necessary to do so.

#### SECTION IV.

##### GENERAL RULES.

21. *Ability to meet expenses.*—Prior to the admission of a private or Government probationary student who has not been granted a stipend, or who is in receipt of a stipend insufficient to meet the expenses as estimated in rule 28, the parents or guardians concerned must satisfy the President that they are willing and able to defray the whole or the balance or all such expenses.

22. The Durbars of Native States deputing students to the Provincial Service course shall, before the beginning of each year deposit with the President a sum sufficient to meet the expenses of the students as estimated in rule 28.

23. *Caution money.*—All students except those already in Government service shall on their arrival at Dehra Dun, deposit in the Post Office, pledged to the President, the sum of Rs. 100 as caution money and security for good behaviour and conduct, and for due observance of the rules.

24. *Employment of private students.*—The President will maintain a register of the names of private students who succeed in obtaining certificates and who desire to obtain Forest appointments, and will circulate annually a list of such passed students to Durbars of Native States (through the Political Officers concerned) and to Conservators and other persons likely to be in need of the services of trained Forest officials: he will if possible note in the list the minimum pay each student is prepared to accept and in what parts of India he is prepared to serve. In forwarding applications for service the President will enclose a statement of Institute certificates obtained and will furnish such other useful information as he may be in a position to supply.

No private student has any claim to an appointment in Government service.

25. *Marriage of students.*—No student of European or Eurasian extraction, not already in the permanent employment of Government or of a Native State, shall be admitted to the Provincial Service course if he is married; nor shall any such student, whether in the permanent employment of Government or of a Native State or not, marry before he has finally quitted the Institute. A breach of this rule will render the student liable to dismissal.

26. *Cost of equipment.*—Books and camp outfit must all be paid for in cash. All necessary articles must be obtained from the Institute contractors or as the President may direct. It is estimated that an initial expenditure of Rs. 150 in the case of Indians and

Rs. 200 in the case of European and other students will be required and students are expected to bring this sum with them to Dehra in addition to the caution money prescribed in rule 23.

The President may authorize an advance not exceeding Rs. 100 to any student towards the cost of his equipment. The advance will be recovered in not more than six monthly instalments and the caution money deposited under rule 23 will be security for it. This advance will, however, be made in exceptional cases only.

27. *Travelling allowance of Government probationary students and students deputed by Native States or British Colonies.*

[Under separate consideration—*vide* Resolution II (iii).]

28. *Estimated expenses during training.*—Rs. 80 to Rs. 100 per mensem, exclusive of travelling expenses.

29. *Quarters.*—The President will allot quarters to the students on their arrival in Dehra Dun. The quarters are tenable, during the whole period of the students' course and the rent is Rs. 5 monthly or Rs. 60 per annum for each student.

All students must abide by such orders as the President or other such officer authorised by him, may issue from time to time for the purpose of enforcing discipline and ensuring cleanliness and sanitation.

The dining room in the mess-house is reserved for students messing in European style; such students will not be allowed to take their meals in their own quarters without special permission.

No dogs are allowed in quarters, nor may dogs, horses or firearms be brought inside the Institute grounds or taken on tour.

Breakages of furniture, etc., in the Institute buildings must be paid for by the students, who are also responsible for the acts of their servants.

30. *Dress.*—All students attending the Provincial Service course are expected to dress in European fashion.

31. *Camp equipment.*—As camp equipment each student requires—

- (1) A small tent, not larger than 10 feet by 8 feet.
- (2) A camp bed.
- (3) A small camp table.
- (4) A camp chair or "morah".

These articles can generally be obtained at a low price on application to the President, provided two months' notice is given.

32. *Books and instruments.*—The books and instruments required by each student will be fixed by the President from time to time. Save with the previous permission of the President these articles must be purchased from the Research Institute on cash payment.

33. *Leave.*—During the course of instruction, no student may leave Dehra Dun without the written order of the President. Nor may students while in camp leave the camp headquarters without the written order of the officer in charge.

34. *Holidays.*—During the rains term Saturday will usually be observed as a holiday or devoted to excursions. In camp it will ordinarily be a half holiday. Such of the usual gazetted holidays as are allowed will be notified as such from time to time.

35. *Removal for incapacity.*—Any first year student may, under the orders of the President, be removed for incapacity or want of due diligence or application. Ordinarily students who at the end of the first year have failed to obtain 50 per cent of the marks in each of the four major subjects and a similar percentage of the total marks for all subjects will be so removed.

36. *Indebtedness.*—Students are not permitted to incur debt. Complaints under this head will be investigated by the President and, if proved to be well-founded, will render the offenders liable to punishment.

37. *Punishments.*—The following punishments may be inflicted by the President and at his discretion may be endorsed on the offender's final certificate :—

Censure, deduction of conduct marks, removal or dismissal.

If any student other than a private student is dismissed, the President will telegraph to the authority who deputed him to the Institute, asking for orders for communication to the student concerned. In the case of a private student intimation of dismissal will be sent to the parent or guardian concerned.

38. *Periodic Reports.*—Quarterly reports on the work and conduct of each student, accompanied by the marks obtained by the student at examinations held during the past quarter, will be issued by the President. In the case of students other than private students these reports will be sent to the authorities who deputed them to the Institute. In the case of private students they will be sent to the parent or guardian concerned.

39. *Library and Museums.*—The Institute library, museums and herbaria are available for the use of students under such rules as the President may make from time to time.

40. *Arboretum.*—The grounds of the official residence of the President, which contain a large variety of correctly named plants, are open to students for purposes of study with the permission of the President. No specimens may be removed without his sanction.

41. *Volunteering and drill.*—All non-Indian students must join the Volunteers. Indian students will undergo a course of drill or physical training.

## APPENDIX D.

Revised Syllabus for the Provincial Forest Service course of training at the Forest Research Institute.

## FORESTRY.

## I—SYLVICULTURE.

## PART I.—NATURAL HISTORY OF THE FOREST.

1. *Introduction*—

- (i) General features of the vegetation of the earth; forest, scrub, grasslands and desert.
- (ii) Factors bearing on the present extent and condition of forests in India.
- (iii) The atmosphere, frost, cloud, rain, hail, snow, etc.

2. *Factors influencing the nature and composition of forests*—(i) *Climate*—

- (a) Definition. Factors upon which climates depend, and local conditions which may modify them.
- (b) Action and reaction between climate and forest.
- (c) Classification of forest climates in India.

(ii) *Soil*—

- (a) Origin and composition.
- (b) Chemical and physical qualities.
- (c) Classification of soils.
- (d) Action and reaction between soil and forest.

## PART II.—COMPOSITION OF FORESTS.

1. *Trees*—

- (i) Growth and reproduction.
- (ii) Requirements with regard to light, moisture, temperature, and soil.
- (iii) Sylvicultural notes on the most important Indian species.

2. *Forest Crops*—

- (i) The natural and artificial forest.
- (ii) The struggle for existence in forests
- (iii) Pure and mixed crops.

## PART III.—METHODS OF TREATMENT.

1. Necessity for scientific treatment. General principles underlying systems of management. Demands to be met from forests.
2. Classification of the different methods of treatment usually applied to forests in India; high forest, coppice, and provisional systems.
3. Choice of method of treatment with reference to sylvicultural requirements of species and physical factors of the locality.
4. Treatment of bamboo forests.

## PART IV.—TENDING OF FOREST CROPS.

Tending pure even-aged, mixed even-aged, and irregular crops—(1) weeding, (2) cleaning, (3) thinning, (4) climber cutting, (5) pruning, and (6) draining.

## PART V.—ARTIFICIAL FORMATION AND REGENERATION OF FOREST CROPS.

1. Direct sowing, nurseries, and planting.
2. Choice of species.



3. Re-stocking of blanks and waste lands.
4. Protection of mountain slopes and regulation of torrents.
5. Fixation of moving sands.

## PART VI.—PROTECTION OF FORESTS.

Protection against injuries caused by (1) atmospheric agency, (2) animals, (3) plants, and (4) human agency.

### II.—FOREST UTILIZATION.

#### I.—HARVESTING AND CONVERSION OF WOOD.

##### (1) *Technical properties of wood.*

Anatomical structure of wood, shape and size of trees, specific gravity, hardness, flexibility, elasticity, fissibility, strength, seasoning power and liability to be affected by moisture, durability, combustibility and heating power, colour and grain, freedom or otherwise from defects and unsoundness.

##### (2) *Industrial uses of wood.*

###### (a) *Timber.*

Classification of timber. Timber used in superstructures, in contact with the ground, in contact with water, in machinery, for boat and ship-building, for joinery and cabinet-making, for making carts and carriages. Various uses of split wood. Wood used for carving, engraving, turning, basket-making, packing cases, and agricultural purposes. Wood-pulp. Miscellaneous uses of wood.

###### (b) *Firewood.*

Wood and charcoal used for heating and lighting. Wood used for products of distillation.

##### (3) *Felling and conversion of wood.*

Implements used for felling and conversion; season for felling; general rules of economic felling; methods of felling; extraction of stumps; rough conversion of wood; clearing the coupe; conversion of timber; stacking and seasoning of timber and firewood.

##### (4) *Wood depôts.*

#### II.—UTILIZATION OF MINOR PRODUCE.

1. *Grass.*—Grazing; cut-fodder; fibre-yielding and thatching grasses; grass from which oils are distilled.
2. *Stems and roots of trees etc.*—Fibres, tans, dyes, oils and other products of distillation, starchy products, drugs and spices, etc.
3. *Leaves.*—For fodder, litter and manure, thatching, tanning and dyeing, etc.
4. *Flowers, fruits and seeds.*
5. *Exuded products.*—Gums, resins, caoutchouc, sugary sap, etc.
6. *Animal products.*—Lac, silk, honey, wax, hides, horns, etc. Hunting, fishing and elephant catching.
7. *Mineral products.*

#### III.—ORGANIZATION OF LABOUR, AND MODES OF SALE AND DISPOSAL OF WOOD AND OTHER PRODUCE.

#### IV.—FOREST INDUSTRIES.\*

1. Charcoal-making.
2. Manufacture of turpentine and colophony.

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\* Some of these may appear to overlap with Chemistry 1-24, but do so to a very limited extent, they being treated in the Chemistry course from a purely chemical point of view.

3. Extraction of oils and tars.
4. Manufacture of catch and katha.
5. Preparation of tannin extracts.
6. Antiseptic treatment of wood.

### III.—WORKING-PLANS.

#### I.—FOREST MENSURATION.

- Instruments used in Mensuration,
- Height measurements of standing trees.
- Girth and diameter measurement of standing trees.
- Measurement of timber in the log.
- Measurement of converted timber.
- Determination of specific gravity of wood.
- Solid volume measurement of branch-wood, root-wood, and other amorphous pieces.
- Measurement of stacked fuel and of bark and charcoal.
- Enumeration of the growing stock.
- Volume measurement of standing trees.
- Volume measurement of whole woods.
- Determination of the age of trees.
- The increment of trees and woods.
- Determination of the height increment.
- Determination of the volume increment.
- Determination of the increment in girth, diameter, radius, and sectional area.
- Stem analysis of trees.
- Measurement of plantations.

#### II.—PRELIMINARY EXPLANATIONS.

Working-Plan. Forest capital. Exploitable age. Increment. Possibility. Revenue and Interest. Definitions of other technical terms.

#### III.—PRELIMINARY WORK.

Reconnaissance of the area. Choice of method of treatment. Formation of Working-Circles. Analysis and description of the crop. Valuation surveys.

#### IV.—THE WORKING-PLAN.

Preliminary explanations. Arrangement of coupes and determination of yield under different sylvicultural systems. Simple coppice. Coppice with standards. Clear felling system. Selection system. Shelter-wood compartment system. Group system. Strip system. Provisional systems.

#### V.—THE WORKING-PLAN REPORT.

Arrangement of subjects. Information to be recorded under each heading.

#### VI.—THE CONTROL OF WORKING-PLANS.

### BOTANY.

#### A.—INTRODUCTION.

Plants and Animals ; sub-divisions of Botany?

## B.—MORPHOLOGY.

1. Root—
  - (a) Normal and adventitious.
  - (b) Various types.
  - (c) Metamorphosed roots.
2. Stem—
  - (a) Nodes, internodes.
  - (b) Various types of stems.
  - (c) Branching.
  - (d) Metamorphosed stems.
3. Leaf—
  - (a) Venation.
  - (b) Various shapes of leaves.
  - (c) Simple and compound leaves.
  - (d) Leaf-margin.
  - (e) Leaf-base and stipules.
  - (f) Phyllotaxy.
  - (g) Buds, vernation.
  - (h) Metamorphosed leaves.
4. Inflorescence, various types.
5. Flower.—
  - (a) Parts of flower, number and arrangement.
  - (b) Regular and irregular flowers.
  - (c) Cohesion and adhesion. Hypogyny, perigyny, etc.
  - (d) Characters of sepals, petals, stamens, pistils, ovules.
  - (e) Distribution of sexual organs.
  - (f) Æstivation.
6. Seed and fruit—
  - (a) Testa, tegmen, and aril.
  - (b) Albuminous, exalbuminous.
  - (c) Characters of embryo, cotyledons.
  - (d) Characters of seedling, hypocotyl, epicotyl.
  - (e) Various types of fruit.
7. General—
  - (a) Duration of members.
  - (b) Texture.
  - (c) Hairs, glabrous, pubescent, etc., glands.
  - (d) Annuals, perennials.
  - (e) Habit, herbs, trees, shrubs.
8. Practical description of plants according to a given schedule.

## C.—ANATOMY.

1. Cells—
  - (a) The cell, cell-contents, protoplasm, starch grains, etc.
  - (b) Thickening of walls, pits, lignification, etc.
2. Tissues—
  - (a) Various types.
  - (b) Intercellular spaces.

## 3. Tissue systems—

- (a) Tegumentary, vascular bundle, fundamental.
- (b) Structure of stem, root, and leaves.
- (c) Secondary growth.
- (d) Bark, lenticels, shedding of leaves.

## D.—PHYSIOLOGY.

## 1. Nutrition—

- (a) Food materials, osmosis, ascent of water in trees.
- (b) Transpiration.
- (c) Assimilation, metabolism.
- (d) Respiration.

## 2. Growth.

## 3. Plant movements.

## 4. Reproduction—

- (a) Sexual and asexual methods.
- (b) Cross and self-fertilisation.
- (c) Distribution of seeds.

## E.—SYSTEMATIC.

## 1. Principles of classification—

- (a) Natural and artificial systems.
- (b) Species, genus, natural order, etc.
- (c) Nomenclature.

## 2. Main sub-divisions of vegetable kingdom; characters of principal orders and families of forest importance, with the chief economic plants belonging to them.

## 3. Variations, evolution, origin of species.

## 4. Collection and preservation of specimens.

*Students will be required to make a detailed botanical study and collection of 20 selected species on the lines prescribed by the Botanist from time to time.*

## 5. Practical use of a Flora.

*Students will be given as much practice as possible in identifying plants with Duthie's Flora of the Upper Gangetic plain.*

## 6. Knowledge of Forest characters.

*In their tours throughout the course students must study the common species described in Kanjilal's Forest Flora and are required to recognize them at different seasons of the year by means of their forest characters.*

## F.—WOUNDS AND DISEASES.

## 1. Wounds—

Occlusion, pruning, girdling, stool-shoots, layers, grafting, budding.

## 2. Diseases—

Definition of disease, symptoms of disease, struggle for existence, relations existing between organisms, competitors, parasites, symbionts. Influence of soil, atmosphere, and fire on plant development.

## G.—ECOLOGY AND GEOGRAPHY.

## 1. Factors influencing the distribution of plants.

Relation between the environment and forms of plants.

Adaptation. Indicator-plants.

Xerophytes, mesophytes, hygrophytes.

2. Chief types of vegetation, woodland, grassland, desert.  
Pioneer-plants. Progressive, regressive, and parallel succession.
3. Principal types of Indian forests and grasslands.

### DRAWING, SURVEYING AND ESTIMATING.

#### I.—FREEHAND DRAWING.

1. Outline drawing from the flat example.
2. Outline drawing from simple geometrical models.
3. Linear perspective.

#### II.—GEOMETRICAL DRAWING.

1. *Plane Geometry*.—Manipulation of instruments and division of lines. Proportions. Construction of triangles. Construction of polygons. Reduction of areas. Miscellaneous problems.
2. *Outlines of Solid Geometry*.—Definition of terms in general use. Principles of projections. Representation of points and lines in space. Plan and elevation of solids in simple positions. Sections of solids.

#### III.—SURVEYING.

##### A.—Lecture Room Course.—

1. Construction of scales, simple, diagonal, and vernier.
2. Conventional signs used in surveys, plans, and sections.
3. Colouring and printing.
4. Method of entering topographical details, hill shading and contour lines.
5. Reducing, copying and enlarging plans by pentagraph, method of squares, and with proportional compasses.
6. Calculation of areas by triangles, co-ordinates, acre-comb, and planimeter.
7. Chain surveying; maintenance and form of field-book.
8. Survey with prismatic compass and chain, field-book, plotting.
9. Plane-table survey.
10. Levelling form of field-books, computation for the reduction of the base line.
11. Plotting and colouring surveys and level sections.

##### B.—Field Work Course—

1. Chain surveying—  
A small extent of country to be surveyed and all interior details to be filled in with the chain and off-set rod only.
2. Compass and chain survey—  
A small survey or road traverse to be made with chain and prismatic compass. Adjustment of prismatic compass.
3. Plane-table survey—  
A small extent of country to be surveyed and interior details to be filled in with plane-table.
4. Levelling—  
Practical use of level. Level sections to be taken between fixed points.
5. Contouring—
6. Use of maps in the field.

### PHYSICAL SCIENCE.

#### I.—CHEMISTRY.

1. Preliminary notions; nomenclature; symbols; formulæ; equations; physical and chemical changes.

2. Elements and compounds. The more important elements with their symbols and atomic weights.
3. Chemical action; mechanical mixture; synthesis and analysis; chemical equation.
4. Oxides; bases; alkalis; acids; salts.
5. Metals and non-metals. Physical characteristics of metals.
6. Oxygen; its properties; its preparation; its occurrence in nature; its connection with plant growth.
7. Water; its composition; its physical properties; its solvent action; solutions; hard and soft waters; petrifying action.
8. Hydrogen; its preparation from water by electrolysis or passing steam over hot iron, and from acids; its properties, such as union with oxygen; its lightness; its insolubility in water.
9. Nitrogen; its properties; its preparation; its occurrence in air; its connection with plant growth.
10. Ammonia; nitric acid; their occurrence in nature; their connection with plant life.
11. Atmospheric air; its composition; a mechanical mixture only.
12. Carbon; its different forms, and their properties and uses; its connection with plant life. Preparation of charcoal from the chemical point of view.
13. Combustion; the structure of flames.
14. Oxides of carbon; their preparation; their properties; their action on the animal system.
15. Coal. Coal gas. Marsh gas. Davy's lamp.
16. Carbo-hydrates (starch, sugars, cellulose, gums).
17. Sulphur; its properties; its preparation; its occurrence in nature; oxide of sulphur; sulphuric acid; sulphates (gypsum, etc.)
18. Phosphorus; its properties; its preparation; its occurrence in nature; phosphates.
19. Chlorine; iodine; bromine; hydrochloric acid and its properties.
20. Silica; its properties; its occurrence in nature.
21. Metallic elements; groups; potassium; sodium; calcium aluminium; magnesium; iron; copper.
22. The chemical composition of soils.
23. The chemical composition of plants.
24. Tannin. Resin. Turpentine. Caoutchouc. India-rubber.
25. A few laboratory demonstrations in practical forest chemistry.

## II.—PHYSICS.

1. Definition and branches; British and metric system of weights and measures.
2. Matter; its form, mass, density, weight. Force; velocity acceleration; gravity.
3. Liquids and gases; comparative properties; pressure exerted by liquid; specific gravity; compressibility of liquids; buoyancy of liquids; hydraulic action.
4. Capillarity; osmotic pressure; their practical effects in nature.
5. Pressure of the atmosphere; practical results in nature; barometer; air-pump; suction pump; force pump; syphon; artesian wells.
6. Heat; effect on solids, liquids, and gases; specific heat; latent heat; the thermometer (Fahrenheit and Centigrade); temperature; boiling point, its dependence on pressure, difference at different altitudes. Steam; fusion; sublimation; evaporation; ebullition distillation; conduction: convection; radiation.
7. Light; velocity of; reflection; refraction; the lens; convex and concave mirrors.
8. The telescope; its uses and action.
9. The microscope; its uses and action.
10. Magnetism; the lodestone; the magnetic needle; practical application.
11. Elastic properties of materials, especially wood.
12. Physical properties of soils with special reference to air and water content.

## III.—GEOLOGY.

1. Sedimentary rocks ; their origin, varieties, and composition ; sandstones ; conglomerates ; shales.
2. Organic rocks ; their origin, composition and characteristics ; chalk ; limestone ; peat ; coal.
3. Igneous rocks ; their composition and origin ; lava ; trap ; basalt ; granite.
4. Metamorphic rocks ; gneiss ; mica ; schist ; marble ; slate ; quartzite.
5. Stratification ; its cause ; dip and strike ; horizontal strata and inclined strata ; faults.
6. Chronological orders of stratified rocks ; characteristics of the great formations ; with a very brief notice of their characteristic fossils.
7. Short account of Indian geology ; characteristics of peninsular and extra-peninsular areas.
8. Rivers ; catchment basins ; watersheds and water-partings ; springs ; mountain torrents ; deltas ; lakes.
9. Ice and snow ; glaciers ; moraines ; icebergs.
10. Mountain chains, their character and distribution ; cause of upheaval ; valleys.
11. Denudation ; action of the sea, of rivers and ice ; action of the atmosphere ; decomposition and disintegration of rock ; formation of soil.
12. Internal heat of the earth ; earthquakes ; volcanoes ; hot springs.
13. Distribution of the chief forest trees according to the nature of the underlying geological formation and sub-soil.
14. Chief physical properties of minerals ; chemical composition and common tests.
15. Chief minerals of India ; quartz, mica, felspar, and kaolin ; ores, iron ; laterite, kunkur, limestone, tufa, etc.

## FOREST ZOOLOGY.

1. General characters and classification of the Animal Kingdom.
2. Protozoa. Connection with diseases.
3. Metazoa. Arthropoda, general characters and classification ; Crustacea, Arachnida, Myriapoda, Insecta.
4. Vertebrates. Classification of birds, mammals, etc. Importance of birds in Forests. Types of damage due to the higher animals.
5. Insecta. Detailed anatomy of a type. (*Periplaneta orientalis*.)  
     General account of the development and metamorphosis of insects. Forms, Structure, habits of larvae, pupae, and imagines.  
     Classification. Discussion and summary of the orders. Principles on which the orders are sub-divided ; systematic position of families of economic importance.
6. Bionomics of insects. General relationships of insects and plants, interrelation of insects, predators, parasites,inquilines, etc.
7. Life histories of economically important forest insects.
8. Insect pests and epidemics and their origins ; principles of pest control in forests.
9. Field-work and methods of observation. Collection, preservation and transport of specimens.

## FOREST ENGINEERING.

## I.—GENERAL.

1. *Building materials.*
  - (a) Stone.
  - (b) Bricks and Tiles.
  - (c) Earths.

- (d) Limes, Mortars, Concretes, etc.
  - (e) Metals.
  - (f) Paints, Varnishes, etc.
2. *Masonry.*
- (a) Stone masonry.
  - (b) Brick masonry.
  - (c) Arching.
  - (d) Foundations.
  - (e) Retaining walls.
3. *Carpentry.*
- (a) Joints.
  - (b) Flat roofs, Floors, Built Beams.
  - (c) Frames, Pent Roofs, Partitions.
  - (d) Staircases.
  - (e) Doors and windows.
  - (f) Centres and Staging.
4. *Simple Mechanics.*
- (a) Composition and resolution of Forces.
  - (b) Strains in structures.
  - (c) Strains in Roofs.
  - (d) Transverse strains.
5. *Simple Machines.*
- (a) The Lever.
  - (b) The Pulley.
  - (c) The inclined Plane.
  - (d) The Wedge.
  - (e) The Screw.
  - (f) Compound Machines.
  - (g) Differential Blocks.
  - (h) Practical demonstration in :—
    - Ropes, knotting, lashing and splicing.
    - Blocks, Tackles and use of Spars.

## II.—BUILDINGS.

1. *Walls.*
- (a) Selection of site.
  - (b) Foundations.
  - (c) Plinth.
  - (d) Thickness of walls.
  - (e) Buttresses.
  - (f) Arches.
  - (g) Doorways, windows, etc.
  - (h) Wallplates.
2. *Floors.*
- (a) Brick on edge, tiled, stone, terraced, asphalt, earth and wood.
  - (b) Construction and protection from insects and damp.



3. *Roofs.*
  - (a) Flat, arched, pent.
  - (b) Slate, thatched, tiled, wood, shingle, iron.
4. *Finishings.*
  - (a) Verandahs.
  - (b) Ventilators.
  - (c) Ceilings.
  - (d) Chimneys.
  - (e) Fireplaces.
  - (f) Doors and windows.
  - (g) Pankahs.
  - (h) Sewers and drains.
  - (i) Lightning conductors.
5. Plans, Specifications and Estimates, with practical demonstration.

### III.—ROAD MAKING, AS AT PRESENT.

#### IV—BRIDGES.

1. Site.
2. Waterway.
3. Design.
4. Wooden bridges.
5. Simple wire-rope bridges.
6. Rail bridges.
7. Masonry bridges and culverts.
8. Estimates, including the taking off of measurements and complete estimates of material and cost.
9. Preparation of a bridge project, with drawings and estimates of cost.

#### V.—TRANSPORT OF TIMBER.

1. Simple transport, carriage by carts, beasts of burden and coolies.
2. Sledge-roads.
3. Tramways.
4. Wet and dry slides.
5. Transport by water, including rafting and floating.

#### VI.—WELLS.

1. Permanent and temporary, wood and masonry.
2. Selection of sites in reference to the various soils.
3. Construction; methods of sinking.
4. Cleaning and protection.

#### VII.—WATER AND RIVER BANK WORKS.

1. Embankments and dams for retaining water.
2. Simple canals.
3. Masonry bunds for protection of river and torrent banks.
4. Spurs and cribs for ditto ditto ditto.

## FOREST LAW.

## I.—GENERAL LAW.

*General notions regarding property.*

1. Of property and its acquisition.
2. Of possession.
3. The consequences of possession.
4. The transfer of property.

*General notions regarding Rights and Servitudes.*

5. Their nature.
6. Distinction between servitudes and ownership.  
The Easements Act, and Statute of Limitations.

*Of Government property and its acquisition.*

7. Estates held by succession from former Governments.
8. Lands occupied by roads, canals, river-beds, railways, etc.
9. Waste lands.
10. Lands acquired for public purposes.

## II.—FOREST LAW.

*Of Forest law in India.*

1. Reasons for special law.
2. Forest laws in Europe and in India. The Indian Forest Acts and Regulations.
3. To what lands the special laws apply.
4. The constitution of permanent forest estates in India.
5. Of the protection of trees and natural produce on lands not being forest.

*The Limitation to which Rights of User are subject.*

6. The principle that rights must be limited and regulated.
7. The extent of the limitation.
8. Principles of regulation applied to different classes of rights.
9. Grazing rights.
10. Grass cutting.
11. Lopping for fodder and leaf gathering.
12. Wood rights.
13. Removal of dead leaves.
14. Other forest produce.
15. Hunting and shooting.
16. Temporary and shifting cultivation.

*The Procedure for constituting Permanent Forest Estates.*

17. The preliminary steps. Difference of procedure under different Acts. Rules for the conduct of forest settlement procedure. Importance of exact adherence to legal procedure.
18. Claims to land.
19. Claims to rights of way or of water.

20. Claims to other forest rights.
21. Definition of rights admitted to exist.
22. Method of providing for admitted and defined rights.
23. Commutation of forest rights.
24. Extinction of unclaimed rights.
25. Appeals from orders of a Forest Settlement Officer or Court.
26. Final notification. Importance of accurate description.
27. Forests reserved previous to the passing of the different Acts.
28. Privileges and concessions granted by Government, though not legally proved to be rights of the nature of easements; their regulation.
29. Village forests.
30. Protected forests.
31. Undivided or shared forests.
32. Control over private forests.
33. Rules made under the various Forest Acts and Regulations.

### III.—CRIMINAL LAW APPLIED TO THE PROTECTION OF FORESTS AND THEIR PRODUCE IN TRANSIT.

1. Protection against natural calamities.
2. Protection against offences by human agency.
3. Preventive provisions.
4. The law under which offences are punished.

#### *Application of the Forest Acts to Forest offences.*

5. Offences against the forest itself—
  - (a) Reserved forests.
  - (b) Protected forests.
6. Special offences.
7. Cattle trespass. The Cattle Trespass Act.
8. Control of timber in transit and offences connected with it—
  - (a) Transit by land.
  - (b) „ water.
  - (c) Drift timber and salving.
  - (d) Rules regarding drift timber and its disposal.

#### *Application of the Penal Code to Forest offences.*

9. Offences directly connected with a forest or its produce—
  - (a) Theft or criminal misappropriation.
  - (b) Receiving stolen property.
  - (c) Mischief.
  - (d) Abetment of offences.
  - (e) Criminal trespass.
  - (f) Attempt to commit offences.
10. Offences indirectly connected with a forest or its produce—
  - (a) Unlawful assembly.
  - (b) Omitting to give aid and information.
  - (c) Giving false information.
  - (d) Giving false evidence.
  - (e) Concealing offenders.

*General principles of Criminal Law relating to offences.*

11. General exceptions (excusing offences).
12. Circumstances aggravating offences.
13. Limitation of time for prosecution.
14. Remarks on conduct of prosecution.

*The Legal principles of punishment.*

15. Imprisonment and fine.
16. Confiscation as a punishment under Forest Law.

*The Criminal Procedure Law.*

17. Complement to the penal laws.
18. Investigation by the police—
  - (a) Cognizable offences.
  - (b) Non-cognizable offences.
19. Cases on complaint to the magistrate.
20. The process of criminal courts.
21. Criminal trials.
22. Method of obtaining attendance of witness; record of evidence; notes on the Evidence Act.
23. The charges.
24. Execution of sentence and recovery of fines.
25. Appeal and revision.

## IV.—THE FOREST SERVICE.

1. General nature of the Forest Service.
2. The appointment of Forest officers and organization of the service.
3. The special responsibilities of Forest officers.
4. The protection extended by law to Forest officers.
5. The legal powers of Forest officers.
6. Offences against the authority of public servants.

## APPENDIX E.

## Memorandum on the Preparation and Control of Forest Working Plans.

The preparation and control of forest working plans is a matter of the greatest importance to the future of forestry in India: it is essential that the principles involved in their preparation should be sound and that the methods of treatment adopted should be based on a knowledge of the sylvicultural requirements of the species concerned and on the best and most economical methods of obtaining regeneration. It is feared that many of our present plans do not fulfil these requirements and therefore this subject is put before the Board of Forestry so that the steps necessary to place matters on a better footing may be considered. This memorandum traces briefly the past history of working plan procedure, notes the progress made up to date and indicates for the consideration of the Board certain points in which improvements seem to be desirable.

2. The first step towards the systematic compilation of Forest working plans was taken in 1872, when under Government Resolution No. 19-1246-1257, dated 17th October 1872, a separate branch of the Forest Department was established for carrying out forest surveys and framing working plans: for the formation of this branch three officers (one Deputy and two Assistant Conservators) were appointed to work under the immediate control of the Inspector General of Forests. The Deputy Conservator of Forests in charge of the Branch was to be regarded as the "Personal Assistant in the field" to the Inspector General of Forests under the designation of Superintendent of Forest Surveys and Working Plans. It was further laid down that work to be undertaken in any province should be arranged for by the Inspector General of Forests and Conservators in correspondence with, and under the orders of, the Government of India and Local Governments. The working plans duties of this branch were held in abeyance, since it was found to be essential that the preparation of reliable maps should precede the preparation of working plans. For this reason the branch was subsequently always alluded to as the Forest Survey Branch.

3. In the early years of the Department, the Inspector General of Forests generally drew up rough schemes for working the forests as he visited the various provinces. Then about the year 1880 special working plans divisions began to be formed, first in the United Provinces, then in Burma and then in the Punjab and other provinces.

In 1882 the principle of preparing plans by local agency subject to the central control of the Inspector General of Forests was definitely recognized and an Imperial Working Plans Branch distinct from the Forest Survey branch was created, orders being issued in Government of India circular No. 17-F., dated the 20th November 1882. This circular stated: "The propriety has come to be recognized of devoting more attention to the preparation of working plans and of placing this branch of the administration on a systematic footing by establishing an Imperial Working Plans Branch, presided over by a specially selected officer, whose services will be made available for the purpose of superintending the preparation of working plans in the several provinces under the Government of India."

4. A Superintendent of Working Plans was duly appointed under the circular just quoted, but so far as can be ascertained little or no progress was effected, for not long after, under Government of India circular No. 21-F., dated 6th December 1884, the post of Superintendent of Working Plans was amalgamated with that of Assistant Inspector General of Forests, the nature of whose duties precluded the touring necessary for keeping in touch with practical working plans operations. In circular No. 21-F., the Inspector General of Forests was again recognized as the central controlling authority in working plans matters both as regards the preparation of the plans and the execution of their prescriptions: for the latter purpose it was laid down that control returns should be submitted to the Inspector General for check.

5. After this there no further change in procedure until the Forest Research Institute at Dehra Dun came into existence in 1906. One of the posts created was that of Superintendent of Working Plans and to the charge of this officer the Working Plans Branch of the Inspector General of Forests' office, hitherto controlled by the Assistant Inspector General of Forests, was transferred. The duties allotted to the Superintendent of Working Plans were the collection and tabulation of statistical information, the scrutiny of working plans under preparation and the checking of control forms. But this arrangement did not continue long, as the posts of Superintendent of Working Plans and Sylviculturist, at first held *ex-officio* by the President of the Research Institute, were amalgamated not long afterwards.

6. The last change, which brings us down to the procedure in force at present, was introduced with effect from the 1st of January 1911, in accordance with the orders issued in the Government of India circular No. 29-F., 160-14, dated the 23rd September 1910. This change consisted in the abolition of the post of Superintendent of Working Plans at the Research Institute, in the retransfer to the office of the Inspector General of Forests of the examination of working plans from provinces possessing no Chief Conservator and in

the delegation to Chief Conservators of the powers of the Inspector General in working plans matters. This procedure, which is based on the recommendations of the Royal Commission upon Decentralization, is embodied in Articles 48, 49, 53 and 57 of the Forest Department Code, 7th edition. The most drastic of the changes introduced was the transference of the Inspector General's powers to Chief Conservators, though the Inspector General is still entitled to bring defects in sanctioned plans to the notice of Local Governments. It is to be noted that this change did not meet with the entire approval of the senior officers of the service.

*Progress in preparation of Working Plans.* The progress made in the preparation of new working plans during the past 20 years is exhibited in the following statement (which includes figures for Bombay and Madras):—

Date.	Area under working plans.			Progress during each quinquennium.
	Square miles			Square miles.
30th June 1894 ... ..	10,279			.....
„ 1899 .. ..	21,620			11,341
„ 1904 ... ..	34,222			12,602
„ 1909 ... ..	48,104			13,882
„ 1914 ... ..	53,926			5,822

The progress made during the last quinquennium has been disappointing. The area for which new working plans were actually required on the 30th June 1914, was 86,558 square miles out of which plans were in existence for 53,926 square miles, leaving a balance of 32,432 square miles for which new working plans are required at once. Add to this further areas of considerable extent for which working plans will in time be wanted, as well as the steadily increasing area for which revised plans will have to be prepared and it will be seen that under existing conditions the work is likely to fall entirely out of hand. To a very small extent lack of maps may be taken to be a reason for this want of progress: but the main reason is want of staff, and it appears probable that working plans requirements have not always been taken sufficiently into account in framing reorganization schemes, and that in some provinces progress in the preparation of working plans with the available trained staff has been prevented by work which has been considered to be still more important.

*Improvements in quality of Working Plans.* 8. Assuming that the objects of management, in which financial considerations will ordinarily play an important part, have been duly considered, it is held that the primary aims of a working plan should be (1) the attainment of the normal forest, (2) the establishment of regeneration to the normal extent, and (3) the prescription of the yield based on the first two considerations. Apart from this, the system of management proposed should be based on the silvicultural requirements of the species concerned.\* These fundamental principles are not contemplated in Article 52 of the Forest Department Code nor are they considered in many of our existing working plans where the yield is calculated without reference to them, and where the silvicultural requirements of the species do not always receive sufficient attention. These remarks apply in general to all working plans prescribing what in India are known as selection fellings, as well as improvement fellings where the latter constitute the main exploitation. The treatment prescribed by such plans cannot be regarded as anything more than provisional pending the introduction of more rational systems of management. The latter, it is true, cannot be introduced otherwise than gradually, owing partly to the incompleteness of our silvicultural knowledge, partly to the paucity of staff, the inaccessibility of the forests, the want of markets and other local considerations. The principles stated above have, however, already been accepted in whole or in part in respect of those Himalayan coniferous forests and sub-Himalayan *sal* forests to which they can be reasonably applied at present. Several working plans aiming at concentrated regeneration and the attainment of the normal forest either have been or are now being compiled in respect of these forests, and it may be safely predicted that during the next decade a fair proportion of the sub-Himalayan *sal* forests and the Himalayan coniferous forests will have been placed under rational management based on the principles enunciated. In Burma at least two working plans for teak forests have adopted the principle of concentrated regeneration, and attention is also being directed towards the execution of intensive cleanings over definite areas with the

\* This whole subject is discussed in Part I of Mr Troop's recently published *Note on some European Silvicultural Systems, with Suggestions for Improvements in Indian Forest Management*, and the conclusions arrived at are summarized on pages 13 and 14 of that note.

primary object of increasing the proportion of teak in the areas in question. Other examples of concentrated systems of regeneration in India are quoted in Part III of Mr. Troup's note already referred to, and there can be little doubt that the principle of concentrated regeneration might well be extended to many other forest tracts in different parts of India. It will not be denied that the introduction of improved systems of management is of the very greatest importance to the future of forestry in India, for this cannot fail to produce a great increase in the ultimate yield and money return derived from the forests. To facilitate the attainment of this object it is necessary that there should be collaboration and free interchange of ideas not only between individual provinces, but also between provinces generally and the Research Institute. Only by this means can the latest results of research work, either local or central, be made available, for the ordinary forest officer has neither the time nor the opportunity to keep himself in touch with the developments of this work.

9. The Board is asked to consider the facts and views stated above and to record its opinion— *Summary of considerations.*

- (1) Whether or not the present procedure is calculated to meet requirements regarding the preparation and scrutiny of working plans and to ensure adequate progress in the quality and quantity of work turned out, and
- (2) If not to propose the steps which should be taken to place matters on a more satisfactorily footing.

10. If the views expressed above are accepted, it is obvious that the items under Method of Treatment in Part II of the working plans headings under Article 52 (i), Forest Department Code, 7th edition, will require some modification. The following amendment is therefore proposed to the existing wording, which is entered alongside for comparison:— *Amendment to Article 52 (i) F. D. Code.*

<i>Existing wording.</i>	<i>Proposed amendment.</i>
METHOD OF TREATMENT.	* METHOD OF TREATMENT.
Object sought to be attained.	Object in view.
(a) As regards the improvement and regulation of the water-supply.	(a) As regards the attainment of the normal forest and the establishment of normal regeneration.
(b) As regards the yield of forest products.	(b) As regards the silvicultural requirements of the species dealt with.
Method of treatment adopted in order to attain the above objects.	(c) As regards the yield of forest products.
The exploitable age.	(d) As regards the improvement and regulation of the water-supply.
	Method of treatment adopted in order to attain the above objects.
	The exploitable age.

11. Apart from the above discussion of the questions connected with the compilation and scrutiny of working plans, it seems desirable to consider the prescribed submission of control forms, which is governed by Articles 54 (i) and (ii) and 57 of the Forest Department Code, 7th edition. In accordance with the provisions of Articles 57 (iii) signed copies of Forms 2 (or 3) and 4 are forwarded to the President, Forest Research Institute and College, Dehra Dun. The President transfers them to the Silviculturist, in whose office they are filed without further check and with the ultimate object of being employed in the compilation of statistical information. Experience has shown, however, that the utility of these forms in this respect is quite incommensurate with the large amount of clerical work entailed in copying, forwarding and recording. It is proposed, therefore, that Article 57 (iii) be deleted from the Code, on the understanding that if at any time the Silviculturist requires any particular control forms for information he shall be at liberty to indent on Chief Conservators and Conservators for them. *Control forms.*

Forms 2 (or 3) and 4 as they now stand were prescribed after much consideration and discussion and are intended to cover the requirements of all methods of treatment. It may be doubted if this object has been attained successfully or if indeed it is even desirable, while it is quite certain that for any method of treatment it would be easy to compile control forms which would give all the necessary information in far less space. It has been suggested that it would be better to give up all idea of having one set of forms applicable to all methods of treatment and to compile for each working plan simple forms designed to meet local requirements and to include only such information as it is really necessary to record. The actual form of these records would be settled in each case by

\* A silvicultural system may be defined as a system of forest management applied with due consideration for the silvicultural requirements of the species, and aiming at the attainment of the normal forest and the establishment of regeneration to the normal extent.

the working plan officer and the Chief Conservator or Conservator concerned, and it seems certain that this would result in a very considerable saving in clerical labour and an increase in the usefulness of these records. The main benefit of this change would be to substitute for nominal check on paper the possibility of actual check on the ground. A control book for each plan could be printed to cover the period of the plan, or any convenient portion of it, each block, forest, or compartment being dealt with separately as required. For each of these areas the prescriptions, both as regards fellings and other works, would be printed once for all and space left against each entry for recording the actual work done. An inspecting officer could take a control book of this kind into the forest and thus follow the extent to which the prescriptions had been carried out, and their results, much more easily than is possible under present conditions.

12. If the views expressed in paragraph 11 are accepted by the Board, then it is proposed that the following amendments be made to the Forest Department code:—

Page 27.

For existing Article 54 (i) (ii) substitute the following:—

Control of working of forests for which working-plans exist.

- (i) For the control of the working of all forests under working-plans, the following control records will be kept up:—
- (1) A Control Book for fellings or girdling operations.
  - (2) A Record of Works of Maintenance, Reproduction, Improvement and Protection.
  - (3) A Forest Journal.
  - (4) A map showing the results of fire-protection.
- (ii) The form of the Control Book and Record of Works for a working-plan will be drawn up by the working-plan officer under the direction of the Chief Conservator or Conservator in accordance with the requirements of each case, and samples of the forms adopted will be printed as appendices to the plan. In devising the forms in question the following general instructions should be observed:—

*Control Book.*—The objects of the Control Book are—

- (a) To compare the results of felling or girdling operations carried out for exploitation purposes with the prescriptions of the working-plan.
- (b) In the event of the area or quantity of material exploited in any year being less than that prescribed in the working-plan, to provide for the bringing forward year by year of the balance still available for exploitation, until it is exploited or written off under competent authority.
- (c) In the event of any exploitation in excess (whether of material or area) of the prescriptions of the plan, to provide that such excess shall, unless orders to the contrary are issued by competent authority, be deducted from the quantity prescribed for exploitation in future years.

[NOTE.—When the prescriptions of the working-plan are by sub-periods and not by years, these instructions should be applied accordingly.]

*Record of Works.*—This will be a brief record of all works carried out in connection with the construction and repair of communications and buildings, wells, tanks, etc., demarcation, sowing and planting, cultural operations, fire conservancy, climber cutting; also improvement fellings, thinnings, cleanings and other tending operations when these are distinct from the main exploitations prescribed, but expenditure under A VIII b and c will not be shown in this form. To provide for a record of operations not definitely prescribed in the working-plan the Record of Works should, when necessary, be divided in the following manner and kept up accordingly:—

- I.—Provisions of the working-plan.
- II.—Suggested measures of the working-plan.
- III.—Measures neither prescribed nor suggested in the working-plan, but carried out during the year.

Ordinarily the Control Forms (*i.e.*, the Control Book and the Record of Works) for any plan will be printed; they will contain a summary of the prescriptions of the plan for each year or sub-period, sufficient blank space being provided for the entry each year of the results of operations.



*Article 57 (i).—Substitute the following:—*

57. (i) Divisional officers will, not later than the 15th August in each year, submit to the Conservator copies of the Control Forms for the previous forest year. In provinces where there is a Chief Conservator, the Conservator will forward the forms to the Chief Conservator not later than the 1st November in each year.

*Delete—Article 57 (iii).*

*Pages 58 to 67.*

*Delete—Forms 2, 3 and 4.*

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## APPENDIX F.

## The Development of Forest Engineering.

The question of Forest Engineering was discussed at the first meeting of the Board of Forestry in 1910, when the Board recorded its opinion that a trained Forest Engineer should be appointed on the Research Institute cadre. The Government of India had the matter under consideration for some time, and in August 1913 the sanction of the Secretary of State was obtained to the creation, temporarily for a period of two years, of a post of Forest Engineer and to the appointment to it of Mr. R. S. Underhill on a pay of Rs. 900 per mensem : his appointment on these terms expired on the 25th August 1915, but the sanction of the Secretary of State has been obtained to his re-engagement for a further period of three years with effect from the 26th August 1915 on an enhanced pay of Rs. 1,000 a month for employment principally in the United Provinces. During his first two years Mr. Underhill spent 4 months in the United Provinces, some 5½ months in the Andamans and the remainder of the period in Burma. The works and projects on which he was employed were as follows :—

*United Provinces.*—(i) Patli Dun Tramway, (ii) Bhowali Distillery, (iii) Transport of firewood to Almora, (iv) Transporting sleepers to Kosi River, (v) Sleeper treatment at Kathgodam and (vi) Plant for the antiseptic treatment of railway sleepers.

*Burma.*—(i) Proposed booms and machinery for arresting and handling teak logs brought down floating streams, (ii) Handling teak logs by means of skidding machines and (iii) proposed re-arrangement of the Government Timber Depot at Rangoon.

*Andamans.*—Plans and estimates for a sawmill and plant for the antiseptic treatment of sleepers.

Mr. Underhill also visited Java and inspected and reported on a sawmill there which has since been purchased by the Government of India to replace the old mill at Chatham in the Andamans.

2. It now remains to be considered to what extent the appointment of a single Forest Engineer for the whole of India has fulfilled requirements. Replies from Local Governments to enquiries made in 1913 showed that in most of the major provinces there were important projects requiring the attention of the Forest Engineer, whose services, however, were not available for more than a small fraction of the work required of him ; this is amply borne out from the fact that his services have been placed at the disposal of the United Provinces for 3 years for employment in that province alone, while it is understood that Madras has recently appointed two temporary Forest Engineers for employment in that Presidency.

In this connection it was pointed out in paragraph 13 of the Government of India's Quinquennial Review of Forest Administration in British India for the period ending the 30th June 1914, that with the inevitable extension in the use of mechanical appliances for extraction and transport one Engineer for the whole of India would be insufficient and there could be little doubt that in course of time the major provinces would require special engineers of their own.

3. From the experience gained so far it may be taken as proved that a single post of Forest Engineer for the whole of India is totally inadequate for the needs of the Department, and the only alternative that seems feasible at present is for provinces to engage their own Forest Engineers, either separately or in combination.

## APPENDIX G.

## Lantana in the Forests of Coorg.

At the meeting of the Board of Forestry in 1913 a paper was read by Mr. Lodge on prickly pear and lantana in Madras and the subject was discussed by the Board. The President, Mr. Beadon Bryant, referred to the conditions prevailing in Coorg and stated that eradication of lantana had been commenced. The following note on the progress made in the eradication of the pest, and on the results obtained, may be of interest :—

In January 1912 Mr. Beadon Bryant made a tour of inspection in the Coorg forests and amongst other matters he investigated the question of the eradication of lantana. In his note on the subject appended to his "Note on an Inspection Tour in the Forests of Coorg," dated 1st February 1912, he described the process which is taking place, and showed that it was only a question of a comparatively short time for the forests to become pure useless lantana wastes. He advocated :—

- (1) the abandonment of fire-protection in the forests most seriously affected,
- (2) uprooting the lantana after it had been burnt ; and
- (3) sowing the seeds of valuable species after the lantana had been uprooted.

In such waste lands ("Paisaris" and "Banes") as contain much sandalwood Mr. Beadon Bryant advocated uprooting the lantana without previously burning it, in order to avoid damaging the sandalwood. He further considered that the sudden exposure of the sandal by the removal of the lantana might possibly injure or even kill the trees, and advocated the conducting of experiments to prove how the lantana can best be removed without causing damage to the sandal.

2. Plate I gives some idea of the dense manner in which the pest grows in Coorg. Practically all the vegetation seen in the photograph is lantana ; it is growing round and up an *Albizia Lebbeck* tree. When it is borne in mind that in a dry year lantana burns freely when green some idea is obtained of the damage caused by such fires. It is naturally impossible to beat out a lantana fire once started. Plate II shows the damage to tree growth which has been caused by two such fires which occurred in 1909 and 1911. In the latter year as there had been no fire in 1910 the lantana had almost attained its previous density.

3. As a result of Mr. Beadon Bryant's visit a grant of Rs. 15,000 was made in 1912-13 and operations were commenced on a considerable scale. It was hoped that as the destruction of the lantana would greatly benefit the local ryots owing to the removal of the harbour which it gives to elephants, tigers, panthers, and pigs local labour on a considerable scale would be available, and it was estimated that in these circumstances it would be possible to carry out the work of eradication for Rs. 6 per acre. The local ryot however is comparatively well off, and is one of the laziest people in the country, and it was very soon found that in spite of the willing co-operation of the Commissioner (Mr. Harris), and his Revenue officers and of the offer of free grazing as a reward for good work the local people were absolutely useless. They would not work six hours a day. It was in consequence necessary to employ contractors who worked chiefly with imported labour which has to be paid higher than the local rate. Owing to the delay incidental to obtaining contractors no great progress was made during the first year.

4. During 1913-14 an allotment of Rs. 25,000 was sanctioned. Contractors came forward freely, and the majority of the work has since been carried out on contract. The rate paid is usually from Rs. 7 to Rs. 8 per acre, but in some cases where the lantana was especially dense as much as Rs. 12 has been paid. The original estimate of Rs. 6 per acre omitted to make provision for uprooting the regrowth springing up after the first uprooting. All kinds of prognostications were made by local residents. I was told that the regrowth would be so vigorous that it would cost Rs. 30 per acre to get the land clear ; that lantana is spread at such a terrible pace by crows and other birds, that as fast as I uprooted it, it would be resown by this agency ; that if lantana were burnt it would come up again much thicker than ever it was before ; and that like the carpenter I ought to weep, as it was doubtful if I should ever "get it clear."

5. Actual facts have, however, given the lie to these prophets of evil. After four years' experience of the work I am convinced that the pest does not spread nearly as fast as is imagined and the reason why it has invaded such a large extent of the Province in such a comparatively short space of time is that it was looked on as an excellent hedge and was planted everywhere for fencing purposes. As regards the allegation that burning makes it grow thicker than before, this has been found to be true on perhaps two or three per cent of the area burnt. In by far the majority of cases the seeds lying dormant in the ground appear to be killed by the fire, and a large number of stems are either killed outright, or are so damaged that they can easily be pulled up after a little rain. Repeated burning, however, is necessary, as if burnt lantana cannot be uprooted in the same year it very quickly recovers its vigour.

6. If the work is properly done during the first year the average cost of uprooting regrowth in the second year varies from 12 annas to Rs. 1-8-0 per acre, in the third year it is about 6 annas and in the fourth year slightly less. In the fourth year, however, provided there is a fair canopy overhead, there are so few seedlings that the greater part of the expenditure is incurred on searching for them, and I think it is better to confine the fourth year's work to burning the area, unless the experience of the fifth year shows that the number of seedlings surviving is serious.

7. The method adopted has, for the most part, been to cut the lantana a foot or so above the ground level, to roll it away from the stumps, and then to dig up the stumps with a mamoty. The plant is very shallow rooted, and the roots come away easily when the ground is soft. A good many of the stumps can be pulled up by hand without the use of any tool, but this is hard work and the coolies prefer to dig up practically everything. The work requires a great deal of supervision, as if the contractors are not carefully watched they cut off the roots just below the ground surface. With careful inspection, however, it is fairly easy to see whether there is a reasonable quantity of roots in evidence, and as a part of the payment is deferred until sufficient rain has fallen to cause any roots left in the ground to send up shoots, contractors are beginning to find that cutting off the roots below the ground is not a paying proposition. Plate III showing the heaps of uprooted lantana gives some idea of the amount of work involved.

8. The work would be considerably reduced if the lantana were cut at the end of the rains without being rolled into heaps, and burnt in the hot weather. It can be done fairly easily by men crawling under the thicket and cutting the stems of the larger plants. It costs about Rs. 2 per acre. This method has hitherto been tried only on a few small areas, and has not been particularly successful owing to the large number of seedlings springing up in the rains. It is probable that two or three annual fires are necessary before the cutting is undertaken in order to kill the seeds lying dormant in the ground, but at the same time it has also been found that on a small proportion of the area burnt without cutting numerous seedlings similarly spring up, and it may be that if the method is adopted on a larger scale it will be found on the whole to be successful. In this event matters will be greatly simplified, as a large amount of the work can be done in the dry weather when labour is fairly plentiful, and uprooting is out of the question owing to the hardness of the ground.

9. Fire is a most useful auxiliary in the campaign against lantana. Repeated fires not only actually kill a number of the plants, but they prevent the lantana from becoming dense. The result of continued burning is that owing to the reduction of the density of the thicket young teak and other valuable species which are lying suppressed under it are enabled to spring up. Plate IV shows an area which has been repeatedly burnt, with some teak seedlings coming up through the gaps in the thicket. The lantana in this area was four years ago a dense tangled mass through which an elephant would have had difficulty in forcing its way. No clearing has been done, though for the purpose of taking the photograph two or three lantana branches were cut.

10. It may be argued that fire is too drastic an agent to use in a forest owing to the damage done to the tree growth. It is, however, a case of ways and means. If the lantana is not burnt before it is uprooted, it must be burnt in the dry weather following the uprooting, as otherwise the cost of eradication is prohibitive, as a mass of seedlings spring up round every heap of debris, and the presence of this debris renders it very difficult to get at the seedlings to uproot them. Without fire the cost would probably be doubled. Further, in most cases the damage had already been done by the fires of 1909 and 1911, and the additional damage done by the subsequent annual fires has been comparatively small.

11. It has been found unnecessary to carry out the sowings which Mr. Beadon Bryant advocated, as the result of removing the lantana has been a wonderful springing up of seedlings of teak and other valuable species. The lantana does not appear to prevent germination to any extent, and as it keeps the ground absolutely clean the radicles of the young plants have no difficulty in finding their way into the soil. Numbers of seedlings have evidently been living suppressed under the lantana unable to do more than keep alive, but apparently not losing their vitality, and as soon as the thicket is removed they spring up most vigorously. This has occurred to an extraordinary extent in the case of *Anogeissus latifolia*, as shown in plate V where the mass of vegetation seen up to a height of 9 feet is pure *Anogeissus* advance growth. In 1912, this area was a dense mass of lantana. Young seedlings are further favoured in the first year or two after the removal of the lantana in that where the lantana has been well burnt a considerable time elapses before grass begins to grow, and the seedlings have a chance of establishing themselves. In parts of the Anekad forest where the lantana used to be particularly thick, and was cleared in 1913, the state of the natural reproduction is—for a South Indian teak forest—extraordinarily good. This forest will now require considerable attention in the way of improvement fellings and cleanings to favour the young growth. If work on these lines is properly carried out there is every prospect that the forest will, in time, be considerably better stocked than it was before the lantana invasion.

12. Plates VI and VII show the young teak and blackwood which has resulted from the removal of the lantana. In the area shown in plate VI the lantana was removed in 1914, in that shown in plate VII in 1913. In the former case practically no weeding was done for the purpose of the photograph, in the latter case, as most of the surrounding trees are dead and there is hardly any shade a good deal of annual weed had sprung up, and had to be cleared.

13. Plate VIII shows a piece of ground cleared of lantana in 1913, with blackwood and honne (*Pterocarpus Marsupium*) seedlings in the foreground and lantana still to be cleared in the background. Practically no weeding was done in this case. The plate shows the contrast which after being cleared land under a forest canopy presents to its previous aspect under lantana. It is difficult to show this clearly in a photograph, but it is a remarkable feature of the lantana operations. It is almost impossible to realise that the cleared areas ever contained any lantana.

14. Mr. Beadon Bryant's fear that the sudden removal of the lantana surrounding sandalwood trees might injure or kill them has not been justified. They do not appear to suffer in any way. The areas treated however for the most part contained a sprinkling of other trees which probably afford sufficient shade to give the necessary protection to the sandalwood.

15. Mr. Beadon Bryant advocated uprooting the lantana where there was much sandalwood without previously burning it. I know, however, of only a few areas in Coorg where there is much sandalwood and where the lantana has not been constantly burnt. They cover about 600 acres. There is in these cases a large quantity of sandalwood standing in dense lantana, and if fire is used here the loss will be very serious. It will be necessary to uproot it and roll it away from the sandal trees. The cost will be high, but having regard to the value of the stock of sandalwood it will be justified. Elsewhere as a rule the damage has already been done and annual fires cannot materially add to it.

16. The area cleared of fairly dense lantana up to date amounts to about 5,500 acres of Reserved forest and 2,200 acres of waste lands and in addition about 7,800 acres of Reserved forest have been cleared of scattered lantana. The cost incurred has been about Rs. 68,000. To render these areas absolutely free of regrowth will perhaps cost some Rs. 15,000 more, and it may possibly be necessary for some years to come occasionally to inspect them until it is found that there is no possibility of a recrudescence.

17. In Mr. Lodge's paper read before the Board of Forestry in 1913, he stated that in Madras elephants had been employed to pull up lantana. This method was also tried in Coorg some years ago, but the employment of elephants is out of the question on any large scale and in any case they cannot compete with the cooly.

In paragraph 13 of his paper Mr. Lodge referred to the difficulty of finding anything that will grow through and kill lantana, and stated that it was believed that lantana would not grow under Castor. I have found nothing (except fire) which will actually kill it but evergreen forest—if fire is kept out—will, in the course of perhaps fifteen or twenty years, grow through the lantana and suppress it, though the lantana does not die. Castor I have found to check the growth of lantana considerably, but it does not kill it.

18. In accordance with Mr. Beadon Bryant's instructions a regular scheme has been drawn up for clearing the whole of the eastern forests, and the greater part of the sandal-bearing waste lands. The total cost has been estimated at Rs. 4,40,000. A small area of waste lands still remains to be examined, and in all probability the total cost will be approximately 5 lakhs of rupees. It is a large sum, but as Mr. Beadon Bryant said it is a choice between forest and lantana. The work is proving to be very beneficial to the forest growth, it is undoubtedly of great benefit to the general public, and there is every likelihood that the cost of the operations will be more than recouped by the additional revenue to be expected from the increase in the stock of sandalwood which should result from the removal of the cause of the fires which at present do so much damage.

H. TIREMAN,

*Deputy Conservator of Forests, Coorg.*

*Dated 22nd December 1915.*

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*Note.*—The photographs illustrating this note were exhibited at the meeting of the Board of Forestry.

## APPENDIX H.

## Note on the necessity for a systematic study of Indian Forest Seedlings.

1. There is at present no illustrated Manual of Forest Seedlings and it is consequently difficult for the average forest officer to identify with certainty the seedlings of his important species or to acquire an accurate knowledge of the state of reproduction in his forests. At present there is little doubt that seedlings of important trees are not infrequently confused with those of unimportant shrubs and *vice versa*. Those forest officers also who gradually acquire a knowledge of a number of seedlings do not as a rule place their observations on permanent record in such a way as would render them accessible and valuable to others. It, therefore, seems advisable that this study should now be systematically commenced with the object of ultimately producing illustrated Manuals of Forest Seedlings.

2. The systematic description and illustration of seedlings forms a part of descriptive forest botany just as does the description of the leaves, flowers, fruit and seed. It is suggested, therefore, that this work should be undertaken primarily by the Forest Botanist who has at his disposal in Dehra Dun (a) a good botanical garden in the immediate neighbourhood of the Botanical Library and Laboratory and (b) a good artist capable of preparing the illustrations. This work should therefore be entered in the Botanist's triennial programme with effect from 1916-17. At the same time, the Forest Botanist can obviously only deal with a limited number of species annually and if good progress is to be made it is advisable that Provincial Research officers or other selected local officers should sooner or later co-operate with the Forest Botanist in this work.

3. In order to obtain Manuals of practical utility with as little delay as possible, it is suggested that the following should be considered as separate units for each of which a separate Seedling Manual should be first prepared before dealing with more complicated forests :—

- (I) The Plains (& Hill-Sál) Forests of the United Provinces.
- (II) The Forests of the Central Provinces.
- (III) The Sál Forests of Bengal.
- (IV) The Sál Forests of Assam.
- (V) The Teak Forests of Burma.

In this way the seedlings of those plants likely to be found together in the same forests would be dealt with in one and the same Manual, while others would be excluded, thus facilitating identification.

4. So far as possible, it is advisable that the seedlings of all plants belonging to the same genus should be dealt with together by the same observer. This is necessary in order that the characters separating the seedlings of plants which are nearly related and much alike may be especially studied and described.

5. All the descriptions and illustrations should be carried out on uniform lines so that all the work done can be eventually utilised, practically as it stands, for the compilation of the Local Seedling Manuals. The work which is not done by the Forest Botanist himself, therefore, should be carried out on the general lines prescribed by him.

6. If the co-operation of local officers can be secured the precise nature of the co-operation will naturally depend on the qualifications of the selected officers and the local facilities for the work. In cases where a qualified Botanist is available the entire work would be done by him, in other cases it would probably be advisable, at all events at first, for the descriptions to be drawn up or edited at Dehra from the specimens sent in by the Provincial officers. Precise details of the co-operation in each case could be arranged by the Botanist in consultation with the local officers, subject to the approval of local Conservators or Chief Conservators. Similarly a three years' programme of work showing the seedlings to be studied by each man could be drawn up by the Botanist in consultation with the local officers in order to prevent duplication of work. Care would be taken to see that local officers get full credit for all work done by them which would be published under their names.

7. Specimens of the seedlings described should in all cases be sent to Dehra so that a seedling herbarium collection may be formed for permanent record and for the purpose of seedling identification.

8. It is suggested that all descriptions completed should be published annually in the Forest Records so that all work done may be published and rendered available for the Department with as little delay as possible. The material thus gradually collected in the Records would ultimately be combined into local Manuals.

R. S. HOLE,  
*Forest Botanist.*

## APPENDIX J.

**The Need for Systematic Record of Insect-Damage and the Experimental Introduction of Control Measures.**

After a period of fifteen years of research on forest insects there exists in no division in the whole of India and Burma, a standardised method of fighting a single species of insect pest, or a systematic method of estimating and recording the value of the loss annually due to insect attack on any one of the more important timber trees.

1. The object of this paper is to invite closer attention to this fact and to suggest lines on which enquiries may be commenced to remedy the existing conditions. It may be pointed out that the state of affairs is partly due to the rapid succession of changes in the direction of the Zoological Branch of the Research Institute, which has entirely destroyed continuity of research and has nullified much of the progress intermittently attained; it is also partly due to the lack of organised attempts to adopt and test in the forest the theoretical control measures proposed for many of the more important pests. The plea that the study of Indian forest insects is as yet in a pioneer stage holds good for a large proportion of pests, but there is, on the other hand, a large and very appreciable number of species of which the life-histories are comparatively well known, and for which remedies have been prescribed. Mr. Stebbing's recent book on Indian Forest Coleoptera lists some 400 species of beetles and out of these it is possible to select by no means a small number for which reasonable control measures are suggested.

It must be admitted that the literature issued by the Research Institute—the series of 5 leaflets, 2 pamphlets, 12 bulletins, 4 records and 5 memoirs, on Forest Zoology,—has not been utilised to the extent that it might have been, and presumably was intended to be. The preliminary notes on the life-histories of the pests dealt with included in most cases possible remedial and protective methods, and usually indicated by a list of queries the nature of the information most urgently required in order to continue the investigation. In very few instances has the invitation to collect further data met with response from those divisional officers intimately concerned with the pest, and in still rarer cases have the control measures received a practical test.

The local officer is in a position best to appreciate the nature and extent of insect-damage occurring in the forests in his charge, yet divisional records contain little to indicate that the fact is realised. In Annual Reports and Provincial Administration Reports the entries in the section 3 (d) "Protection against injury from natural causes" are very scanty and on analysis disclose statements which are frequently valueless or misleading. Instances could be given of incorrect identifications, errors in determining the cause of the damage, etc., which fully indicate that insufficient use is made of the Zoological Branch of the Research Institute for consultation. The number of enquiries with regard to insect-pests sent in to Dehra Dun during the last three years is only forty, that is, less than eight per cent of the divisional charges in India and Burma have made use of the Research Institute each year.

It is hoped that the scheme of scheduling information on the principal kinds of damage, here proposed, will provide material in a systematic form for condensation in Annual Reports, and make it possible to include eventually under Section 3 (d) a more or less accurate indication of the extent of insect-damage in a division.

2. *Possibility of introducing control measures.*—It has frequently been stated that practical control measures against insects are not required in India until more intensive silvicultural operations are introduced. With the introduction of more intense management, and the nearer approach to efficient conservancy the liability of the forest crop to insect-damage inevitably increases; at the same time, the difficulty of putting control measures into force is correspondingly reduced. Hence, there is a tendency to use this truism as an argument for the postponement of the introduction of a control policy, and to overlook the fact that there are, at the present moment, numerous areas in which the degree of silvicultural management has reached a sufficiently high intensity to permit a serious consideration of the question of insect-pest control. Such conditions are to be found in forests under working-plans where insect injury occurs in natural regeneration, to timber on felling-areas and in transport, to artificial cultivation and afforestation to plantations, etc. In these areas the management is sufficiently concentrated to allow control measures to be adopted, and in the writer's opinion, postponement of their introduction will find the forest officer unprepared, when the unchecked increase in its numbers, results inevitably in extensive outbreaks of the pest.

3. *Types of insect-damage.*—The possibility of introducing control measures while dependent on the intensity of silvicultural operations, is also influenced by the nature of

the damage done by the pest and its method of attack. The principal kinds of damage to forest trees in India are due to 5 classes of insects—

1. Primary bark-borers, which attack and kill living trees of all ages by mining under the bark.
2. Primary sapwood and heartwood borers, which attack living or freshly killed trees and cause technical defects in the timber, usually not fatal.
3. Defoliators and pests of new growth and fruits and seeds.
4. Pests of natural and artificial regeneration.
5. Pests of forests products, which injure unseasoned timber, fuel, logs and other crude products.

For several pests belonging to class 1 and a few belonging to class 2 control measures have been proposed in departmental literature, and the methods are analogous to those in force in European and American forests, but for the pests belonging to the remaining classes, no satisfactory measures have yet been discovered, with the sole exception of the toon shoot and fruit borer (class 3)—

4. *Cases of successful application of control measures.*—As has been mentioned above the instances in which control measures have been given a practical test in the forest and have been proved effective are very few. We are nevertheless in a position to state definitely that certain species of insect-pests can be and have been profitably controlled by methods applicable under existing silvicultural conditions. The following instances may be cited:—

1. A bark-beetle attack in 1903-1906 in the *Pinus Gerardiana* forests of North Zhob, Baluchistan.
2. An attack by bark-beetles (*Scolytus*) and longicorn borers in deodar forests in the Simla Catchment Area, 1908-1910.
3. An attack by the pine bark-beetle (*Ips*) in chir regeneration areas in Chakrata Division, 1912-1914, and in Naini Tal Division in 1915.
4. The control measures evolved for the sal heartwood borer and for the toon shoot and fruit borer have been tested practically on a small scale with complete success.

5. *Method of Introduction of a control policy.*—The first essential of a control policy is that the presence of a pest in a forest and the method and appearance of its attack should be known, and recognised by those who have to carry out the control measures. Until divisional officers and the subordinate staff are acquainted with the work of the principal insect-pests of the locality no general adoption of a control policy may be hoped for. It is suggested that a scheme of systematic collection and record of information is required, which will provide forest officers with a knowledge of the nature, extent, and value of the insect damage to the principal trees of the division. It is obviously impossible to entertain the idea of an immediate compilation by divisional officers of a list of insect-pests by their specific names. The main reasons for this lie (1) in the absence of published information on many of the principal pests-species, (2) in the fact that the greater number of species is met with, in connection with damage, only during their immature stages. The immature stages cannot be identified, even by an expert, until they have been definitely associated with the adult form of the insect. Certain types of damage by insects are readily recognisable as due to such agency and it is suggested that information should first be recorded under *heads corresponding to the nature of the damage* with the intention of determining ultimately the identity of the insect or insects directly concerned. The types of the damage to which a forest tree is liable during the course of its life and to which the timber is liable during the period it remains in the forest, are detailed in the accompanying annexure I. It should be possible to assign examples of damage met with to one of the types enumerated without difficulty. As a general rule, the method can be applied freely to all the principal forest trees. The possibility of confusion of similar types of damage due to different species of insects or to groups of allied species is small, and correct interpretation of the recorded information may be left to the expert.

6. *Details of procedure.*—A preliminary survey of the regeneration areas, felling-areas, depôts, etc., and past records of the division should give an indication of the different types of damage which normally occur in the locality. It is unlikely that more than five or six different kinds of damage will be found to be of sufficient importance to deserve attention. In many divisions a group of defoliators, a heartwood borer, one or two pests of regeneration, and a few borers of unconverted timber and fuel probably constitute the lists of pests on which observations are desirable. To avoid taking in hand more than can be attended to in divisions in which more than one principal timber species exists, it is advisable to restrict the earlier work to *six kinds of damage* only, selecting those of primary importance. The examples of minor damage or injuries of irregular occurrence are better neglected at the outset.

The first step in the investigation of any one type of damage is to ascertain definitely the agent responsible, *i.e.*, the living insect *in situ*. Too little is known at present of the



traces which most Indian forest insects leave behind them to enable one to rely solely on such evidence for identification of the insect. It is nevertheless not so difficult as would at first appear to obtain alive the insect responsible for every kind of injury, provided careful examination is made in the early stages of the attack. If specimens of the damage, together with live insects and food material are sent to Dehra Dun for laboratory examination and identification, the possibility of confusing the true author of the damage with harmless species can be avoided. Methods of sending examples of damage, living insects and dead specimens are detailed in Annexure II.

In cases where no destructive agent can be found and yet obvious traces of insect attack are present, efforts should be made to find the pest at work when the attack is renewed later in the season or in succeeding years. In the meanwhile the extent of the damage can, where possible, be estimated, and recorded. It is estimated that a period of two years will be required before lists of the chief classes of damage are drawn up for all divisions, but in forests in which sâl, teak and conifers are the principal species, lists may reasonably be expected to be complete after one season's work.

*7. Introduction of Control Measures for selected Pests.*—As soon as the chief types of damage are determined and the insects responsible identified, we shall be in a position to see to what extent it is practicable to introduce control measures on a large scale, and which divisions are most urgently in need of protection. From the scanty information now available on the distribution of the major pests of sâl, teak, deodar and chir, it is evident that the degree of injuriousness of an insect species varies throughout the habitat of the tree-species which is its host. In some localities it may not rise to the status of a pest and in others it may be absent. The requirements of each division occurring within the range of an important timber-species, for protection against insect damage, vary and the same method of control cannot be rigidly applied in all divisions. It is suggested that at this stage in the investigation it would be desirable to select certain forests in a province or within the range of a pest, in which experimental measures may be introduced. The divisions likely to be most suitable for the purpose are those in which—

- (a) the particular type of damage is of regular occurrence ;
- (b) the annual loss is appreciable and to a certain extent measurable ;
- (c) the methods of silviculture and utilisation are favourable for protective measures ;
- (d) the divisional officer remains permanently in charge during the progress of the operations.

The choice of forests in which these conditions obtain could be made by Conservators with the assistance of the Zoologist, who would draw up a detailed scheme for the guidance of the officers concerned.

Under favourable conditions it is expected that the results obtainable from the systematic application of protective measures for a period of three or four years will be sufficient to indicate the efficiency of the measures and demonstrate that they can profitably be adopted in Indian forests.

*8. Summary of proposals.*—1. The compilation of a list of the chief insect-pests of every division in India and Burma, which entails—

- (a) the determination of the chief types of insect-damage to each of the principal forest trees of each division,
- (b) the submission of specimens of the pest and its work to the Forest Zoologist for identification,
- (c) the record of the information collected in a systematic form, *i.e.*, a list of species of insect-pests.

2. The experimental introduction of control measures for certain primary pests, which entails—

- (a) the selection of a certain number of divisions in each province most suitable for the testing of control measures on a large scale,
- (b) the construction of a plan of operations for each locality,
- (c) the systematic application of the measures for a period of at least three years.

## ANNEXURE I.

## Types of damage due to injurious forest insects.

## I.—DAMAGE TO THE LEAVES, FLOWERS AND FRUITS.

1. *Defoliation.*—

- (a) (1) By caterpillars.
- (b) (2) By beetles.
- (c) (3) By other kinds of defoliators.

2. *Injury to the developing flowers and fruits.*—

- (a) (4) Inflorescence, fruits, or seeds bored by caterpillars.
- (b) (5) Inflorescence, fruits, or seeds bored by weevils and grubs.
- (c) (6) Other kinds of injury.

3. *Injury to ripe or stored fruits and seeds.*—

- (a) (7) Fruits or seeds bored by caterpillars.
- (b) (8) Fruits or seeds bored by pulseweevils or other beetles.
- (c) (9) Other kinds of injury.

II.—DAMAGE TO YOUNG GROWTH, *i.e.*, SEEDLINGS AND YOUNG SAPLINGS OF NATURAL OR ARTIFICIAL REGENERATION.

[Excluding I (1).—Defoliation.]

1. *Injuries to the roots, and stem at soil level, externally.*—

- (a) (10) Root-pruning by cockchafer grubs, mole-crickets, ants, etc.
- (b) (11) Other kinds of external injury to the roots and rootlets by insects living in the soil.
- (c) (12) Stem girdling or partial barking by crickets, cut-worms, ants, white-ants, etc.
- (d) (13) Other kinds of external injury to the root collar, cotyledons, etc.

2. *Injuries to the roots and stem by internal borers.*—

- (a) (14) Roots, sapwood or pith of stem, bored by grubs of beetles or moths.
- (b) (15) Other kinds of internal injury to the roots and stem.

3. *Injuries to the leading and lateral shoots, coppice shoots, etc.*—

- (a) (16) Shoots and twigs bored internally by grubs of beetles and moths.
- (b) (17) Shoots and twigs girdled or bitten off externally by beetles, etc.
- (c) (18) Other kinds of injury.

4. *Injuries due to galls or incrustations, or insects sucking externally.*—

- (a) (19) Injuries by scale insects, mealy-bugs, blight, etc.
- (b) (20) Injuries in the form of galls, excrescences, pseudocones, etc.

## III.—DAMAGE TO LIVING OR FRESHLY FELLED POLES AND TREES.

1. *Injuries due to borers between the bark and sapwood.*—

- (a) (21) Injury by bark-beetles (*sensu stricto*) fatal or secondary.
- (b) (22) Injuries by flat headed and round headed borers, beetle grubs, etc.
- (c) (23) Other kinds of injury, fatal or secondary.

2. *Injuries due to borers in the heartwood.*—

- (a) (24) Injuries by longicorn borers and other beetle grubs, fatal or secondary.
- (b) (25) Injuries by moth-borers, bee-hole borers, etc.
- (c) (26) Injuries by shot-hole borers and pin-hole borers, ambrosia beetles, etc.
- (d) (27) Other kinds of injury.

**IV.—DAMAGE TO UNSEASONED FOREST PRODUCTS, STORED TIMBER, FUEL STACKS, ETC.**

- (a) (28) Injuries by heartwood borers.
  - (b) (29) Injuries by bostrichid beetles, powder pos tbeetles.
  - (c) (30) Injuries by pin-hole and shot-hole borers, ambrosia beetles.
  - (d) (31) Injuries by white ants.
  - (e) (32) Other kinds of injury.
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## ANNEXURE II.

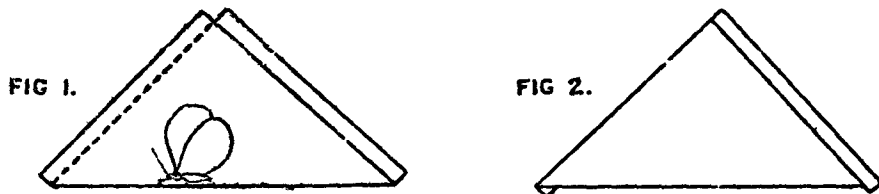
## Instructions for the collection of specimens of Insects and Insect-Damage in Forests.

The suggestions given below are intended to apply to conditions in which ordinary entomological collecting apparatus, *viz.*, tubes, cyanide-bottles, pins, corked boxes, etc., are not available.

**Killing Insects.**—All insects except moths, butterflies, may be killed by dropping into alcohol, methylated or other spirit. Kerosene or petrol or oils should not be used. Small beetles, bugs and soft bodied insects may be killed by immersing in boiling water. If available benzene evaporating on cotton wool may be used to kill beetles, wasps, bees and flies. Moths and butterflies may be killed by pinching the body (thorax) between the fingers or small pliers on the underside, after folding back the wings. Many small insects will die if kept in a closed box or bottle for a few days with camphor or naphthalene.

**Packing dead insects.**—Dead dry insects (except butterflies, and moths) may be wrapped individually in soft paper without crushing them, and packed in a wooden box with plenty of loose paper or wood shavings as packing all round. In the rains, when there is danger of mould developing during the journey, the specimens should be dried before packing, and a little crushed naphthalene, or saturated solution of carbolic acid added. Large quantities of small insects may be packed in coarse dried sawdust, from which all fine dust has been sifted. It is essential that the boxes, or tins used should be quite filled, to avoid injury to the specimens by shaking about. Cotton-wool should not be used for wrapping up dry insects.

Butterflies and moths should be put into triangular envelopes with their wings folded together over their backs. The envelopes are made by taking an oblong piece of paper (almost any sort will do if not too stiff), and folding across diagonally as in figure 1. Double one edge up, the other down as figure 2. These envelopes containing the moths may be packed flat in the box without crushing.



For adult insects preserved in spirit see below under *larvæ*.

**Packing larvæ and pupæ.**—Caterpillars, grubs, maggots, pupæ, etc., which have been killed must be preserved in a liquid, *i.e.*, alcohol (70 per cent) methylated or other spirit, or formalin (2½ per cent). If medicine bottles or tubes are used for packing they should first be thoroughly cleaned. The cork may be sealed with candle wax or bees wax, but *not* with sealing wax.

Kerosene, petrol or turpentine or oils, etc., should not be used. A label written *in pencil* giving full particulars should be enclosed in each bottle. The bottles should be despatched in wooden boxes with sawdust or woodshavings as packing.

**Packing Live Insects.**—*In the case of the immature stages of insects, wherever possible it is advisable to send the caterpillar, grub, pupa, etc., alive.* The specimens arrive in a better condition for examination, and if sufficient are sent, a portion can be preserved and the remainder bred to the adult stage in the Insectary at Dehra Dun.

(a) **Caterpillars and other defoliators.**—Leaf-eating caterpillars should be sent with a supply of food for a long journey, but can go without food for 24 hours. They should not be sent in bottles or glass tubes or small tins, but in wooden boxes. A large mass of green vegetable matter should not be sent tightly packed as it is likely to ferment. It is advisable to prepare a small wooden box with a lid and take it into the forest and collect and pack the insects on the spot. Twigs and shoots of the food plant should be tied in small bundles and fastened by nails to the sides of the box, so that nothing can shake loose; an absorbent layer of blotting paper or of dry grass should be placed on the bottom of the box. Very large leaves, such as those of teak, are best packed loosely in a mass of dry grass in a box. Wooden boxes do *not* require holes for ventilation purposes. Fifteen or twenty small caterpillars can be sent in a box about 8" x 8" x 15". In the case of very large caterpillars 3 to 4 inches long, which require some space to move about in, it is advisable to pack them separately with a shoot of the food plant in a large tin box, perforated for ventilation, and enclosed in a wooden box with dry grass packing all round.

(b) *Wood borers*.—Boring grubs of shoots and branches and boles should be sent in the wood in which they are feeding. Their presence is indicated by holes in the bark, ejected wood-dust and fibres, etc., and can be confirmed by cutting up similarly affected logs or branches to discover the exact position in which the larval galleries occur. Logs two feet long, or multiples of two feet, are of the most convenient dimensions to send. Small branches and saplings are best tied together in a bundle and packed in dry grass and sacking and enclosed in a long wooden box, or a bamboo tube. Larger logs and sections of tree-trunks two to three feet in girth should be wrapped in damp grass, palm leaves, the bases of plantain leaves, moistened jute fibre, etc., and sewn up in sacking.

Larvæ and pupæ taken alive and undamaged from borings under bark and in wood, may be sent in tightly corked bottles in bark or wood-dust of the natural degree of moistness. Any empty space should be filled up with soft paper.

Small bark-boring larvæ may be sent between two pieces of bark in contact on their inner surfaces.

(c) *Larvæ living in soil*.—Cockchafer grubs, cutworms and other soil living larvæ may be sent in small numbers in a box full of soil, but there must be no empty space. They may also be sent in a nest of dry grass with some packing material all round, in a wooden box. They require no food material and no arrangements for ventilation.

*Specimens of damage—*

(a) Specimens of defoliated leaves and shoots, damaged seedlings, etc., should be pressed flat between sheets of blotting paper, as botanical specimens, and packed in stiff cardboard.

(b) Scale insects on twigs, galls, etc., and damaged seeds or fruits should be sent in spirit.

(c) Wood specimens large and small may be packed in sacking or paper.

*Labels*.—Every consignment of specimens of living or dead insects, or damaged material should be accompanied by a label, giving (a) the locality of collection, (b) the date, (c) collector's name, (d) reference to forwarding letter. Spirit specimens should have labels inside the bottle or tube, written in pencil or in Indian ink but not in ordinary office ink.

*Despatch of Specimens*.—Specimens of small weight should be sent by parcel post, registered, and heavy specimens as railway parcels by passenger train, addressed to the Forest Zoologist, Forest Research Institute, Dehra Dun, United Provinces.

*Supply of apparatus*.—Tubes, pins, boxes, collecting apparatus, breeding cages, etc., will be supplied on application to the Forest Zoologist.

C. F. C. BEESON,  
*Forest Zoologist.*

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## APPENDIX K.

## The Promotion of Rangers to the Provincial Forest Service.

Reference is invited to Article 15 of the Forest Department Code, 7th edition. The article, as it now stands, precludes the promotion to the Provincial Service, except after long service or after a further course of training at Dehra Dun, of Rangers who by special ability and industry have proved themselves fit for advancement to that service. The Government of India have ruled on various occasions that they have no intention of closing to Rangers the door of advancement to the Provincial Service, but at the same time the intention of the article to limit promotion in the manner indicated is quite clear. This intention however has not always been adhered to by Local Governments, some of whom have promoted to the class of Extra Assistant Conservator, Rangers whose service cannot reasonably be held to have been long.

2. The practical value of the further course of training contemplated in Article 15 (i) of the Code is at least open to doubt, and it is believed that there is a general consensus of opinion that if a Ranger has served long enough to have proved himself specially fitted for advancement to the Provincial Service, it is a waste of his time and of Government money to send him back to the special Provincial Service course.

3. It has been represented with good reason that Article 15 as it stands does not altogether fulfil the needs of the Department, and that some revision is desirable in order to allow for the direct promotion of Rangers by selection: such a revision should provide:—

- (1) That a Ranger does not become an Extra Assistant Conservator of Forests before a Provincial Service candidate who started his training at the same time. It usually takes 5 years from the commencement of training for a Provincial Service candidate to become eligible for permanent promotion to the class of Extra Assistant Conservator of Forests.
- (2) That a Provincial Service candidate shall always have a fair start in the service over a Ranger candidate of the same standing, this start including an allowance for the fact that owing to the higher educational standard demanded, the Provincial Service candidate probably starts his training at a later age than the Ranger candidate.
- (3) That as a man who has proved himself to be a first class Ranger may not necessarily be a good Provincial Service officer, Rangers promoted in this way to the class of Extra Assistant Conservator shall be on probation for at least two years.

Taking these points into consideration it is thought that 8 years might be fixed as the minimum completed service within which any Ranger should be promoted to the Provincial Service; this would give the Provincial Service candidate of the same standing a start of five years, which is believed to be sufficient.

4. If these proposals are accepted, the necessary alteration to Article 15 can be made by the omission of the words "or to Rangers" in 15 (i) and by the introduction of a new sub-section (ii) as follows:—

"To selected Rangers with not less than 8 years' service who have obtained the Honours or the Higher Standard certificate for the Rangers' course at the Forest College, Dehra Dun, or at the Burma Forest School, and who by unusual ability and industry have proved themselves fit for special promotion to the Provincial Service. Provided that Rangers promoted under this clause shall be considered on probation in the class of Extra Assistant Conservator for two years, or such further period as the Local Government may consider desirable."

To the present sub-section (i), which would become (iii), it is proposed that the following addition should be made:—"Promotion under this sub-section is intended to be given towards the close of a Ranger's career as a reward for long and meritorious service."

## APPENDIX L.

**Proposals for the Training and Improvement of the Position of Forest Guards.**

*Introduction.*

These proposals are revised from a note I submitted on the same subject to the Chief Conservator of Forests, Central Provinces, in March 1914. In the Conference held at Pachmarhi in June of that year the Conservators said:—

“The suggestions are based on methods obtaining in parts of Europe. The main proposals include the holding of classes once a week for the instruction of guards and the allotting of 5 acres of fenced land inside reserved forests to each guard for cultivation, in order to make service more attractive. The Conference considers that the proposals are not suitable to the conditions of the province and are at present impracticable.”

The following two facts form my apology for again urging consideration of the matter.

Firstly, the Deputy Commissioner, Nagpur, while reviewing the Forest Administration Report of the Nagpur-Wardha Division for 1913-14 said:—

“I trust that the scheme for training of Forest Guards has not been finally rejected. No doubt any complete system of training on the European model is impracticable, but there is so much that the simplest woodman with an axe and a good pair of eyes can do. I had made the suggestion to the Forest Officer when accompanying him on one occasion and found that he had been advocating the training of guards for years past. Such elementary wood craft as (i) the cutting of all climbers, (ii) the cutting of worthless saplings (iii) coppicing and (iv) breeding teak and valuable seedlings can be taught to many of the guards under a keen Forest Officer, provided some small inducement is offered. The surplus in this Division, even after the heavy reduction in the grazing revenue, is still nearly Rs. 90,000. I should like Mr. Naidu given a chance of showing what can be done with Forest Guards with a small grant for rewards of Rs. 250 per annum. The experiment may, I recommend, be tried.”

The opinion of an independent observer like Mr. Clarke is of special value to me in my endeavours to bring to notice what I find to be a great desideratum.

Secondly, being an Indian myself, I have an intimate knowledge of the hold which the family ties and domestic customs, peculiar to India, have on Forest Guards. I have also had the rare opportunity of studying, at no juvenile period of my own life, the domestic and social amenities of European Forest Guards. I feel therefore that I should not hesitate to appeal for a hearing before a higher tribunal, *viz.*, the Board of Forestry, where my cry does not confine itself only to the amelioration of the condition of Forest Guards but aims at improving simultaneously their professional worth, resulting in considerable benefit to the State and progress in the science of Forestry.

*Origin of the idea.*

Owing to the scanty rainfall in 1907, there was an early and scanty harvest and a great demand for employment. The tracts in which most of the Reserved forests are situated in the Buldana Division in charge of which I then was, were particularly bad and the population had to be provided with work.

2. According to the provisional working of the forests, begun a few years before, the fellings, in considerable areas, had not been completed by means of adequate cutting back operations. All good material had been removed by purchasers and the bad material was left behind. Advantage was therefore taken to provide employment to the people by carrying out cutting back operations on a large scale.

3. During the conduct of these operations I sorely felt the ignorance and incapacity of our guards, as these operations could not be concentrated like ordinary Public Works Department relief works but were scattered over considerable areas and Forest Guards had to look after, sometimes a handful and sometimes large gangs of coolies and exact correct work from them. It is an acknowledged fact that the shortcomings of the subordinate staff are hidden by the skill and ability of superior officers. Hence in ordinary times the ignorance and incapacity of Forest Guards do not cause much alarm and improvement is relegated to time, but when we are to show our readiness to conduct forest operations on a large scale, they severely come to prominence. I therefore brought this matter to notice in the Divisional Annual Report for 1907-08.

4. In reviewing this Annual Report both the Conservator (Mr. C. G. Rogers) and the Commissioner (Mr. F. G. Sly) recognized the necessity for training our guards and improving their prospects and Mr. Rogers asked me, officially, to submit proposals for training the guards. The matter is since engaging my attention and while touring in Germany, France and Sihlwald of Switzerland, I paid special attention to this subject and discussed with both Sir William Schlich and Mr. Caccia the ideas I then formed in my mind as to what could be done in this direction in India. Before describing these proposals, a review of some more facts is necessary.

*Some more facts of importance.*

5. The progress of Forestry in India ever since the inception of the Department is such as any country in the world would be proud of, considering the habits, customs and sentiments of the people and consequent difficulties any progress is beset with. But the process is one of filtration of skill from above without the guarantee that any noticeable portion of it reaches the lower strata. Thus it is not difficult to see that a waste of this skill could be prevented only by preparing even the lowest layers so as to receive and benefit by the skill that filters through. Indeed it is like the Army in which a good leadership is wasted, if the individual efficiency of rank and file is not secured.

6. Even the Police Constable receives training. His duties are, no doubt, very arduous as he has to work for the safety of person and property and learn a great deal more about the liberty of the subject than a Forest Guard need do, but his subjects could complain against any wrongs done to them whilst those of a Forest Guard cannot do so and yet require as much attention, if their protection, improvement and regeneration has to be ensured.

Perhaps the present Forest Guard has a parallel in the "chaprasi" of the Revenue and Judicial departments who do mostly message carrying and the like without such direct and permanent responsibility as attaches to the charge of a Forest beat. And curiously enough the Forest Guards are known by the populace in the Central Provinces as Forest *Chaprasis*.

7. Next there is a greater amount of moral rectitude necessary in a Forest Guard than in any of the classes of officials with whom he could be compared. He has constantly a great deal to do with the villagers. He deals not only with men, but also with men, women and children who must feel that they have a friend and brother in him always upright in his conduct. Such a feeling goes more towards the protection of the State property entrusted to his care than his mechanical watching or patrolling. For, in the first place, the people would hesitate doing things which would bring him into trouble and in the second place they would know that if they committed such wrongs he would not hesitate in exposing them to just punishment. If in addition to this a Forest Guard, by means of a systematic training given him, is enabled to show to the people that he is not a petty tyrant nominated over them but a man skilled in a profession which is now little understood by them, he would rise in popular estimation, and that would prove a much desired gain to the department.

8. On the other hand, if the Forest Guard is inclined to be dishonest, which is largely the case at present, he incites the very people to whom he has to set a good example into committing forest crime and derives illegal gain therefrom at the expense of the property entrusted to his care. Owing to the manner in which it is possible to manage our forests now and in the near future, it is not easy to detect such cases and much less easy is it to prove them, as invariably it is both the guard and the people that are involved and both naturally combine to frustrate detection and proof.

9. Again very few Indians are without a number of near relatives dependent on them. By custom and by religious precepts, be he a Hindu or a Mohammedan, he is bound not to withhold support from them. The lower and less educated the stratum of society is, the greater is the tenacity with which this obligation is adhered to. With the advance of education a man thinks more of his own claims and the claims of his own family and the dependents learn to become more and more self-reliant. It will, however, be a long time before the stratum of society to which a Forest Guard belongs, is educated to that extent in the ordinary course of events. Even then the needs of his own family would use up all the concessions which is now possible for Government to give him.

It is not always that the dependents can work and contribute towards the support of the whole family. The official position of the guard, humble as it is, gives him and his family a kind of prestige. The family is too proud to work and even if they are prepared to work they are not eagerly employed, as the employer feels he has to accord them different treatment from that which he gives other village labourers. For this reason men belonging to forest tribes or agriculturists, who living in forests tracts have become expert woodmen, refuse to become Forest Guards. They say it deprives them of the opportunity of conjointly working with the family, whilst the pay that Government gives them is not sufficient for the maintenance of themselves and their families. At present therefore the recruitment to the class of Forest Guards is from town-bred Mohammedans and Brahmins and the ubiquitous "pardeshis" whose one idea is to make as much money as possible by any means, fair or foul, so long as they are in service.



10. A wily Forester or Deputy Ranger, who is in charge of a group of beats and often also a dishonestly inclined Ranger, are not slow in seeing this state of affairs, and instead of making attempts at exercising an effective check on the guards' work, make common cause with them, and matters then go on in such a way as to defy detection, in 9 cases out of 10 even from the most acute Divisional Officer. On the other hand, if the position of a Forest Guard is adequately improved, he is not likely himself to fall into temptation, the severity of which varies directly with the prosperity of the country in which a forest lies and would also refuse to be made a tool of by his dishonestly inclined immediate superiors.

*What obtains in Europe.*

11. Forest Management on the continent is of a high class. It is possible to attain this because the officer in charge of a Division has got his guards trained to carry out, intelligently and willingly, whatever he wants for the benefit of the forest and because also he has got a charge small enough to enable him to look after minutely. This latter condition could not be obtained in India, as the forests are extensive and comparatively inferior and expenditure already forms such a large percentage of gross revenue; but as to the former condition there is no reason why attempts should not at once be made to secure it.

12. Forest Guards, there, correspond in intelligence and social status to Foresters in India. They are literate, education there being compulsory. They generally come from families of woodmen or of men already in service. They are given practical and theoretical training according to the practice adopted by each province, and until their training is completed and they are declared to be qualified they work in the forests like labourers earning ordinary wages.

All this is possible because the life of a Forest Guard is made so comfortable and every encouragement is given to make him all the more fond of rural life. The pay he gets is not more than what others in his station of life get and often it is less, but the facilities given him to do, in an innocent way, what he could for his private benefit, is attractive to men who love rural life. Thus he gets a free house, with a plot of cultural land close by at nominal or no rent, free clothing, a free gun, etc. In France a Forest Guard's wife is allowed to keep a restaurant. When works requiring special skill, such as relieving saplings of the principal species of suppression without exposing them, putting down of game to a harmless extent, etc., are done by Forest Guards they are given rewards.

*Their adaptability to Indian conditions.*

13. In India where the net revenue is so small, it is not possible, at present, to expect any really effective increase of pay to the guards, but without increasing any direct expenditure we could adopt one continental custom which absolutely is applicable to India, *vis.*, the giving out of some land for cultivation to the guards. This will at once secure to us the right stamp of men. I would recommend the adoption of this plan even to the Foresters and Deputy Rangers in charge of Forest Reserves (a group of beats) but for the present I confine myself to the case of guards. The plot of land keeps the family of the guard employed and he will be given the means of using his spare time profitably to himself rather than spending it in the village, as a rule, hurtfully. Indeed it is a reward which is more agreeable to the life of a Forest Guard than any increase of pay, and as such terms could only be given by Government there is naturally every incentive for a guard to work well and remain in Government service. Even a transfer would be greatly feared whereas now a dismissal is not of much consequence. It would then be possible to get recruits from aboriginal tribes or agricultural classes. Of course we cannot, to start with, expect literacy in the guards but eventually it will also come.

14. In return for this the guards must acquire skill and efficiency in doing forest work that comes within their scope. They will not attend only to Forest police work or message carrying for Range officers and Range Assistants without any feeling of responsibility, but become efficient units in the departmental organization.

*The proposals.*

15. I therefore propose that every Forest Guard in charge of a Forest beat should be given a properly fenced plot of land to cultivate, provided he undergoes practical training and becomes qualified in the ordinary work of a beat. This plot is to be big enough only to occupy his spare time and supplement his income. In good soil 5 acres would be sufficient and in poor soils perhaps a little more may have to be given. The plot will be in the forest as near his quarters as possible and it should be cultivated by him and his family and not leased out.

16. The training will be all practical in the subjects mentioned in the enclosed list. It should be said that guards could only learn what they daily see and do in the forests and the verbal instruction given them is simply to draw their attention to what they would otherwise not notice.

17. The manner of imparting this instruction is to have one or more teaching centres according to the number of candidates and teachers available in the Division. A man trained in the Provincial Vernacular Forest School of some experience could be taught to teach. The teaching centre will be the Headquarters of a Reserved forest charge.

Picked guards to be ordered to go to the centres that would be fixed for them once a week for one day, say a Saturday. They could receive verbal instruction in the morning and do practical work in the afternoon and return home the next day. This arrangement will not disturb the arrangements in a Range, provided there are men available fit to teach in a number of places. The transferring of picked men to beats close to a teaching centre (distance up to 20 miles) is another convenient plan when there is a paucity of Range Officers or Range Assistants capable of teaching. When the training is completed the men could be retransferred to their original or the more distant beats permanently.

The weekly instruction to be given only in the rainy season at the end of which an examination would be held by the Divisional Forest Officer. If the instruction is not grasped thoroughly in one year a man would take two years to get through: till then he would be working in the forest under present conditions.

The men that are not selected would probably be too old or undeserving of such training, they must continue under present conditions and not be admitted to the privilege proposed.

New men belonging to a right class of people may be given instruction provided they keep working in the forests on wages in the intervals. If they qualify they could be posted to vacancies when they occur.

18. In the Grand Duchy of Hesse the above is the manner in which guards are trained. Candidates, who, as already stated, are sons of woodmen or men already in the Department, have to work in the forests and attend weekly lectures at Darmstadt, the capital of the Grand Duchy, in winter. Only one winter's training is considered sufficient for one batch of men.

*Are there any objections to the proposals?*

19. It is impossible to imagine objections to give the guards a training especially when it could be given without the establishment of schools and staffs of Directors and Instructors and with no more increase of expenditure to Government than what the grant of a small allowance to the man selected to teach and travelling allowance to the guards leaving their beats for instruction once a week, entails. But the chief objection is said to be that the prospects must be improved to make the guards respond to the instruction and that when the improvement consists of letting them cultivate a small plot of land, the fear is that the guards would sit down at home looking after the land and neglect the forests. By way of an answer to this I have only to remind observers that they cannot be reasonably sure that all Forest Guards at present go to their forests every day, and that if a Forest Guard spends reasonably a few days to till his plot of land it is no real loss to Government. I also add that he cannot be blind to the enormity of his loss, if he neglected his beat.

The system has given satisfaction in Europe and unless an Indian is taken to be incapable of being alive to his interests I do not see why it should not render equal satisfaction here. Indeed its adoption here seems more justified, in view of the Indian domestic and social customs, than in Europe. Again Forests management in India is after continental models and it would therefore be not unbecoming to adopt a continental practice which augurs so well. Nor is it improper at any time for the Department to awaken to one of its numerous responsibilities which had hitherto, unfortunately received little attention.

S. SRINIVASALU,

*Divisional Forest Officer, Nagpur-Wardha Division.*

**LIST OF SUBJECTS PROPOSED FOR THE TRAINING OF FOREST GUARDS.**

**I.—SYLVICULTURE.**

**A.—INTRODUCTION.**

1. *Trees.*—A knowledge of their principal characteristics and requirements, illustrations from the trees found in the local forest. Particular reference to hurtful influence of weeds, adverse soil and climatic conditions, etc.

2. A practical knowledge of pure and mixed crops and artificial and natural crops. Measures taken and might be taken to favour special species in the struggle for existence. A practical knowledge of various types of forests met with locally.

#### B.—CREATION AND REGENERATION OF FORESTS.

##### (a) Artificial formation.

1. A practical knowledge of the main principles governing choice of species, site, method of formation and condition of success.

2. Practical knowledge of collection, testing and storage of seed, season of sowing *in situ* under various methods, planting under various methods, season of planting, nursery, management, transport of seed and plants and maintenance operations in plantations.

##### (b) Natural regeneration.

1. Main principles of the systems of natural regeneration in force in the Division and a practical knowledge of the manner in which these principles are carried out in practice.

2. Practical knowledge as to actual work, such as coppicing, assisting in marking, etc.

#### C.—MAINTENANCE AND IMPROVEMENT OF FORESTS.

Practical knowledge of carrying out cutting back operations, climber cutting, cleaning weeding, pruning, etc.

#### D.—WORKING PLANS.

The maintenance of boundaries of coupes, sample plots, etc.

#### II.—FOREST PROTECTION.

A practical knowledge of the danger to forests from—

(a) Encroachment, trespass and over-felling.

(b) Fire.

(c) Animals, birds, insects and fungi—

Practical knowledge to protect the forests against these according to the practice in force in the local forest. Special attention to be given to the manner in which boundaries are to be maintained in good order, mode of cutting guide lines, mode of fire tracing, patrolling and combating a fire when one occurs, manner in which the attacks from animals, insects and fungi, etc., are combated in the local forests.

#### III.—FOREST UTILIZATION.

1. Technical properties of chief timbers and wood in demand in the Division for Agricultural implements, etc.

2. Practical knowledge in felling, conversion, collection, classification and stacking of timber and practical management of forests and sale depôts.

3. Knowledge of principal trees used for fuel and making charcoal. Practical knowledge of felling, collection, classification and stacking of firewood. Practical knowledge of charcoal burning.

4. Practical knowledge of collection of the more important minor products, their cultivation, collection and storage.

5. Systems of disposal of forest produce in force in the Division and its check.

#### IV.—FOREST LAW, DEPARTMENTAL ORGANISATION AND ACCOUNTS.

1. A knowledge of the organisation down to a Guard. The powers and duties of a Forest Guard under the Law, Code and standing orders with a knowledge of disciplinary rules in force in the Division.

2. Brief description of the acts prohibited in the State Forests and a knowledge of the privileges and concessions given by Government to the public.

#### V.—SURVEYING.

A practical knowledge of laying out a straight line, parallel lines and right angles with a chain or measuring tape.

**VI.—FOREST ENGINEERING.**

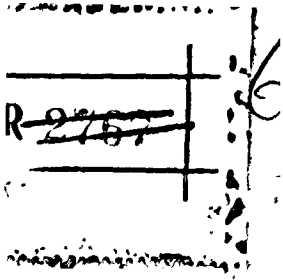
1. Practical knowledge of constructing new roads and doing road repairs, the mending of or deviating from obstacles such as nallas, hillocks, rocks and scarps with the use of a staff and rope if necessary.
2. Practical knowledge of building ordinary huts of the type built in the Division for Forest Guards and Forest Watchers.

**VII.—BOTANY.**

1. A practical knowledge of the various parts of the plant and their functions.
2. Practical knowledge of the conditions necessary for germination and of those that are adverse to it.
3. The collection and pressing of Botanical specimens.

**S. SRINIVASALU,**

*Extra Deputy Conservator of Forests, Nagpur-Wardha Division.*



PROCEEDINGS

~~R-2767~~

OF THE

S1835

BOARD OF FORESTRY

AT MEETINGS HELD AT

DEHRA DUN

Dy. Forest Officer  
9/19/20

BETWEEN THE

31ST MARCH AND 8TH APRIL 1919

WITH

14

APPENDICES



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Proceedings of the Board of Forestry at meetings held at Dehra Dun between March 31st and April 8th, 1919.

This was the fourth meeting of the Board which was constituted as follows :—

- MR. G. S. HART, C.I.E., Inspector-General of Forests, *President*.  
MR. T. R. D. BELL, C.I.E., Chief Conservator of Forests, Bombay.  
MR. O. G. ROGERS, C.I.E., Chief Conservator of Forests, Burma.  
MR. B. B. OSMASTON, C.I.E., Chief Conservator of Forests, Central Provinces.  
MR. P. H. CLUTTERBUCK, C.I.E., Chief Conservator of Forests, United Provinces.  
MR. W. F. PERRÉE, C.I.E., President, Forest Research Institute and College.  
MR. A. W. BLUNT, Conservator of Forests, Western Circle, Assam.  
MR. R. McINTOSH, Conservator of Forests, Eastern Circle, Punjab.  
MR. F. TRAFFORD, Conservator of Forests, Bihar and Orissa.  
MR. H. G. BILLSON, Conservator of Forests, Western Circle, United Provinces.  
MR. S. COX, Conservator of Forests, Northern Circle, Madras.  
MR. B. O. COVENTRY, Conservator of Forests, Kashmir.  
MR. F. L. C. COWLEY BROWN, Principal, Madras Forest College.  
MR. J. L. BAKER, Deputy, Conservator of Forests, Bengal.  
MR. R. D. RICHMOND, Assistant Inspector-General of Forests, *Secretary*.

In addition, Messrs. R. S. Troup, S. H. Howard and R. Bourne attended in connection with the discussion on the collection of statistical information, and Mr. A. J. Gibson at the consideration of his paper on Business-Office Methods.

The proceedings were opened by the Hon'ble Sir Claude Hill, the Member in charge of the Department of Revenue and Agriculture, who referred to the value of these meetings in affording opportunities for the interchange of ideas between officers serving in the various provinces, and to the fact that such meetings would become increasingly desirable with the development of provincial autonomy, so that it might be necessary for the Board to meet more frequently than once in three years as at present, or at any rate for sectional meetings to be held at shorter intervals. Sir Claude drew attention to the part taken by forest officers and the forest department in the war, and to the additional work thrown upon those whom it was not possible to permit to join the Army. Alluding to the scheme for the enlargement of the Research Institute and to the importance of research, Sir Claude spoke of the possibility of the development of the educational facilities in connection with the recommendations of the Public Services Commission, and the employment of Indians in the higher branches of the service. Concluding, the Hon'ble Member made reference to the creation of a special staff of Forest Engineers and to the necessity for devising better means of informing the public of the results of investigation and research.

The Inspector-General then thanked Sir Claude Hill for attending the meeting and for his interesting address. Mr. Hart referred to the action taken on the recommendations made by the Board at its last meeting, reviewed the work done by the Research Institute since its inception and gave details of the scheme for its extension. Increases in the staff of the department were mentioned as, also, was the striking improvement in the financial results of the last three years. Speaking of the employment of Indians in the Imperial Service Mr. Hart emphasised the

necessity for obtaining men of the right kind, and exhorted forest officers to welcome Indians to the service in the right spirit, and, by example and precept, to instil into them the highest ideals of keenness and efficiency. The development of forest industries, improved methods of silvicultural treatment and extraction, and the future prospects of the Department were referred to.

The addresses of the Hon'ble Member and of the Inspector-General will be found in full in Appendices A and B.

Sub-committees were constituted to consider the Triennial Programme of the Research Institute, and the subjects of Forest Journals and Working Plan headings.

With the previous sanction of the Government of India the following subjects were discussed by the Board:—

1. Methods of collecting and recording statistical information and the organization of Silvicultural Research.
2. Suggestions for future Forest Colleges.
3. Increase in staff of the Imperial and Provincial Services.
4. The dissemination of information from the Research Institute.
5. Revision of Imperial Form 10 of the Forest Department Code—7th edition.
6. Formation of a Special Forest Engineering Branch.
7. Utilization Circles or Charges.
8. Sale depôts for government timber.
9. Triennial programme of work for the Research Institute for the period 1919—1922.
10. Revision of working Plan headings.
11. Forest Journals.
12. The number of students to be admitted to the Provincial Service Class 1919-20 to 1921-22.
13. Business office methods.
14. The industrial possibilities of Indian Forests.
15. The expansion of the Central Research Institute.

The Board also considered proposals by the Trigonometrical Survey in regard to symbols for forest maps.

At the conclusion of the meetings Mr. Harvey, Chief Engineer of the North-Western Railway, met certain of the members of the Board and discussed the general question of the sleeper supply required by the Government railways: the conclusions arrived at have been communicated to the Railway Board.

#### *I.—Organization of Silvicultural Research and the collection and compilation of Silvicultural information.*

In October 1918 representatives of the provinces met at Dehra Dun and formulated proposals (the full text of the proceedings is given in Appendix C) which were submitted for the consideration of the Board. The Board discussed these recommendations in detail and resolved that they should be accepted with the following modifications.—

(1) Recommendation (2) (v) should read—

“The results of work by the provincial branches should be promptly reported to the Central Research Institute for record. Owing to the risk of fire it is desirable that all records should be duplicated.”



- (2) In regard to the publication of the results of investigations, recommendation (2) (vi), the representatives of all provinces, other than Burma, desired that publication and issue should be from Dehra Dun. The Chief Conservator, Burma, stated that in his province local arrangements for publication would be preferable.
- (3) With reference to inter-provincial co-ordination and exchange of information, recommendation (3), the Board desired that for the words "the post and office of the Imperial Sylviculturist" the words "the Sylvicultural branch of the Central Institute" should be substituted and that recommendation 3 (c) should read as follows :—  
 "to co-ordinate the work between the different provinces. For this purpose the officers of the Sylvicultural branch should be afforded all facilities for visiting work in progress in provinces."
- (4) As regards recommendation 4 the Board was of opinion that the annual meetings of the Sylvicultural Association need not necessarily always be held at Dehra Dun. When so, the President of the Research Institute should preside, while when held in the provinces the Chief Conservator, or the Conservator of the Circle in which the meeting takes place, should normally preside. The Board further considered that the Association should have a permanent Secretary who should be a member of the Sylvicultural branch of the Central Institute; also that the proceedings of the Association should be printed. The Board emphasized the desirability of the deputation of local sylviculturists to the Central Institute for at least a month, on first appointment, in order to acquaint themselves thoroughly with the methods of carrying out research work.
- (5) That the method proposed for the collection and compilation of statistical information might be suitably adopted until modified in the light of further experience.
- (6) That in regard to the details to be observed in sample plot measurements the following should be added to (iii) :—  
 "One point of first measurement should be marked on the stem, both on hill slopes and on the flat."
- (7) That the recommendation regarding the acceptance of the definitions of tree classes, methods and degrees of thinning should be referred to the Sylvicultural Association for further consideration.

#### II.—*Suggestions for future Forest Colleges.*

Mr. Cowley Brown's paper (Appendix D) on this subject was considered by the Board. The Board agreed generally with the suggestions made and resolved as follows :—

- (1) That while in the case of provincial schools or colleges a Board of Control, consisting of the head of the Forest Department in the province, three or more senior forest officers and the Director, or Principal, of the College, is desirable, no such Board is necessary in the case of Dehra Dun, as the President is in close touch with the Inspector-General of Forests and is able to consult the officers of the Research Institute.
- (2) That the staff of a forest college should consist of the Director, or Principal, and Senior and Junior Instructors, and that Senior Instructors should be in charge of the classes and be responsible for the instruction on all subjects while on tour. Also that in provincial Colleges the Director, or Principal, should receive an allowance of Rs. 150 per mensem, the Senior Instructors Rs. 100 per mensem and the Junior Instructors Rs. 75 per mensem.
- (3) That both Senior and Junior Instructors should receive the first class rates of travelling allowance admissible for their class, and that the Director, or Principal, should receive the same travelling allowance

as a Conservator. In regard to the Forest College, Dehra Dun, the existing allowances were held to be justifiable, as the staff is recruited from all provinces and the touring is more extensive than is the case in provincial colleges.

- (4) That the Principal and Instructors at Dehra Dun and all provincial colleges should be allowed free quarters owing to the difficulty in inducing selected officers to accept these posts, and to the fact that house rent in the localities where colleges are, or ordinarily will be, located is generally higher than in an ordinary district headquarter station. And that in the event of this recommendation being accepted the house tutor should receive special consideration.
- (5) That Government Forest Colleges should make provision for the training of students from Native States and Colonies adjacent to India, where this is possible without prejudice to the requirements of the provinces concerned.
- (6) That the necessity for a medical officer for each class is doubtful, but that it is most desirable for a Havildar to be attached to each class, as Havildars would be of considerable utility in drilling the students and in attending to matters of discipline, both in regard to the students and the menial staff of the college. They should preferably be recruited from the Sappers and Miners so that they may be of use in assisting with some of the field engineering instruction.
- (7) That the proposal dealing with the Principal's Standing Orders was of considerable importance and should be accepted.
- (8) That a demonstration forest should be attached to all forest colleges and that it should preferably be in the college estate itself.
- (9) That the question as to whether the course should commence with a short period of theoretical instruction in headquarters, or with a tour and practical instruction in the forest must depend upon local climatic and other conditions.
- (10) That lectures should not extend beyond one, or at the most one and a quarter hours.
- (11) That the maintenance of Instructors tour journals is most important.
- (12) That it is desirable to utilize examiners other than the Instructors for the final examinations whenever possible.
- (13) That it is sufficient to award one gold medal each year, to be given to the head of the class provided he has obtained honours.
- (14) That there is no necessity to debar Europeans from employment as rangers in Northern India.
- (15) That while in some ways the extension of the course of training for forest rangers from two to three years is desirable, the great increase in expenditure on buildings and staff, and the delay in providing trained men, render it impossible to recommend this at present.
- (16) That instruction in riding should be given where possible.

### *III.—Increase in staff of the Imperial and Provincial Services.*

The Board considered Mr. Tireman's paper, which is printed as Appendix E., on the necessity of an immediate increase in the establishment of the Imperial and Provincial branches of the Forest Service. It was noted that, although a few forest divisions comprising considerably less than 100 square miles of workable forest were already in existence, the truth of the assertion regarding the generally unwieldy and uneconomic size of these charges could not be contested. The Board expressed its conviction that the size of divisional charges would necessarily decrease with the extension of intensive treatment, and desired to place on record its view that for a long time past the staff has been quite inadequate to deal

with the needs of the service. It considered, therefore, that Mr. Tireman's suggestions could usefully be borne in mind in the more advanced provinces.

The Board then expressed the unanimous opinion that an immediate increase in the staff, by recruitment from officers who have served in the Army during the war, was essential. The majority of the Board was of opinion also that officers recruited in this way from the forces in India and Mesopotamia should be employed at once in provinces, and should be sent to England for training when they can be replaced by trained recruits: it was recognized that it would be essential to treat officers recruited in India, and utilized in this way, in the same manner as regards pay, service for leave, pension, etc., as officers recruited in England and trained before joining the service in India.

#### *IV.—The dissemination of information from the Research Institute.*

A note on this subject by Mr. R. S. Pearson, Imperial Forest Economist, will be found in Appendix F. The Board warmly supported the proposal for the more speedy dissemination of information from the Research Institute by means of leaflets, and considered that this might be supplemented by the issue to the press of communiqués containing any information likely to be of commercial or general interest.

#### *V.—Revision of Imperial Form 10 of the Forest Department Code—7th edition.*

A letter on this subject from the Chief Conservator of Forests, Burma, to the Inspector-General of Forests, is printed as Appendix G. The Board decided that it was desirable to restrict the surveys recorded in form 10 to those carried out by the Survey of India Department, for which purpose the suggested revised form was considered to be suitable. It was recognized that if the recommendation to revise form 10 is adopted it will be necessary to revise Article 79 of the Forest Department Code, 7th edition, so as to charge to the appropriate heads, and not to A *viii* c., the cost of departmental surveys made in connection with road alignments, plantations, depôts, valuation surveys and so on.

#### *VI.—Forest Engineers.*

The Inspector-General of Forests explained the present position in regard to the proposal for the employment of forest engineers. The Board was of opinion that forest engineers should be allotted permanently to provinces on first appointment.

The Board next considered the suggestion made by the Industrial Commission in paragraph 62 of its report, to the effect that exploitation officers should normally be members of the trained forest engineering service. The Board concluded that this would probably be necessary in Burma, and that if so the men concerned should be recruited as regular members of the forest engineering service after the prescribed course of special training. In other provinces, however, it was thought that a cheaper agency could be employed for work of this kind, and that the men required might be recruited in India without previous training, either in forestry or engineering. The Board was of opinion that Local Governments should be left to deal with this question by the appointment of men on such terms and conditions as they might find suitable.

#### *VII.—Utilization Circles or Charges.*

The Board discussed the question of Utilization Charges, or Circles, in provinces.

Mr. Perrée first gave the Board a brief sketch of the factors leading to the formation of a Utilization Circle in the United Provinces, and of the present position of the Circle. Mr. Perrée stated that there are three well defined stages of economic development: (a) the scientific or laboratory stage, ordinarily to be carried out by the pure and applied scientists of an institute such as it is hoped to establish at Dehra Dun; (b) commercial research in which samples are produced on a scale

admitting of a test by consumers under ordinary commercial conditions ; and, if the above have produced satisfactory results, (c) the strictly commercial stage taking the form either of pioneer factories under Government control or of exploitation by private enterprise. The first stage would ordinarily be carried out at Dehra Dun ; the second would be local, except perhaps in the case of pulp and tans. There is thus a clear indication of the functions of the Forest Research Institute and of those of local Utilization Circles or branches ; there is no clashing of interests but the two are interdependent.

Mr. Perrée drew attention to the fact that the recruitment of suitable men for the staffs of pioneer factories is difficult and ordinary terms of engagement are not suitable for men employed in them ; he suggested the necessity of devising terms of employment analogous to those obtaining in commercial undertakings of a similar nature, emphasized the necessity for the closest co-ordination among provinces in order to avoid over-production of certain articles, such, for example, as bobbins, and referred to the desirability of establishing subsidiary industries round main sawmills, rather than independently of them. Mention was made of the difficulty of establishing industries due to the high scale of freight charged on Indian railways, rendering it hard to compete with imported materials as the main industries in India are situated at sea ports.

The Board was informed that the creation of a Utilization Circle has already been approved, provisionally, for Burma, that a similar proposal is under consideration in the Punjab, and that a Utilization Charge had been inaugurated in Bengal. The Board desired to record its conviction that either Utilization Circles, or Charges, according to the size of the province concerned, will be found of the greatest utility in all provinces, and laid stress on the view expressed by Mr. Perrée regarding the engagement, under commercial conditions, including the payment of commission, of the staff employed in pioneer factories. Reference was made to the difficulties likely to arise if the labour employed in pioneer factories, and engaged more or less permanently, is treated as temporary establishment. Following the principle under which the engagement of labour should be dealt with in accordance with commercial practice, it was considered that the labour itself, when engaged, should be treated similarly, and the Board resolved to recommend the revision of the definition of labour ordinarily adopted.

The Board agreed as to the necessity for co-ordination and suggested that close touch should be maintained between the Utilization Officers of the various provinces by means of periodical meetings.

*VIII.—The position regarding the establishment of the sale depot in Calcutta and the agency for the sale of Indian timbers in England and Europe was explained by the Inspector-General of Forests.*

The Board did not consider it necessary to record any resolution on this subject.

*IX.—The Triennial programme of work of the Forest Research Institute for the period 1919—1922.*

The programme, as submitted by the President, Forest Research Institute and College, was considered by sub-committees consisting of Messrs. Bell, Osmaston and Trafford and Messrs. Perrée, Coventry and Cowley-Brown. The proposals of the sub-committees were then considered by the Board which finally approved of the programme given in Appendix J.

*X.—Revision of working plan headings.*

This subject was scrutinized by a sub-committee consisting of Messrs. McIntosh, Billson and Cox, which submitted draft proposals. These were discussed by the Board, who recommended that the following be adopted :—

The Working Plan shall as far as possible, or necessary, be drawn up on the following lines.

*Introduction.*

## PART I.

*Summary of facts on which the proposals are based.*

## CHAPTER I.

The tract dealt with	..	..	Name and situation. Configuration of the ground. Geology, rock and soil. Climate. Water supply. Distribution and area. State of the boundaries. Legal position. Rights and concessions.
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## CHAPTER II.

The Forest	..	..	..	Composition and condition of the crop. Injuries to which the crop is liable.
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## CHAPTER III.

Utilisation of the Produce	..	..	..	Agricultural customs and wants of the population. Markets and marketable products. Lines of export. Methods of exploitation and their cost. Past and current prices.
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## CHAPTER IV.

Staff and labour supply	..	..	..	.....
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## CHAPTER V.

Past systems of management	..	..	..	General history of the forest. Past systems of management and their results. Special works of improvement undertaken. Past yield. Past Revenue and Expenditure.
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## CHAPTER VI.

Statistics of growth and yield	..	..	..	....
(To include allotment to quality classes, mean annual increment, current annual increment, yield tables, etc.)				

## CHAPTER VII.

Estimate of Capital value of the forest..	..	..	..	....
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## PART II.

*Future management discussed and prescribed.*

## CHAPTER I.

- Basis of proposals .. .. . General objects of management and brief statement of treatment required to secure them :—
- (a) As regards the attainment of the normal forest and the establishment of normal regeneration.
  - (b) As regards the Sylvicultural requirements of the species dealt with.
  - (c) As regards the yield of timber and other forest produce.
  - (d) As regards the improvement and regulation of the water supply.
- Methods of treatment to be adopted.
- Working Circles, their area and distribution reasons for their constitution.
- Period of working plan and necessity for intermediate revision.

## CHAPTER II.

- Working Plan for — Working Circle .. . . .
- General constitution of the circle and character of the vegetation.
  - Blocks and compartments (permanent).
  - Analysis and valuations of the crop.
  - Method of treatment (exploitable size, choice of species, sylvicultural system, calculation of the rotation, division into periods, allotment to periodic Blocks, felling cycle, calculation of the yield).
  - Method of executing the felling.
  - Tabular statement of fellings to be made.
  - Subsidiary sylvicultural regulations (sowing, planting, weeding, cleaning, thinning and supplementary fellings).
  - Other regulations (grazing, protection, exercise of rights and privileges, collection and record of statistics, and control including forms, records and maps as required here or generally.

*(Chapters for all other working circles.)*

## CHAPTER.

- Miscellaneous regulations (prescribed and suggested).
- Roads and other export works.
- Improvement of water ways and water supply and methods of exploitation.
- Possible development of forest industries.
- Buildings.
- Maintenance of boundaries.
- Surveys and maintenance of maps.

## CHAPTER.

- Establishment and labour.

## CHAPTER.

- Financial Forecast and cost of plan.

## CHAPTER

## Summary of prescriptions.

Appendices . . . . . Only those appendices required for the elucidation of the plan should be printed therewith.

General prescriptions under "other regulations" including the maintenance of control forms, records and maps may be made provision for either under Chapter II or in the chapters dealing with all working circles generally.

*XI.—Forest Journals.*

A sub-committee consisting of Messrs. Rogers, Blunt and Baker dealt with this subject and drew up a note which was considered by the Board.

The Board expressed the view that in cases other than those in which the form and scope of the forest journal, or compartment register, is prescribed in working plans, the forest journal is a most valuable record the maintenance of which should be governed by the following principles. The majority of the Board held that the upkeep should be obligatory.

1. That the entries in the journals should be limited to observations made in the field, but that only references to information recorded elsewhere should be made.

2. That the units for which separate forest journals should be maintained, where not laid down in working plans, should be fixed by Chief Conservators or Conservators: also, that as it is of great importance to ensure continuity the units once fixed should not be changed without the fullest consideration.

3. That the journals should be written up by the divisional forest officer or by one of his gazetted assistants.

4. That information might suitably be indexed under the following headings subject to such alterations as may be considered necessary by the Chief Conservator or Conservator concerned:—

*A.—Growing stock.*

- (i) General.
- (ii) Natural reproduction.
- (iii) Bamboo flowering.
- (iv) Seed-years of important species.
- (v) Seasons of flowering, ripening of seed, leaf-fall and new leaf.
- (vi) Species, whether or not killed by girdling.
- (vii) Coppicing capacity of important species.

*B.—Factors influencing the crop.*

- (i) Man: Forest offences.
- (ii) Fire protection.
- (iii) Climate.
- (iv) Injurious plants, such as Lantana, Eupatorium odoratum, Strobilanthes and any other species which may become dangerous.
- (v) Other causes of injury.

*C.—Results of work done.*

- (i) Marking for regeneration fellings and the result of the operations.
- (ii) Marking for fellings other than for regeneration. (These will include fellings made for the improvement of the forest as well as those for yield purposes.)
- (iii) Climber cutting.
- (iv) Felling of ficus-bound trees.
- (v) Stream improvement.
- (vi) Notes on extraction.
- (vii) Brief reference to roads, bridges, paths, buildings, camping grounds, fences and wells.

*XII.—The number of students to be admitted to the Provincial Service course during the three years 1919-20 to 1921-22.*

The representatives of the various provinces estimated their annual requirements for this period as follows:—

Burma and the Andamans	..	..	..	..	..	..	10
Bombay	..	..	..	..	..	..	7
Punjab	..	..	..	..	..	..	1
Bihar and Orissa	..	..	..	..	..	..	2
Assam	..	..	..	..	..	..	1
Bengal	..	..	..	..	..	..	1
Kashmir	..	..	..	..	..	..	1
United Provinces	..	..	..	..	..	..	3
Madras	..	..	..	..	..	..	4
Central Provinces	..	..	..	..	..	..	1
						<b>Total</b>	<b>31</b>

Adding 9 for Native States and private students the total annual requirements will therefore probably amount to a minimum of 40. The Board considered that, in view of the certain expansion of forest work in India and Burma, this requirement might probably be relied on to be permanent and that, in any case, an effort should be made to meet the urgent demands of local Governments for forest education of this standard. On the other hand it was held to be essential that the standard of training should be maintained and that this could not be done with a class exceeding 30 in number. As, under, present conditions, it is impossible to obtain more instructors from provinces the Board decided to recommend that additional blocks of quarters should be erected at once and that the maximum limit of the class for the next three years should be fixed at 30.

*XIII.—Business office methods.*

The Board considered Mr. Gibson's paper on business office methods—Appendix K—and, after hearing an explanation from Mr. Gibson, decided that the present system was undoubtedly open to considerable improvement. Stress was laid on the necessity for the maintenance of a register of receipts and issues under present conditions, and, after further discussion, the Board decided to recommend the appointment of a small expert committee to consider the subject and to suggest an up-to-date method suited to the needs of the Department, with due regard to the question of cost, which might then be tried experimentally in one or more selected forest offices.

*XIV.—New measures for new demands in Forest Industrialism.*

Mr. Raitt, who advises Government in connection with the paper pulp industry and who was invited to attend the meeting of the Board, read a paper (Appendix L), in which he referred to the difficulties at present experienced by capitalists in starting new industries in India, due to leisurely methods of the administration in the preliminary negotiations and to the insecurity of the terms to which Government will ordinarily agree, resulting in diffidence in the investment of capital in India and leading to its transfer elsewhere. He drew attention to the difficulty of obtaining information in regard to forest products, advocated a Forest Industrial Survey and the grant of extended powers to forest officers as regards leases and contracts. He pointed out that British India does not possess a monopoly of the various forest products concerned, which can be obtained all over South Eastern Asia with equal facility.

The Board, while not agreeing with all Mr. Raitt said, decided to draw attention to the desirability of a survey of the kind suggested, and to recommend the



appointment of a small committee to consider and report on the products and localities to be first investigated and on the ways and means of carrying out the investigation.

*XV.—The expansion of the Central Research Institute.*

The project for the enlargement of the staff and buildings of the Forest Research Institute was discussed informally by the Board. It was pointed out:—

- (1) That even with the staff at present proposed quarters would be required for 20 research and educational officers of the standing of Imperial service officers, 13 assistants in branches and 2 educational assistants and that further expansion was certain.
- (2) That owing to the impossibility of obtaining private accommodation in Dehra it was essential that Government should provide these officers with quarters.
- (3) That even with the acquisition of all the small areas of suitable land contiguous to the present estate it would be impossible to provide sites for the necessary number of houses.
- (4) That the water supply of the present estate was precarious and might become still more difficult in future. Even now all drinking-water for the students and staff has to be carried by hand from the mess of the 2nd Gurkha Rifles.
- (5) That the establishment of demonstration areas and experimental gardens in connection with the present institute, though essential, is impossible.
- (6) That even with the small amount of plant now proposed the site available for workshops will be occupied to its fullest extent and there will be no possibility of expansion.
- (7) That it would be very advisable to remove the students from the vicinity of the Dehra Dun bazaar.
- (8) That at present the President's house and offices are over a mile from the Research Institute, the experimental garden 2 miles away and the hospital  $1\frac{1}{2}$  miles away, whereas it is most desirable for everything connected with the Institute to be situated in one compact block.

The Board, therefore, resolved to recommend:—

- (1) That a suitable area containing a minimum of 500 acres, and preferably up to 1,000 acres, should be acquired in the neighbourhood of Dehra Dun, sufficient to provide for all present and future requirements of the Institute. The possible transfer of the Institute to some other centre was considered, but it was held that no other situation offered equal facilities and advantages.
- (2) That after a careful lay out of the whole estate the construction of the necessary buildings should be completed with as little delay as possible; temporary buildings should be erected for the plant, workshops and other urgent requirements on the present estate, thus causing the least possible interference with the continuation of the work of the Institute.
- (3) That a committee should be appointed at once to examine sites and make proposals.
- (4) That on the completion of the new buildings the present Research Institute estate should be utilized for the decentralized ranger classes; the President's house and office, the old forest college and the house tutor's residence being disposed of by Government.

*XVI.—Symbols employed for forest maps.*

Major King of the Survey of India attended the discussion on this subject:

The Board agreed that the symbols proposed by the Trigonometrical Survey for forest maps (Appendix H) were suitable with the addition of "and Reserved lands in Madras" after "Protected Forests" in item 5 of the table B. Forest Boundaries. It was considered, too, that it was not necessary to adopt a coloured symbol for fire lines and it was suggested that information be obtained as to the most economical form of colouring and combination of colours for the reproduction of working plan maps.

## APPENDIX A.

*Opening address by the Hon'ble Sir Claude Hill, K.C.S.I., C.I.E.*

It affords me the very greatest pleasure to be here to-day and to have the opportunity—I fear the only one I shall have during my term of office—of attending a meeting of the Board of Forestry, and to make the acquaintance of such of you as represent the provinces here to-day. It is to me a great misfortune that your Board of Forestry only meets once in three years instead of, as in the case of the Board of Agriculture, every other year, for I have seen enough of these meetings to appreciate the very great value which they possess, not merely from the point of view of the results of deliberations—though these are invariably of the greatest possible value—but also in connection with the opportunity it affords to officers prominent in their provinces to exchange ideas generally with fellow members of the service serving in other provinces and those at this Institute. I have perhaps particular reasons for appreciating the value of such interchange of ideas since I come from one of the two provinces, Madras and Bombay, in which there is a greater degree of self-containment in forest operations. That greater independence is a feature which will increase and develop gradually in the other provinces in India as provincial autonomy increases, but for that very reason the value of such meetings as these is all the greater, and I feel confident that, as provincial autonomy does develop hereafter, it will be found so increasingly desirable to give opportunities for exchange of ideas and information that, instead of having your meetings once in three years, they will, as in the case of the Board of Agriculture, take place at least once every other year. It is perhaps not wholly irrelevant to this subject to refer to the great isolation which characterises so much of the life of a forest officer, and in all cases in which work is done over long periods in such circumstances there is an additional advantage in convening meetings for discussion. Isolation and concentration on a particular line of work is always apt to induce specialisation of thought and sometimes intolerance of view; not that I wish to suggest that that is characteristic of forest officers, since that is very far from being my experience; but I know from my own experience that work on special subjects in lonely conditions tends to narrowness of outlook, for which, so far as my experience goes, there is only one remedy, and that is, rubbing shoulders with others engaged in similar work. This perhaps is an additional argument in favour of more frequent consultations in regard to forest work.

While I am on this subject, I should like to give you one result of our experience in this matter in the case of agriculture. There we have found that a Board meeting even once every two years is wholly inadequate for the purpose of getting through the work of exchanging ideas, discussing developments and formulating schemes of advance. Indeed, the work three years ago before the Board of Agriculture was so heavy that we were forced into recognising that the time had come for inaugurating sectional meetings annually. These sectional meetings, which have enabled specialists in particular lines to meet and discuss their problems, have not only proved of the utmost value to research—whether mycology, entomology or chemistry—but have relieved the Board of Agriculture of no inconsiderable volume of work. I am not quite sure how far the analogy in the Forest Department holds good. It is obvious, of course, that where agricultural research in the provinces is more organised and developed than is the case with forestry, the need for such sectional meetings is more imperative, but, even in forestry, you have already silviculturists everywhere who should certainly meet as frequently as possible, and you will shortly have forest engineers in no inconsiderable number; and the development of utilisation work will, unless I am very greatly mistaken, compel you to have frequent meetings of your forest economists and utilisation officers.

Before proceeding to other matters, I should like to mark this occasion, being the first since the conclusion of hostilities, by a reference to what the Forest Department has contributed directly in manhood towards the war. 73

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Imperial Service officers and 13 Provincial Service officers were permitted to join the army or accept employment on war work of other kinds. A great many more desired to join up but this could not be permitted if the work of the Department was to be kept going, and if the supply of produce for the requirements of the Army was to be maintained. Several military decorations have been earned by our officers but we have unfortunately also to deplore the death of 8 young members of the service, namely, Messrs. Patterson, Alington, Jeffrey, Ellis, Dickson, Gwyer, Donald and Milne, all of whom, except the last two, who died of disease, were either killed in action or died of wounds. 8 Imperial officers also were wounded. And, gentlemen, if I may say so, those who remained behind in India and who have shouldered the burden of the past four years with a depleted staff and an ever-increasing demand on them for work have equally served their country well. Few people appreciate what the additional burden of work has been, whether in the Forests, Public Works or other service in this country, though we all realize the hardship that has been involved in so many cases in being debarred from the taking of leave. I can assure you, however, that the hard-work which has been done by all of you so uncomplainingly and cheerfully has been very greatly appreciated by Government.

I want now to turn for a moment to a matter which is of vital importance to the future, namely the schemes which are in hand for the enlargement and development of the Forest Research Institute. That Institute is partly concerned with educational work as well as with research. The matter was first considered at an informal meeting about a year ago in this room when we discussed the possibilities of expansion and the general needs of the situation. A Committee also discussed the matter last July and drew up a comprehensive scheme which was designed to meet not only immediate requirements but, so far as they can be foreseen, to suffice for the inevitable expansion of the future, especially in relation to research and commercial development. That scheme, which has been referred to local Governments, has not yet been elaborated to a stage when the sanction of the Government of India can be formally secured. It contemplates a considerable strengthening of the sylvicultural branch, a development and division of functions of the botanical branch, the inauguration of regional entomologists, and, under the forest chemist, the appointment of a soil chemist and a distillation expert. On the economic side, we propose to strengthen the forest economist's branch by an assistant, a wood technologist, a minor forest produce expert and experts in subjects such as pulp, tan stuffs and dyes, etc., though some of these may not be permanent appointments. As Mr. Hart will explain to you in greater detail, it is further proposed to modify the administration of the Institute by inaugurating a Council consisting of the President and the heads of branches, more or less on the lines of the organisation which we have found to work on the whole successfully at Pusa. This development we hold to be justified not only from the point of view of research, in which so much lee-way has to be made up, but also from the point of view of the educational needs of the Institute. In regard to education I am not in a position to say so much as I could wish, as things are still at the stage of deliberation, and a very great deal must depend upon what this Institute is in future to be expected to do in the way of education. As you are all aware, in future we hope to arrange to secure that Indians with the requisite qualifications will be associated in forest work in the Imperial Forest service, and I know that you will all agree with me that in this matter the Forest Service and the forest administration, which we are developing for the benefit of India at large, should be shared with Indian gentlemen of the right stamp. I do not propose here to give a dissertation upon the proposals of the Public Services Commission but it is necessary that I should say that, provided we can find Indians with the requisite qualifications willing to enter the Forest service, it is our business to arrange for their proper training. The matter presents unusual difficulties in the case of the Forest service inasmuch as Indians have hitherto for one reason or another shown no special desire to undergo a forest training, presumably because other lines of service have proved to be more attractive to them. One question of vital importance in the future will be what is

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the best arrangement for securing the training of our forest officers of the future, whether Indian or British. I think all will agree that training should take place at one place, that all should be trained together, whether it be in England or in India; and the conditions and circumstances governing such training is a matter of very great importance, regarding which a decision has not yet been reached. So long as there is a possibility of its being decided that such training should take place in India, it will be realised that the contingency is one which has to be borne in mind in reference to the organisation of the Institute here, which is the only possible place at which such training could take place outside the United Kingdom. As I have said, that matter is still under consideration. It is one of the many problems arising either directly or indirectly out of the recommendations of the Public Services Commission regarding whose recommendations, as I have said, I do not propose to detain you with any remarks today, since I know the Inspector General is going to refer to the matter.

It will be realized from what I have already said that the development of research is one of the subjects to which the Government of India attach the very highest importance. It cannot be for a moment pretended that we are in that respect adequately equipped or staffed, but it may perhaps fairly be claimed that it is only of comparatively recent years that it has been understood how important research is to forestry and to the exploitation of the enormous forest resources of India to the best possible advantage of the State. In regard to silviculture, indeed, it may be said that we have made a beginning, but, from the account which Mr. Hart will give you of the history of this Institute, I am afraid it must be admitted that it is only during the past few years that adequate recognition has been given of the need for higher research in chemistry, entomology, botany and so forth. It is because we are coming to realize the importance of this that we have been considering the urgent needs of the moment in the way of increasing our equipment and accommodation; and to those of you who are here and who have not seen it before, I would suggest that, while in Dehra Dun, you should ask to see the scheme of development which we have under consideration, since the more opinions we have on the subject and the more suggestions that are made, the more likely are we to deal adequately with it and to secure the understanding and sympathy of the department and local Governments.

I am the more anxious to make clear that in forestry we recognise the need for scientific development in that we are simultaneously taking what we hope will be considerable strides in advance in science as applied to agriculture and industry generally. I dare say many of you have read Sir Thomas Holland's Industries Commission's report and have seen the suggestions which have been made for co-ordinating research generally. We have recently been considering at Pusa the developments which should result therefrom this movement towards closer co-ordination of research and it has been recognised by the scientists working there that there is a great deal to be said for closer co-ordination of all allied scientific work, even though specialised under different heads. For example, botany, whether it is agricultural botany or forest botany, and entomology, whether forest or agricultural, must necessarily work in so closely together as to make it almost inevitable that there should be some co-ordinating directorate.

To those of us who are in a hurry, this perhaps is a misfortune. We should all like to see results quickly but I venture to believe that research officers generally will recognise, even if the public do not, that, when we are endeavouring to establish scientific development upon a really sound basis, it is perhaps better to go slow at the beginning rather than to take hasty steps in advance which may have to be retraced. Let me give you an example of what I mean. At our Agricultural Institute at Pusa, we are contemplating, as here, an advance in our botanical and mycological section. If we were looking at agriculture and agricultural botany and mycology alone, it would be easy enough to build the necessary additional laboratories and to engage the necessary additional staff and the thing would

be done; but there are factors in the case which necessarily make one pause. It has to be considered firstly, whether for those particular sciences the situation of Pusa is the best possible, or secondly, whether the desirability for co-ordinating research, say, in botany, might not make it desirable to bring agricultural and forest botany into closer contact. It is perhaps preferable to delay progress by a little to thresh out these doubts rather than to go ahead ignoring their existence.

Turning now to more practical matters, I think you will realise from what the Inspector General will shortly tell you that considerable progress has been made on the utilisation side in the last two or three years. The war has afforded us a stimulus for development of forest produce which has not been neglected and, if anything had been required to hasten the much-needed introduction into India of a staff of forest engineers, the war would have provided the stimulus. I look forward to the time when every province will have its staff of forest engineers and, as I have already said, when there will be meetings of these at frequent intervals to concert further developments. This alone, coupled with the work of a developed forest economists branch, can remove the reproach that the low return which we at present get from our forest area in India compares so unfavourably with the corresponding returns of other countries.

I did not intend to detain you for so long as I fear I have done, since I know you want to get to work and Mr. Hart has a great deal to say to you, but I did want to make it clear that the Government of India attach the very greatest importance to deliberations by the Board of Forestry and that they believe that your discussions will help them very greatly with advice and guidance in steering a course towards more efficient development.

There is one more point to which I should like to refer. I have read with interest a note by Mr. Pearson dated the 28th of February last on the dissemination of information by the Forest Research Institute. Now, as I have so often had occasion to observe before, all Governments, except possibly the more democratic governments of the antipodes, are bad advertisers, and, of all bad advertisers, the Government of India and their allied officers are the worst in the world. Whether we do good or not may perhaps be questioned, but, if we do good, it is certainly by stealth, and, in these days of political reforms and democratic developments, it is no longer permissible to hide our light, if we have any, under a bushel. Here, in this Research Institute—and of Pusa the same tale is told—the results of our investigations and research are so badly advertised that the man in the street questions whether we have any. Mr. Pearson has rightly looked at the matter from a commercial standpoint. After all, our results are intended all the time to produce commercial advantage and we are not doing the whole duty of man unless we attain a certain degree of publicity. It was therefore with very great pleasure that I approved the other day the proposal to issue periodical leaflets and to take the other steps which Mr. Pearson advocated.

**APPENDIX B.**

*Address of the Inspector General of Forests.*

Before proceeding to review the results which have followed the last meeting of the Board in 1916, I wish to express my thanks, in which I know you all join, to Sir Claude Hill, the Honourable Member in charge of the Department of Revenue and Agriculture, for the trouble he has taken in coming to open the fourth meeting of the Board of Forestry on the eve of his departure on leave and for the very interesting address to which we have just listened.

All of you are familiar with the action taken by the Government of India on the recommendations made by the last Board of Forestry and there are only two points to which I need draw your attention.

(i) We shall discuss again the question of a forest engineering branch of the service. In the meantime I am glad to be able to tell you that considerable progress has been made in dealing with this important subject. Most local Governments have recognized that men of this class are required and have asked for one or more of them. As you are probably aware the Government of India deputed Mr. Leete to study the forest engineering methods employed in America and Canada. In addition to being a senior officer of great experience, Mr. Leete has devoted great attention to matters connected with forest engineering throughout his service and so was particularly suitable to carry out this enquiry. His report, which is a very valuable one, has been received and the first portion of it is now in proof, while, as the result of one of his recommendations, the Government of India have asked the Secretary of State to engage for them two consulting forest engineers from America for a period of two years, extendable to three if desired. These consulting engineers will advise the Government of India and local Governments on forest engineering problems and will help in starting off on the right lines the dozen or so junior forest engineers who it is hoped will shortly be recruited and distributed amongst provinces after a period of special training.

(ii) In educational matters the position as regards the Provincial Service course has been much improved by the acceptance by the Government of India of the recommendation made by the last Board for the appointment of two Assistant Instructors. For this course we have now two Instructors and two Assistant Instructors, so that, with the research officers delivering short courses of lectures in their special subjects, it is now possible to maintain the standard of instruction at a high level. This is not altogether the case with the Rangers course, which for some time past has been short of one instructor, as the number of officers who have joined the army and the cessation of recruitment have made it impossible to obtain an officer for this post. The reduced staff has done its best, but there is no doubt that each of the large Ranger classes must have an Instructor and an Assistant Instructor if the teaching is to be kept up to the standard required.

In addressing the Board three years ago I referred to the question of decentralizing the training of forest Rangers and expressed the opinion that the scheme would have come into force by this time. The necessity for the curtailment of expenditure caused by the war and the uncertainty as to the arrangements for the future training of recruits for the Imperial branch of the service have prevented this. But decentralization will be introduced to some extent next year, as from 1920 Ranger students from the Central Provinces, Bihar and Orissa, and the Central India States will go to the Madras Forest College at Coimbatore. This will enable the Dehra College to

take more students from the other provinces, until the Government of Bombay can construct the proposed Forest College at Dharwar thus permitting the scheme of decentralized training to be introduced in full.

One hears from time to time, Gentlemen, whispers to the effect that the Department as a whole does not know very much of the work done by the Research Institute. I think, therefore, that it may not be out of place if I give you a short sketch of the principal work done since forest research was first commenced.

Work in the Chemical branch was started by Dr. Warth in the nineties and some ten years later a second and more serious attempt was made, though the lack of accommodation and appliances limited the scope of the work to the chemical valuation of materials submitted by various officers and departments. The provision of a laboratory and equipment in 1914 gave the Chemist an opportunity of proving the value of this branch. The demand for analytical work has steadily increased and left the relatively small staff little time for original work. Nevertheless a good deal of investigation has been carried through with the main object of demonstrating, on a commercial scale, the possibilities, or otherwise, of developing certain industries. It is possible only to mention a few of the principal investigations. These comprise tanning extracts, chiefly in relation to mangrove bark, and the distillation of turpentine from the resins of Indian pines, resulting in the introduction of the redistillation process in our present distilleries. The possibility of Pine needle oil has been fully investigated while the chemical properties of the natural varnish of *Melanorrhæa usitata* have been proved to be identical with Japanese lacquer varnish. The first researches into the manufacture of Thymol from "Ajowain" seeds were made at this Institute and have resulted in the erection of a factory in the Dún which now supplies a large part of the world's requirements. Latterly the manufacture of turpentine, rosin and gum from the gum resin of *Boswellia serrata* has been investigated and this will, it is hoped, yield important results. A very large number of other minor investigations have been carried out; their number may be gauged from the fact that 57 notes and reports have been prepared, the majority of which have been published. These results must be considered creditable in view of the small staff and the inadequate equipment at our disposal. The Zoological branch was the next to be started by the appointment in 1906 to the Forest College staff of an Entomologist for educational and research work. Although the title was later changed to that of Zoologist, in point of fact the work has practically been confined to entomology. This work may be divided into three distinct periods. The first from 1906 to 1911, when a general survey was carried out, resulting in the discovery of a large and complex fauna. Scientific research was however hampered for want of literature, equipment and authoritative identification. Much general work was taken up though little specialization was possible. Of 34 publications issued to date no fewer than 26 appeared during this first period. The second period lasted for some two years only; but in it valuable reforms were inaugurated and provision was made for the fundamental requirements of research, comprising a reference collection named by specialists, an extensive library and adequate laboratory and insectary equipment. Valuable investigations were made into the læ insect, the chir scale and the principal borers of *sal*, while an extensive collection of termites was gathered in all forest divisions; this last material is being utilized for the volume of the Fauna of India dealing with this group. The third period, which brings us to the present time, has revealed that the most productive methods of investigation lie in the consideration of the forest as a biotic association of plants and animals and in the treatment of insects from an ecological standpoint. In considering the ecological position of forest insects on broad lines it was determined (i) that Indian forests are not subject to epidemics under normal conditions but (ii) that conditions favourable for epidemics and the evolution of new primary pests may be created by the establishment of pure plantations and uniform forests. Thus the large pine bark beetle and its associates, and the 'toon' shoot and fruit borer seem to be results of artificial methods of regeneration. Pests of the natural forest such as the heartwood borers of *sal* and teak and the defoliators of this latter



species have been worked out, but such enquiries necessitate the investigation of a complex association of insects and their alternative food plants. Investigations of this kind are therefore prolonged and remedial measures are not easy of solution or application. The collection of insects has made good progress and now contains 8,000 species. The number of specimens cannot be calculated but about 12,000 are added each year of which fully half are bred in the insectary. The museum and library have expanded steadily while there are some 5,000 ledger files. Card indices have been prepared for Indian insect species, food plants, pests of trees, literature, etc.

In the Botanical section, which started with the creation of the Research Institute in 1906, the work falls under the main heads of education, systematic botany, diseases of trees, and oecology. The educational work has included the publication in 1909 by Mr. Hole of an excellent manual and the botanical work of past students indicates that the teaching has borne good fruit.

Systematic botany has had for its principal object the dissemination among forest officers and economic workers of a good knowledge of the names and economic uses of forest species, firstly by encouraging the publication of floras and descriptive lists, of which several have been issued by local officers and several more are under preparation, and secondly by identifying specimens for enquirers. For satisfactory identification work a good herbarium is essential as well as a well equipped library, and since 1906 more than 20,000 sheets have been added to our herbarium, in addition to Mr. Duthies' valuable collections incorporated in 1908. Since 1908, 4,100 specimens have been identified for forest officers and others and this work has resulted in the discovery of a number of new species, among which may be mentioned species of *Albizzia*, *Spodiopogon*, *Hopea*, *Ixora*, *Grewia*, *Eugenia* and *Tamarix*.

In dealing with diseases of trees it has been established that the *Trametes Pini* of the Blue pine is conveyed by spores alighting on wounds and can be controlled by the prevention of lopping. As regards the spike disease of sandal the Forest Botanist has suggested a line of enquiry that may give good results. In oecology the most important work comprises a long series of experiments on the factors influencing the growth of seedlings and has indicated a method of working the *sal* forests of Northern India which, it is estimated, will reduce the regeneration period by some 35 years.

The importance of soil aeration, which is now recognized in England and America as a potent factor influencing plant growth, was first brought to notice in India by the Forest Botanist.

The work, which has been carried out with the help of the Chemical Branch, has established the primary importance of this subject in the case of *sal* and probably of other important trees also and has proved that it can be controlled by suitable silvicultural treatment: it indicates, also, that the control of the root diseases of *sissu* and *sal* probably lies in the improvement of the soil conditions in the moist type of forest in which these diseases are mainly noticeable. This work, therefore, is of great importance to Indian forestry. Many valuable investigations have also been made, among which may be mentioned those regarding the various types of grass land in their relation to tree growth, the method of working grasses for paper pulp, the germination of teak seed and the seasonal coppicing of this species. For much of this work the Department is indebted to Mr. Hole who, with intervals of leave, has held the post of Forest Botanist since 1906.

When the Research Institute came into being in 1906 Sylviculture and Working Plans were constituted as separate branches. A Superintendent of Working Plans was appointed at once, but the post of Sylviculturist was held successively by the Principal and by the Superintendent of Working Plans, in addition to their own duties, with the result that little or no progress in Sylvicultural work was possible until 1910, in which year a satisfactory start was made in systematic research work. The Sylviculturist's work is partly statistical and partly experimental; in addition all available information bearing on Sylviculture and forest management is systematically classified and recorded.

and no small amount of the Sylviculturist's time is occupied in supplying officers of the Forest Department with information and advice. Since 1910 altogether 293 permanent sample plots and 74 temporary plots have been laid out and measured, many of them twice. The permanent plots, which are situated in the Punjab, the United Provinces, Bengal, Bihar and Orissa, the Central Provinces and Madras, are remeasured quinquennially: their object is to ascertain the rate of growth, volume production and intermediate yields of typical forest crops of different kinds. Experimental work is carried out in the Kaunli garden, 10 acres in extent, at Dehra Dun, while a great deal of the earlier preliminary work was located in the Surajbagh garden, afterwards abandoned in order to make room for the Research Institute buildings and grounds. Apart from garden experiments, however, there are numerous experimental plots in the forests, which are visited periodically with the view of recording observations. Regeneration fellings on a practical scale, as applied to the *sal*, are studied in the Thano forest in the Dun, which is under the management of the Research Institute. The results of Sylvicultural research must necessarily be slow in appearing, since it is frequently necessary to continue experiments for many years before definite results are obtained. Among the published work of the Sylviculturist may be mentioned a monograph on *Pinus longifolia*, notes on the Blue Gum Plantations of the Nilgiris, statistics relating to the teak forests of Burma, a note on drought in the *sal* forests of the United Provinces, a preliminary note on the working of *Dendrocalamus strictus*, as the result of experiments carried out over a series of years, and various papers on other subjects. Statistics based on sample plot measurements have been regularly published since the completion of the first quinquennial remeasurements. When last on leave in 1913 Mr. Troup, who held the post of Sylviculturist from 1909 to 1914 and to whom much of our Sylvicultural progress is due, took the opportunity of visiting a number of continental forests with the object of studying the latest developments in Sylvicultural systems. The results of this study were published in a very valuable note describing various continental systems of management and containing suggestions for improvements in forest management in India. Some of these suggestions have already been adopted in practice. It was at first the intention to produce monographs on the principal Indian trees somewhat on the lines of that on *Pinus longifolia*. This idea was afterward abandoned in favour of bringing out a complete work, in book form, dealing from a Sylvicultural point of view with all the principal trees of our Indian forests and with a number of species of secondary importance. This work, on which Mr. Troup has been engaged for some years, will be published shortly in England. It will embody the results of the Sylvicultural work of the Institute since the commencement and will certainly be of great value to all forest officers.

It has now been recognized that future progress in Sylvicultural research must depend largely on the extent to which the work can be decentralized. But for the war, with the consequent suspension of recruitment for the Imperial Forest Service and the absence of so many officers on military duty, a good deal more would have been accomplished in this direction, as local Governments are alive to the importance of this branch of research. The ideal is for local Sylviculturists to work in different provinces, with the Forest Research Institute at Dehra Dun as a central agency for co-ordinating their work, recording results and distributing information.

The first work undertaken in the Economic section was to co-ordinate and arrange all past records and information connected with forest utilization. These records, together with much valuable information collected from time to time by forest officers, were further supplemented by the records dealing with forest products which were transferred to the Research Institute on the abolition of the office of the Reporter on Economic products. A further valuable contribution of wood and minor forest product collections was taken over from the Forest College; these were rearranged and classified during 1910-1911 and have since received many additions.

The first enquiry of importance was in connection with the manufacture of matches in India. The direct result of this enquiry was the erection of a number of factories, from the working of which the many difficulties to be

surmounted when carrying out such enquiries soon became apparent. The next question examined was the antiseptic treatment of timber, dealing with the best methods of treatment and based on durability tests extending over many years. From the very nature of such an enquiry in India, where the treatment of timber is virtually unknown, definite results can only be obtained years after the initiation of the experiments. Still the work done resulted in the laying down by the United Provinces Government of an extensive plant for treating pine sleepers for the State Railways by the open tank process: this met with partial success, but had to be closed during the war, primarily for want of creosote. Since then the North-Western Railway have prepared a concrete scheme for the treatment of pine and fir sleepers in pressure cylinders and are now advertising for creosote.

About the same time as the above a complete scheme of enquiry was drawn up with the object of ascertaining the value of bamboos and grasses for the preparation of paper pulp. An expert was appointed to carry out the chemical side of the investigation, while the more likely areas were visited by the Forest Economist for the purpose of ascertaining data regarding the yield and the cost of extraction, and of selecting possible factory sites. Even, however, after the collection of what was considered to be conclusive proof that bamboos could be utilized commercially for paper pulp; no firm took steps to start the industry, and it is only during the last 12 months that anything has been accomplished. There are now at least three companies, or syndicates, taking definite steps to erect plants, and though it is not permissible to state how far they have progressed with their arrangements, it may be assumed that bamboo pulp will be on the market within the next 18 months to two years.

Among the minor industries that of pencil making was examined as early as 1909: but exhaustive experiments with a large number of timbers have shown that with the exception of Baluchistan Juniper, which is not available in commercial quantities, there is no first class pencil making wood available in India, though several timbers have been found suitable for inferior grade pencils. The pencil making industry, therefore, is at present dependent on a Juniper timber from British East Africa for first grade pencils. In 1909 an enquiry was commenced to ascertain whether paving blocks could not be introduced into India: paving blocks were laid down experimentally in Rangoon, but the results were not altogether satisfactory. In 1915 a large number of blocks were supplied free to the Calcutta Corporation and the Bombay Municipality. The Calcutta experiments failed, though it is doubtful if this failure was due to the unsuitability of the blocks, for in Bombay the authorities were so well pleased with the results that they placed an order with the Forest Department for further consignments.

Experiments were carried out in the laboratory and field to ascertain whether more up-to-date methods for distilling Rosha grass oil could not be introduced, and the results obtained were published. It is understood that a company has been granted a lease in the Central Provinces and is about to erect steam stills; this may lead to important results.

A number of investigations have been in progress with the object of finding uses for Indian timbers at present not largely on the market, and discovering timbers suitable for special purposes. Thus as far back as 1913 *Anogeissus latifolia* was introduced in the East Indian Railway workshops at Jamalpur for shafts for welding hammers, and many timbers were tested for pencils, pen holders and rulers, of which a few are at present in use. A bobbin factory, started in Calcutta, used Indian timbers only: these were found quite suitable, but the factory had to close down as no bobbin expert could be obtained in war time. Again three-ply woods were tested for a firm which has since erected an up-to-date three ply factory. Another timber has recently been tested for rifle stocks which has passed all the workshop tests and is now being given a service trial. Then again, several Indian timbers have been tested for tent poles, boot lasts, leather cutting blocks, etc., etc., and some of them have proved to be eminently satisfactory. Many similar enquiries have been in progress; but the above instances are sufficient to show the lines along which work has been proceeding.

Of recent years the three most important enquiries in progress have been in connection with :—

(i) The natural seasoning of timber, (ii) *Boswellia serrata* gum-oleo-resin and (iii) the possibility of preparing charcoal briquettes. Reports on the first two experiments have been issued and considerable attention is being paid to these subjects; the third enquiry is still in progress. A variety of other experiments have been in hand, often instigated by enquirers, and a large number of mechanical tests have been carried out on timbers, both for constructional and special purposes.

The results of the more important enquiries have been published. Forest Memoirs have been issued on *sal* timber, Indian woods and their uses and match making: Forest Records on the antiseptic treatment of timber, the seasoning of timber, bamboos for paper pulp, tea-box woods and *Boswellia serrata* gum oleo-resin: Bulletins on a variety of subjects dealing with the mechanical properties of timber, and trade notes, published as Bulletins, on 18 of the more important species of Indian timbers. A Manual on Forest Utilization and a Commercial Guide have also been issued.

Generally it may be claimed that the work of the Institute on the utilization side has stimulated an interest in Indian timbers and minor forest products, which is likely to have far reaching effects, and has clearly demonstrated that provided liberal funds are made available for plant and staff the returns will be highly remunerative. In 1906 the Economic Branch was unknown. Now enquiries are received from all parts of the world and number over 3,000 a year. The start was made by Mr. Troup, but Mr. Pearson has been in charge of the Branch since 1909, and the growth and influence exercised by the Branch are largely ascribable to the energy and ability with which he has carried on his duties.

The staff of the Institute is partly occupied with educational work and the accommodation is limited. The necessity for extension has been recognized by the Government of India for some time past and this matter was considered last July by a committee over which Sir Claude Hill presided. The scheme has not yet received the final approval of the Government of India, as, among other things, certain questions regarding the plant required have not yet been decided, while the extent to which the educational side of the Institute may require expanding depends, as in case of the Rangers course, on the arrangements for the future training of Imperial Service recruits. Still I may say that if we get what the Committee decided to recommend the Institute itself will be converted into a really fine building and the staff of Imperial research officers will consist of :—

- (i) The Sylvicultural Branch with one Sylviculturist and two Assistant Sylviculturists.
- (ii) The Botanical Branch with one Systematic Botanist, one Oecological Botanist, one Bacteriologist and one Mycologist.
- (iii) The Entomological Branch with one Entomologist at headquarters and 4 regional Entomologists.
- (iv) The Chemical Branch with a Forest Chemist, a Soil Chemist and a distillation expert.
- (v) The Economical Branch with one Forest Economist, one Assistant Forest Economist, one Wood Technologist, one Minor Forest Produce expert and experts in subjects, such as paper pulp tan stuffs and dyes, for such periods as may be required.

Each Branch will have a number of subordinate assistants, while the Economic branch will be equipped with plant sufficient for the production of commercial samples at the least. It is hoped, too, that the Heads of Branches

will receive a moderate addition to the allowance now drawn by research officers, and that the affairs of the Institute will be managed by a council consisting of the President and the Heads of Branches. With this equipment, Gentlemen, and with the assistance of local research officers in provinces, we may, I think, be certain that the Forest Research Institute will be placed in a fair way to deal with the many scientific and commercial problems which await solution in connection with the proper development of the forests in the Indian Empire. I have only one other remark to make regarding the Research Institute and that is that if it is to succeed we must have for the Branches staffed by forest officers the best and most suitable men that can be found in the service, for unless the men here command the confidence of the Department generally the Institute cannot fulfil its purpose. I trust that Local Governments and their forest advisers realize and will remember this when the new posts are sanctioned and the time comes to select officers to fill them.

Many things have happened, Gentlemen, in the last three years. As regards the sanctioned strength of the staff a moderate increase has to be recorded. On the 31st of March 1916 this was 235 Imperial Service and 233 Provincial Service officers. It is now 254 and 262 respectively, while the orders of the Secretary of State have not yet been received on one small scheme of reorganization providing for an increase of five Imperial and three Provincial officers in Bihar and Orissa and two large schemes for Burma and Bombay are likely shortly to reach the Government of India.

The financial results of the Department have again improved considerably. For the year ending the 30th June 1915 the Revenue, Expenditure and Surplus for British India as a whole, including Burma, were Rs. 2,97,00,000, Rs. 1,82,00,000 and Rs. 1,15,00,000 while for the year ending the 30th June 1918 the corresponding figures were approximately Rs. 4,22,00,000, Rs. 2,12,00,000 and Rs. 2,10,00,000. The considerable increases in the price of timber and of forest produce of all kinds, due to war conditions, are responsible to some extent for this large increase in Revenue; but though perhaps we must expect some small setback, the figures quoted are eminently satisfactory as showing the increased volume of the business transactions of the Department. It is not possible to separate accurately the amount of the revenue and surplus derived from the reserved and protected forests from that coming from the unclassed forests. But I shall not, perhaps, be very far wrong if I allot four-fifths to the former class, including the forests in the Andamans, where there are no regular reserves at all. On this assumption the gross and net figures for the year 1917-18 amount to annual returns of 7.5 annas and 3.7 annas per acre respectively for India as a whole including Burma. These figures may seem very small indeed in comparison with the returns derived from forests in Europe: but it must be remembered that vast areas of our forests in India and Burma are still unprovided with proper means of communications, that other very large areas are protection forests pure and simple, consisting of high mountain ranges, either above the limit of tree growth or so situated that they are never likely to yield utilizable produce, that other very considerable areas are mainly grazing grounds stocked with tree growth of the poorest quality, that large quantities of produce valued at approximately 85 lakhs of rupees are either given free, or sold at privileged rates to right-holders and others, and, finally, that methods of concentrated working and the use of mechanical appliances for extraction are still in their infancy. If, however, the general average is low and shows the possibility of very great improvement there are instances in India of very fine returns indeed. Thus for the 6,500 acres of the Nilambur plantation working circle in the South Malabar forest division of the Madras Presidency, the figures in the year 1917-18 were Revenue Rs. 3,51,921, Expenditure Rs. 76,389 and Surplus Rs. 2,75,532, showing a net return of Rs. 42.4 per acre per annum. Again for the whole of the forests in the United Provinces the net return per acre in the same year was 9.9 annas.

Orders on the recommendations of the Public Services Commission as regards the forest department have not yet been issued. But a great deal of work in this connection has been done both by local Governments and by the

Government of India, and it is, perhaps, permissible to say that when these questions are finally decided the officers of the Department generally may find their position as regards pay and pension considerably improved. Another result that is certain is that in future the Imperial branch of the service will contain a considerable and increasing proportion of Indian officers. Before the war very few Indian officers had entered the Imperial branch of the service. The reason for this state of affairs was not that entry to the Imperial branch of the Forest Service was in any way more difficult for Indians than to any other of the Indian services, but simply that the Indian gentlemen who went to England to complete their education had no use for the forest department and preferred services such as the Indian Civil Service, the Public Works Department and the Indian Medical Service. I think I may claim that the British officers of the service are prepared to welcome the entry of Indians of the right kind. But I think, also, that they are justified in doubting whether Indians of that kind are likely to come forward in sufficient numbers, at any rate at first: they know the present and prospective values of the vast Government estates committed to their charge; they know the necessity for the employment of really first class men if these estates are to be properly developed; and, judging by past history, they fear that the forest service is likely to obtain only the class of Indian recruit who is unable to find employment in the Imperial branches of other, and possibly more congenial, services. We must trust the Secretary of State and the Government of India to see that we do not get men who are unsuited to the work. For the rest we must extend to the Indian recruits the same welcome that we have always given to the European, and we must endeavour by precept and example to instil into them the standards of keenness and efficiency which, I am thankful to say, have always characterized the members of our service.

War conditions have prevented any rapid development of industries based on the utilization of forest produce. As mentioned previously the manufacture of paper pulp from bamboos has not yet been started, though various firms have entered into, or are likely shortly to conclude, agreements with local Governments, and it seems certain that this important industry will soon be commenced in Burma and possibly in Bengal and on the West Coast of the Bombay Presidency. The manufacture of three-ply wood for tea boxes and other purposes has been started as a going concern in Assam by Messrs. Bird and Company, and you will see samples of this material, which seems to be of excellent quality, in the Economic museum of the Institute. It appears that many of the so-called softwoods, which have hardly been utilized at all up to the present, can be employed satisfactorily for this purpose, which promises, therefore, to be of great assistance in finding a use for timbers that have hitherto been regarded as more or less worthless. Another big project now rapidly approaching the starting point is that of Messrs. Davenport and Company at Rajabhatkhawa in Northern Bengal. This project is connected with the utilization of the outturn of all woods, other than *sal*, from the large Buxa reserved forest in the Buxa division of the Bengal Circle. It will embrace plant for the manufacture of three-ply wood, for destructive distillation, for the manufacture of charcoal briquettes and for the production of tannin extracts. Among smaller undertakings I may mention the modern plant installed at Ramnagar in the United Provinces for the extraction of Cutch, and a steam distillation plant for the extraction of Rosha oil, which is about to be erected in the Nimar district of the Central Provinces. Government, too, have not been idle in this matter of commercial forest development. The resin industry in the United Provinces and the Punjab has been steadily expanded and, though it has not yet reached anything approaching its full possibility, now yields a gross revenue of over 15 lakhs of rupees. In October last a special forest circle to deal with utilization was sanctioned in the United Provinces, while, in advance of the general reorganization of the staff in Burma, the Government of India have recently agreed to the creation of a similar circle in that province. Bengal, also, has instituted a utilization charge and other provinces will, it is hoped, not be long before they follow the lead thus given them. The plant now under erection by the United Provinces Government at Bareilly consists of a large

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and up-to-date resin distillery, on the lines of the French plant previously installed by the Punjab Government at Jalloo which latter will I understand, shortly be duplicated—of a sawmill to deal with miscellaneous timbers, of a bobbin plant, of kilns for seasoning timber, and of the previously existing wood working institute, which it is intended to utilize as a centre for commercial research in timbers and for technical education. In the same province the extraction of Stockholm tar from stump wood of pine fellings has been undertaken successfully, and this promises to develop into an important industry. In Bombay a metre gauge forest railway some 20 miles in length has been built from the main Madras and Southern Mahratta Railway to Dandeli in the North Kanara division, and one new permanent sawmill and three new portable sawmills have been erected. Again a scheme has recently been sanctioned for the departmental development of forest work in the Andamans. This scheme will entail an expenditure of some 12 lakhs of rupees and will undoubtedly be remunerative.

The most satisfactory development of recent years, and the one which, in my opinion, will exercise the greatest effect on the future of forest development in India, is in Sylviculture. I refer to the now general acceptance of concentrated methods of treatment in place of the so called selection system. When this system was started very many years ago by the late Sir Dietrich Brandis it was the only treatment possible under the conditions then obtaining. But those conditions have changed greatly. The vast areas with which we have to deal, the want of communications, the sparseness of the forest population, the want of staff and the undeveloped state of the demand for many of our Indian timbers, will necessitate the maintenance of the selection system over very large areas for many years to come and will confine the introduction of more up-to-date methods of treatment to our most productive and most accessible forests. In special types of forest, such as the pure *Pinus longifolia* areas in Kumaon and Jaunsar, treatment on these lines has actually been in force for many years; but when, at the Burma Forest Conference in 1910, Mr. Troup advocated the more general application of the principle to natural mixed high forest, with special reference to the teak forests of Burma, the proposal met with a certain amount of opposition. Now, however, I am glad to say, that the majority of the officers in the service hold that it is not enough to be content with the removal of mature trees of a few of the most valuable species at long intervals, and with occasional intervening climber cuttings and more or less perfunctory improvement fellings, in the interests of such regeneration as may be able to establish itself in the struggle for existence under natural conditions, which are often far from favourable to the very species we wish to reproduce. We hold, now, that it is our business to exercise more control over nature and to make every acre of such forests as can be brought under the new methods bear to its fullest capacity crops of the species which will yield the best results under the local conditions. Many difficulties, involving much patient research into local conditions and the characters and requirements of the various species, must be surmounted before we can attain this result. But it is only by first solving the many Sylvicultural problems involved, and then by applying the results to concentrated systems of management, that we shall be able to get the full possibility out of our forests, to avail ourselves of American and Continental experience in the use of mechanical appliances for the extraction and transport of timber, and to place our less well known timbers on the markets of the world in quantities that will ensure their finding purchasers at profitable rates. On the other hand the adoption of concentrated methods of working will involve various obligations. In the first place we must be prepared to put back into the forests a fair proportion of the revenue we derive from exploitation and so secure the success of regeneration, largely by artificial measures. In the second place it will not be enough to place the timber on a line of rail, or on a seaport, in the form of logs and expect the public to buy it, and turn it to use. I do not believe there is any reason why India should import timber for any purpose whatever. On the contrary I hold that in the course of time India should be a very large exporter of timber of many kinds, instead of the best quality of teak, which, with small exceptions, forms practically all the timber that leaves India at present. But if this is to come about Government must be prepared to undertake pioneer work. Large

sawmills must be established and equipped with the most efficient and up-to-date drying kilns, so that timber is made available, seasoned and in the forms in which it can be utilized, with the least subsequent trouble to the trade. Again with the sawmills must be associated plants for wood manufactures, such as veneers, ply wood, matches, barrels, shingles, etc., etc. As Mr. Leete has pointed out in the report to which I have referred previously the relations that exist between the development of lumbering and that of the industries which depend on it for their supplies of material are intimate in Canada and the United States, for the one cannot develop without the other. This must hold good in India also, and if private initiative and capital are insufficient to deal with these matters Government must either be prepared to take them up, at any rate until the suitability of the timbers for the various uses is proved sufficiently to induce private enterprise to step in, or be content to see the development of its forests postponed indefinitely.

The position of the Forest Department in India is unique, for by far the greater part of the very extensive and really valuable forest tracts in the country are the property of Government, and so can be managed by the department in the best interests of the country. As I have shown above the present return derived from the vast forest estate is a very small one; but if on the one hand the Government of India and the local Governments are prepared to provide the necessary staff, on terms which will attract men of the class required, and to sink the necessary capital in development, and if on the other hand the officers of the department go steadily ahead with concentrated work on the right lines, the future prospects will be very bright indeed. Few, if any, of us will be here to see it: but I think we may confidently look forward to the time when the Forest Department will be one of the greatest and most important services in India and when the revenue derived from the forest estates of Government will be many times greater than it is at present.



## APPENDIX C.

27  
Proceedings of the Silvicultural Conference held at Dehra Dun between the  
21st and 26th October 1918.

This Conference was convened by the Inspector-General of Forests in his circular No. 337-109—2, dated 27th April 1918, with the object of examining in detail the methods of collecting forest statistics, and of submitting recommendations for standardizing a definite system of collecting and recording such data.

The Conference was constituted as follows :—

Mr. B. B. OSMASTON, President of the Forest Research Institute, *President*

Mr. R. S. TROUP, Assistant Inspector-General of Forests.

Mr. A. RODGER, Forest Research Officer, Burma.

Mr. R. D. RICHMOND, Deputy Conservator of Forests, Madras.

The Hon'ble J. W. BEST, Deputy Conservator of Forests, Central Provinces.

Mr. W. A. ROBERTSON, Deputy Conservator of Forests, Burma.

Mr. E. O. SHEBBEARE, Deputy Conservator of Forests, Bengal

Mr. A. N. GRIEVE, Deputy Conservator of Forests, Bihar and Orissa.

Mr. E. A. SMYTHIES, Silviculturist, United Provinces.

Mr. A. A. F. MINCHIN, Silviculturist, Madras.

Mr. H. L. WRIGHT, Deputy Conservator of Forests, Punjab.

Mr. J. V. COLLIER, Deputy Conservator of Forests, United Provinces.

Mr. S. HOWARD, Deputy Conservator of Forests, United Provinces.

Mr. J. R. P. GENT, Deputy Conservator of Forests, Bengal.

Mr. F. K. MAKINS, Deputy Conservator of Forests, Bihar and Orissa.

Mr. EDWARD MARSDEN, Silviculturist, Forest Research Institute, *Secretary*.

In opening the proceedings Mr. Osmaston emphasized the importance of laying down definite lines upon which the collection of data should proceed, and pointed out that progress in this direction would depend on the way in which the conference selected the methods which it was proposed to standardize.

### I.—ORGANIZATION OF SILVICULTURAL RESEARCH.

Before proceeding to consider in detail methods of measurement, it was found necessary to discuss the general organization of silvicultural research, and the agency by which the work should be carried out. After the matter had been debated at some length the following resolution was passed unanimously :—

(1) The Conference recognizes that silvicultural research work, both statistical and experimental, for a vast sub-continent such as India, of necessity must be decentralized. It is understood that Local Governments have in some cases appointed their own silviculturists, and in other cases propose to do so. The Conference strongly urges that in all the major provinces at any rate, the silviculturist should not be expected to carry out additional work, owing to the volume and special nature of silvicultural research. The Conference considers that only in this way will it be possible to cope adequately with the innumerable and intricate problems that await early solution, and to collect the vast amount of silvicultural data on which all further forest development in India depends.

(2) Following the lines of Resolution IV of the Board of Forestry, 1913, the Conference therefore suggests that the following proposals should be accepted :—

- (i) A silvicultural research branch should be instituted in each province. The main duties of this branch would be :—
  - (a) to carry out such silvicultural and statistical research as is of provincial importance,
  - (b) to give all possible assistance and information in the matter of research and statistics to working plans and other local officers, and to co-ordinate work with them,
  - (c) to carry out as far as possible any special silvicultural and statistical research which may be required for the general research work of India.
- (ii) All expenditure incurred by provincial branches will be paid by the provinces concerned.
- (iii) The programmes of work under (i) (a) and (b) should be prepared annually by the silvicultural branch in each province, and in order to facilitate co-ordination they should come before the association mentioned in paragraph 4, after which they should be submitted to Chief Conservators and Conservators for final sanction. The association would have no power to modify the programmes, but would point out any modifications which might prove advantageous. Programmes of work under (i) (c) would be arranged by Chief Conservators and Conservators in consultation with the President, Research Institute.
- (iv) The officers of the provincial branches should have full use of the libraries, files and other records, laboratories photographic branch and facilities at the Forest Research Institute, and should be given every opportunity and encouragement of keeping in touch with the Imperial Silviculturist and with research work in other provinces.
- (v) The results of work by the provincial branches should be promptly reported from time to time to the Imperial Silviculturist for record. Owing to the risk of fire it is desirable that all records should be duplicated.
- (vi) Chief Conservators and Conservators will arrange for the publication of results of investigations under (i) (a) and (b) in such manner as they consider most suitable. The Conference wishes to draw attention to the facilities available at Dehra Dun for publication and distribution. Results of investigations under (i) (c) will be published by the President, Research Institute, in consultation with Chief Conservators and Conservators.

(3) The Conference further recognizes that adequate co-ordination and exchange of information between province and province is essential; that this can best be done through the agency of the Forest Research Institute, and that the post and office of the Imperial Silviculturist should be in a position :—

- (a) to record the results obtained in the different provinces,
- (b) to be a central bureau of information for the different provinces,
- (c) to be able to co-ordinate the work between the different provinces when required. For this purpose he should be afforded all facilities for visiting work in progress in provinces.

(4) Finally, the conference recognizes that the decentralization of silvicultural research and the formation of provincial branches necessitates the creation of a central Silvicultural Board or Association which should meet annually to discuss research programmes, the compilation of statistics, and other relevant matters. It is considered that the creation of such a body would tend :—

- (a) to co-ordinate work between provinces,
- (b) to encourage the interchange of ideas,
- (c) to prevent errors in methods of working or in the compilation of results.

This association, whose function would be advisory, should consist of representatives in silvicultural research from each province, with the Assistant Inspector-General of Forests and the Imperial Silviculturist as members *ex officio*. At each meeting the association would elect its own chairman and secretary.

The Conference then passed a resolution to the following effect :—

The Conference recommends that silvicultural research officers should be afforded facilities for visiting Dehra Dun on first appointment and from time to time in order to acquaint themselves with the methods of carrying out research work and of recording information which have been found satisfactory.

## II.—COLLECTION AND COMPILATION OF STATISTICAL INFORMATION.

Mr. Howard then read a paper\* on the most recent method adopted in European research for compiling the records from sample plot measurements, and for preparing yield tables.

It was agreed that this method should be adopted.

The determination of quality classes was then discussed for : (A) trees of known age, (B) trees of unknown age.

For (A) trees of known age, it was decided that in the case of regular crops, the height-growth of the dominant stems referred to age was the best indicator of quality, and that for the present Baur's methods of graphic classification should be adopted. Not enough *data* have been collected to determine how many quality classes should be formed for each species throughout India; so it is desirable to collect *data* for all species when an opportunity presents itself, with the object of preparing both general and local yield tables.

For trees of known age in irregular forest, it is necessary to evolve a reliable method. Meanwhile it is suggested to take as an indicator trees which appear to have grown up under the same conditions as those obtaining in regular crops; if this is not possible, to take as a check the mean height of several trees which have reached their maximum height.

For (B) trees of unknown age, it was resolved that the problem should be worked out in each province by the silvicultural research branch, preferably by a whole-time officer owing to the pressure of work on the silviculturist and to the urgency of this special research. The result of these investigations should be put before the Association of Silviculturists.

Some suggestions as to method were made for use (i) in sample plots (ii) in forests. (i) For sample plots, plotting height increment upon height seems promising; height increment upon volume, and volume increment upon height also furnish possibilities, volume increment upon diameter is worth trial; other combinations in some cases show little distinction between qualities at certain stages, and in other cases show variations due not to quality alone. (ii) For allotting woods to existing quality-classes, the average height of several trees whose height-growth has stopped affords an indication. And height referred to diameter may be useful, at any rate in the second half of the rotation. Not infrequently the character of the undergrowth is helpful, as with bamboos in Burma.

In the discussion upon rules for laying out sample plots it was resolved that for regular forests, permanent sample plots should be established in crops which are as far as possible even-aged and fully stocked. For irregular forest, the conference recognises that the study of reproduction and of the most suitable method of treatment with the object of establishing normal density is of paramount importance. Yet owing to the enormous areas of such forest involved, it is necessary to arrange for the collection of increments statistics. It is suggested that long, narrow strips, laid out by compass and running through all the local types of forest may prove the best form of sample plot. They would yield *data* for local application.

\*Not printed in these proceedings owing to Press difficulties : to be published shortly.

For sample plots in irregular forest the minimum diameter class to be recorded should be left for local decision. Data should be recorded for calculation both of volume per unit of area as well as of the increment of individual stems.

All sample plots in regular crops should be thinned, and in irregular forest the sample plots should be subjected to the same treatment as the surrounding forest.

By taking several plots and felling all suppressed and dead stems (light thinning), it would be possible to ascertain the numbers which die naturally as crop becomes mature.

For sample plots in regular crops the following details were agreed upon :—

- (i) The minimum area of a sample plot should be normally half an acre, to be reduced only in cases of necessity.
- (ii) Measurements of girth should be abandoned, and the mean of any two diameters taken at right angles should be substituted.
- (iii) These diameter measurements should be taken at a height of 4 feet 6 inches from ground level, and when on a slope this height should be taken always on the uphill side.
- (iv) All volume-measurements should be recorded as true solid volume calculated by the  $\pi r^2$  method.
- (v) When the sample plot is on a slope exceeding 10°, its area should be reduced to its horizontally projected equivalent. For slopes of 10° or less, this reduction may be neglected.
- (vi) The forest surrounding the sample plot should be treated in the same way as the sample plot is treated for a distance beyond the boundary of the plot equal to the average height of the plot; and sample trees for a felling should be selected only from this surrounding strip or from amongst the trees felled in thinning.
- (vii) For calculating the age, the economic age should be used in preference to the actual age; when the rings at the centre are crowded so as to be indistinguishable or unreliable, the age for this portion may be estimated by drawing the curve for the later period and continuing it backwards.
- (viii) For the average diameter of the trees in a sample plot, the mean diameter of the main crop should be taken.
- (ix) The relation of diameter at half height to diameter at 4 feet 6 inches should be recorded for sample trees.
- (x) Periodic height measurements of trees which are likely to form part of the final main crop should be taken.

The question of forms for record was referred to a sub-committee who suggested that the Imperial Silviculturist should prepare a set of instructions for making and recording measurements as agreed upon by the Conference, embodying the methods and forms to be published by Mr. Howard in his note on the latest methods of European research in this direction, as suitable for adoption in India; this set of instructions with forms to be circulated to Chief Conservators and Conservators before the 1919 meeting of the Board of Forestry.

It was considered that till more reliable data are available the collection of statistics from temporary, unthinned sample plots would yield useful information for the compilation of preliminary yield tables. It was held to be especially applicable to coppice forests. It was also agreed that the establishment of permanent plots in coppice forest to ascertain the effect of various methods of tending is of great importance.

After some discussion the Conference agreed that the volume of trees should be divided into :—

- (A) Stemwood, and (B) Branchwood, and that in both cases the volume should be recorded separately for timber and small-wood. Timber is defined to be logs

Definition of timber and smallwood.

with a minimum mean diameter of 8 inches over bark at the thin end. Small wood is anything smaller than this, down to a minimum mean diameter of 2 inches over bark at the thin end. Measurements of the diameters in the centre of the sections, into which the logs are divided for accurate calculation of volume, should be made after stripping the bark in the case of timber, but over bark for smallwood.

Smallwood should be expressed in solid volume, and reducing co-efficients from stacked to solid volume should be worked out locally if required for local use. For general yield tables, stacked volumes are not wanted.

Provinces are at liberty to adopt any local standards of measurement considered suitable as apart from this generally accepted standard.

It was decided that whether a numerical standard was fixed or not, a verbal definition of the different kinds of thinning was required. And that at present a numerical standard was not practicable, but in time it might be possible. It was decided to accept the definitions of tree-classes, of methods of thinning, and of degrees of thinning proposed by Mr. Howard in his article "A Classification of Thinning and Increment Fellings" in the "Indian Forester" of February 1916, with the exception that the word "dominant" is preferred to "dominating" for his class I.

It was decided that the prescription of a standard form for collection of data for tree-analyses should be postponed till more information is available.

Form for tree-analyses.

### III.—FOREST JOURNALS.

The Conference then passed the following resolution upon the subject of Forest Journals.

Recent discussion in the "Indian Forester" and elsewhere has shown a confusion in the idea to be conveyed by the term "Forest Journal." Under this name three separate records have been confused, viz :—

- (1) Control Book,
- (2) Compartment Register,
- (3) Forest Journal.

(1) The *Control Book* is a working plan document, and records for control purposes how the prescriptions have been carried out. It is therefore maintained for working circles or felling series, which are working plan units and liable to alteration or sub-division at any revision of the working plan. The form in which the Control Book should be kept is a matter for the working plan officer.

(2) The *Compartment History*, as it is proposed to term this register, is a historical record maintained by compartments, which are permanent geographical units not liable to alteration or sub-division at working plan revisions. In the Compartment History is recorded, as far as possible in narrative form, under suitable broad subjects every operation or event likely to affect the growth or treatment of the crop in the compartment together with observations and remarks by inspecting officers. This information, which should not ordinarily be tabulated, may be recorded under subjects such as record of fellings (year, locality, area comprised, nature of felling and mode of execution, volume and character of outturn, method of disposal, revenue directly realised, expenditure). Record of works of improvement (year, locality, area treated, nature of work done, cost, revenue directly realized); notes on growing stock (year, locality, working plan description and subsequent descriptions of growing stock, notes on natural reproduction, silvicultural results of past operations such as regeneration fellings, improvement fellings, thinnings, cultural work; silvicultural operations required, seed-years, lowering of bamboos, strobilanthes, etc. Matters affecting extraction, minor produce (bamboos, resin, grass, etc.), grazing, fire, frost, pests.

Material for this Compartment History may be provided by the rangers monthly at the same time as they send in their accounts.

The object of separating the Compartment History from the Control Book is to have a handy book for reference in the forest in which the history and previous

treatment of any compartment (permanent unit) is found chronologically arranged in one place. The value of this as a means of indicating past mistakes and future lines of treatment is obvious.

When the compartment coincides with the working plan unit it may be possible to combined Control Book and Compartment History though the two records differ in principle. If necessary, the Compartment History may be maintained by groups of compartments, entries invariably being made separately for each compartment.

(3) *The Divisional Journal*.—It is proposed to substitute this term for "Forest Journal." Information of a general or special nature which cannot be recorded conveniently in office files should be tabulated and recorded in special vertical, loose-leaf files under the card-index system. Information on subjects such as the following might be thus recorded :

Artificial reproduction and nursery notes, seed-years, flowering of bamboos, experiments, areas suitable for sample-plots, climatology, damage by animals, grazing, fire, pests, elephants, saw-mills, extraction, notes on economic products, produce markets, labour, forest villages, routes, camping grounds and water-supply, tramways, roads and communications, buildings, black list of contractors, settlement notes, shikar and poachers, black list for shooting permits, correspondence with Forest Research Institute, conservators' general inspection notes, notes to successor or handing-over notes.

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## APPENDIX III.

## A CLASSIFICATION OF THINNINGS AND INCREMENT FELLINGS BY S. H. HOWARD.

At the present moment there are in the United Provinces, and probably in other provinces, various sized areas of forest which are beginning to be treated under one of the uniform methods. Thinnings, etc., are already being performed in many of the younger age-classes of these forests, and this work will no doubt increase greatly in the near future. As far as I know there is no standard classification of these operations in India, and I believe I am correct in saying there is no complete classification in tabular form in English, though Schlich's "Manual of Forestry" contains a partial one. There is no doubt that any trained forester can judge the intensity and kind of thinning required in a given area and can perform the operation, but different foresters may describe the same thinning by slightly different terms. It often renders descriptions of thinnings clearer if some standard set of terms is used. To show that this difficulty really does exist the following example is given :—

During the last two years I have had to examine a certain number of sample plots almost all instituted by trained officers, some made nearly thirty years ago, some quite recently. These plots are in pairs, the one thinned, the other unthinned. In the case of the thinned plot a "heavy thinning" was made. The term "heavy thinning" can mean at least two distinct operations, and on examination I found that at least *three* had been made under the one term "heavy thinning," viz., what I have called in this classification a "heavy ordinary thinning," a "heavy crown thinning" and a "light increment felling."

Moreover in the near future it will be necessary for Divisional Officers to explain to their subordinates the kind of operation they wish to have performed in an area, and it may simplify matters a good deal if some standard classification is at hand for them to refer to.

Most countries in Europe and most provinces in Germany have tabulated thinning in some form or other. All these classifications amount to much the same thing and I give below the one which appears to me to be the simplest and clearest. If others will criticise this scheme and suggest alterations where they think fit, it may be possible to establish a standard classification for India.

The following translations have been used :—

*Niederdurch forstung* is translated "ordinary thinning" instead of the rather cumbersome phrase "thinning in the lower storey."

*Hochdurch forstung* is translated "crown thinning" instead of "thinning in the upper storey."

*Lichtungshieb* is translated "increment felling." The literal translation "light felling" cannot be used, as "light felling" in English means something quite different to "lichtungshieb." "Felling for light" would do but is cumbersome, and as the object of this felling is simply to produce increment the term "increment felling" is used.

I have not attempted to define a thinning or an increment felling fully, only so much is inserted as is necessary to differentiate the two:

*Classification.*

The various trees on an area of evenaged high forest may be classified as—

I. *Dominating trees.*—This section includes all trees which form part of the uppermost leaf-canopy. It contains the following classes of trees :—

- (1) Healthy trees with a normal crown development and good boles
- (2) Trees with an abnormal crown development or badly shaped boles.

In this latter class are included—

- (a) trees whose crown space is crammed by neighbouring trees ;
- (b) badly shaped old advance growth ;
- (c) trees whose general development has been faulty, e.g., with double leaders, etc. ;
- (d) thin and spindly trees ;
- (e) diseased trees of all sorts ;
- (f) old seed-bearers.

II. *Dominated trees.*—This section includes all trees which do not form part of the uppermost leaf-canopy. These are—

- (3) Dominated trees, which, however, are not yet actually under the shade of their neighbours and the leading shoots of which are, therefore, still more or less free.
- (4) Suppressed trees, that is trees standing under the shade of their neighbours and with their leading shoots dominated.

(Classes 3 and 4 then may on occasions be useful for protecting the soil or helping to clean the boles of their more vigorous neighbours.)

- (5) Dead and dying trees which are of no use either for soil protection or for cleaning the boles of neighbouring trees. Small and very badly suppressed trees may also be included in class 5.

*N.B.*—Under class 2 the trees referred to under (a), (c), (d) and (e) may also occur in the dominated section. There is, however, no need to designate them separately under any class except class 2 as it is classes 3—5 which usually disappear first in the thinnings.

*Thinnings* are mostly concerned with the removal of—

- (a) dead and dying trees ;
- (b) trees which are being left behind in the struggle for existence ;
- (c) diseased trees ;
- (d) trees with poorly developed boles or crowns ;
- (e) misshapen trees ;
- (f) trees with good crowns and boles which are harming more valuable trees.

Thinnings may thus include trees falling under classes 2 to 6 either wholly or partly and, in exceptional cases, some trees of class 1.

The essential point about a thinning, however, is that *no lasting interruption of the leaf-canopy is created*.

*Increment felling*.—(Lichtungshieb) includes all trees of classes 2 to 5 even when they are vigorous and healthy and not doing damage to their neighbours, and sometimes a greater or lesser part of class 1 as well. The essential point, however, is that *a lasting interruption of the cover is created*. This interruption always lasts a long period and usually most of the remaining life of the wood. It is, therefore, usually employed when some form of soil protection wood is to be introduced either artificially or naturally, cf., Eichenlichtungsbetrieb.

#### *Thinnings.*

The following kinds and intensities of thinnings may be formed :—

#### I. Ordinary thinning (Niederdurch forstung or Eclaircie par le bas—

- (1) *Light thinning* (A grade).—This is limited to the removal of—

- (i) dead and dying trees and very badly suppressed poles ;
- (ii) diseased trees,

*i.e.*, class 5 and a few of class 2.

This thinning is of little practical use and is seldom made except for the purpose of comparative research with regard to increment.

- (2) *Moderate thinning* (B grade). This consists in the removal of—

- (i) dead, dying and much suppressed trees ;
- (ii) suppressed trees ;
- (iii) spindly trees, and branchy advance growth which it is impracticable or not desirable to prune or lop, and diseased trees.

*i.e.*, classes 5 and 4 and part of class 2.

- (3) *Heavy thinning* (C grade). This usually consists in the removal of—

- (i) all trees of classes 5 to 2.
- (ii) and some of class 1, in such a way that only good trees with nice crowns and well-shaped boles remain as nearly as possible equally distributed over the area and with room on all sides for proper crown development but *there must not be a lasting break in the leaf-canopy*.

In the executing of B and C grade thinnings the following points should be noted :—

- (a) In all cases in which holes would be created by the removal of dominating trees (probably class 2 trees), dominated and even suppressed trees (classed 4 and 3) should be left to cover the ground.
- (b) In removing *sound* trees of class 2 with badly shaped crowns or boles the operation must be made with due regard to the stocking and condition of the whole crop.



## II. Crown Thinning (Hochdurch forstung or Eclaircie par le haut).

This consists in the removal of dominating trees with the object of caring for and encouraging a certain number of specially good trees. Only two grades are distinguished.

(1) *Light*.—This consists in the removal of —

(i) dead, dying and much suppressed trees ;

(ii) badly shaped and diseased trees, stems with double leaders ;

(iii) trees, the removal of which is necessary from a group in order to make those left more or less of even size.

It, therefore, includes class 5, a large part of class 2 and some of class 1, but not classes 3 and 4, which are left to shelter the soil and help to clean the boles of the selected trees.

The removal of bad advance growth, etc., if it is likely to cause too great an interruption of the cover, can be spread over more than one operation, but such advance growth should be rendered harmless by lopping or pruning.

(2) *Heavy*.—This grade is applied in order to favour a definite number of selected stems with the object of producing large timber. It consists then in the removal of all class 5 trees and any other tree which hinders the proper development of the selected trees, *i.e.*, class 5 and some of classes 2 and 1 but *not* classes 3 and 4.

This thinning is specially suited to crops nearing the ending of the rotation.

### *Increment Fellings.*

I have already stated on previous page that the essential point of an increment felling is that it *does* create a lasting interruption of the cover. More trees are removed than in the heaviest C grade thinning, in other words, the selected trees are left more or less isolated, and classes 3 and 4 are not left to cover the soil. The soil, therefore, is not supporting as many trees as it could support and, although the increment per tree is large, there comes a stage when the reduction in the number of trees more than counterbalances the increased increment per tree. Exactly where this point is reached is certainly not known in India. Experiments were being performed in Europe but the problem was not by any means solved in 1912 and probably is not solved yet. Moreover, other points such as the quality of the wood, the value of any underwood, etc., come in. This subject is still quite in its infancy, and I only insert the classification of these increment fellings to make the table complete not because there is any likelihood of such a felling being made in the near future in India. Moreover, these grades are only experimental and the second is known to be too heavy, as it passes the stage at which the increased increment per tree is counter balanced by the decreased number of trees.

The grades are—

(1) Light.

(2) Heavy.

If the basal area of a wood excluding classes 3 and 4 is measured after a C grade ordinary thinning then the light increment felling removes 20—30 per cent. of that basal area and the heavy increment felling removes from 30—50 per cent.

I have not used the term “predominating trees” anywhere. The best of the dominated trees are sometimes designated as “predominating” but the distinction is needless as naturally whenever any dominating tree is felled the worst are taken and the best left.

# Sample Plot Calculations

BY

S. HOWARD, B.A.,

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1. The various reasons why the usual methods of measuring the volume of sample plots are inaccurate and the advantages of using the methods detailed in this paper were all given in detail at the recent silvicultural conference at Dehra Dun. As a result the conference decided that in future the method advocated in this paper should be used. The arguments in its favour are not repeated here nor are reasons given to show how the present method eliminates the various inaccuracies in the text book methods; this is simply a manual of directions as to how the calculations are to be made.

2. One point in the method is that at a re-measurement of a plot the *old* sample trees as well as the *present* ones are used to calculate the data for obtaining the volume and, as a result, the calculations made at a re-measurement contain certain additions to those made at the first measurement.

3. *At the first measurement.*—Two diameters at right angles are measured for each tree. Trees are then allotted to groups, in a mechanical manner which will be given later, and the diameter of the arithmetical mean tree of each group is found by direct calculation.

From the sample trees felled two curves are drawn showing (*a*) heights for any given diameter, (*b*) form factors for any given diameter.

From these two curves the proper height and form factor for the calculated arithmetical mean tree of each group is obtained.

By multiplying the total basal area of the group by the height of the calculated arithmetical mean tree by the form factor of the calculated arithmetical mean tree the volume of the group is obtained.

An addition of the volumes in the several groups gives the total volume of the plot.

4. *At a re-measurement.*—Two lots of sample trees are available, those felled at the re-measurement and those felled at the first measurement. Both are therefore used in constructing the two curves, *viz.*, the height curve and the form factor curve.

In order to use both lots of sample trees it is necessary to know what the sample trees felled at the first measurement would have become if they had grown on till the re-measurement. To do this requires a little calculation and the drawing of two more curves, *viz.*, the height increment curve and the diameter increment curve.

The object of this combination of sample trees is to eliminate the two most fruitful sources of error in all sample plot measurements, namely, bad selection of sample trees and the tendency in all individuals to select sample trees either always a little worse than the real sample or always a little better.

This, however, though it corrects the *re-measurement* does not affect the *first* measurement and the selection of those sample trees was equally liable to error. A simple calculation at re-measurement enables the height curve for the first measurement to be redrawn using combined sample trees. The volume of the plot at the first measurement can then be recalculated and errors corrected.

5. An example of all work done at a re-measurement will now be given and the figures explained. The work at first measurement will be obvious from this and is given in para. 36.

The work is best explained by showing how to fill up the various forms. The numbers of the forms may be changed when they are issued from the Forest Research Institute but this will cause no difficulty. All forms are given at the end of this paper.

The example actually worked out is in the metric system. The first measurement was made in 1905 and the remeasurement in 1911. This is, however, 7 years and not 6 as the first measurement was made before the end of the 1905 growing season and the remeasurement after the end of the 1911 growing season.

*Form 1.*

6. The plot is marked for thinning. Every tree standing is then measured two diameters at right angles being taken. They are written down in Form 1. Only the main crop (trees not marked for thinning) are entered under the column of the year (1911), those marked for thinning are entered in the right hand columns.

*N.B.*—The figures on this form do not form part of the example worked out—they are fictitious figures only.

In actual practice the Forest Research Institute will probably issue a field form for this and Form 1 will be filled up in office from it. Diameters are to be measured in inches and decimals of an inch (in the example worked out they are in centimetres and decimals).

*Form 2.*

7. Trees are then arranged by centimetre classes on Form 2. In India inch classes will be used. The trees are then placed in their groups. A table is given at the end showing how to allot to groups for different numbers of trees in the plot. Thus for 50 trees the first group is composed of 20 trees of the *largest* diameters and then the 30 left. For 400 trees four groups of 30 trees each are made beginning with the *largest* diameters then three groups of 60 trees each and then one group of 100 trees. Note also that as two diameters are measured for each tree 50 trees will give 100 entries on Form 2 and therefore to get 20 trees in the first group and 30 trees in the second it is necessary to take 40 diameters in the first and 60 diameters in the second and so on.

The table also gives the number of sample trees to select for each group. In selecting sample trees they should be, if possible, of roughly the diameter of the arithmetic mean of the group but *they must be of typical growth*. This is far more important than finding a tree of exactly the right diameter and so long as the diameter falls within the limits of the group that is all that really matters.

Note that in filling Form 2 the main crop is kept separate from the trees removed in thinnings. The main crop is every diameter entered under the year of measurement in Form 1. The trees removed in thinnings are those removed in 1911 and are found in the right hand columns.

Having arranged the trees by diameter classes these same trees are then arranged with their 1905 measurements, these measurements also being found on Form 1, and of course main crop and trees removed in thinning in 1911 are entered separately. These measurements also are then allotted to the same groups just made.

*For example*—In the illustration given there were in the main crop in 1911 a total of 178 diameters (*i.e.*, 89 trees). These were arranged into 3 groups two of 50 diameters each and one of 78 diameters. The 1905 measurements of these same trees were arranged likewise. As these are the same trees we can say that the first group of 50 diameters in 1905 ranged from 18 centimetres to 25 cms. diameter and that by 1911 it ranged from 20 centimetres to 27 centimetres.

If several species occur in the crop each species is treated separately;

*Reverse Form 2.*

8. From the sample trees felled in 1911 this is filled up, most of it is quite obvious but certain columns may be explained.

*Column 3.*—Naturally this can only be filled up direct for trees with annual rings.

*Column 5.*—For trees with annual rings the top of the stem is sawn off till it shows the number of rings that there are years since the last measurement, in this example seven. This length is measured and

that is the growth in height since last measurement. It should be entered in feet and decimals of a foot in India or in feet and inches as the Research Institute decide—this example is metres and decimals. For trees without rings this column must be left blank.

*Column 9.*—This basal area is looked out in a table.

*Column 10.*—This is the total stem volume. It was not measured in this example and does not affect future calculations.

*Columns 11 & 12.*—These are the measured volumes of the felled sample trees.

*Column 13.*—This is simply total height multiplied by basal area that is Column 4  $\times$  Column 9.

*Columns 14, 15 and 16.*—These are simply the form factors found in the usual way by dividing the actual measured volume by the volume of the cylinder. That is column 15 is column 11 divided by column 13.  $\frac{2675}{6374} = .420$ . In the example only total timber was taken so columns 14 and 16 are blank.

The italic figures are the averages of the sample trees and are the figures actually used for all curve drawing, etc. Consequently although a sample tree need not be of the same diameter as the calculated mean sample trees, when two or more sample trees are felled to represent a group these two should be as nearly as possible of the same diameter as each other.

*N. B.*—(i) In all back checking, which is explained later, only the total timber form factor is used that is column 15. The stem timber form factor is recorded to find out the changes in the stem itself during the life of a tree and not for the purpose of calculating the volume of the plot. In the case of very small trees the total timber form factor will be a small figure or may even be nil. In such cases naturally the larger figure, i.e. is small-wood, would be used for the back check but the method is identical. The point is that only one of the two need be used for back checks though both are recorded. The use of one automatically corrects the other.

(ii) In the case of this Form 2 the F. R. I. will issue a field form on which the actual measurements will be made. This real Form 2 will be entered up from the field form in office.

The filling of Forms 1 and 2 constitutes the whole of the field work. Every thing else can be done in head-quarters whenever there is time.

#### Form 3.

9. Two of these are needed one for calculating the 1911 volume the other for recalculating the 1905 volume. Each is dated. Main crop and the trees removed in thinnings in 1911 are kept separate in both forms and so are species.

*Form 3, 1911, Columns 1 to 7. Main Crop.*

10. *Column 1.* Copied from Form 2. *Begin with the largest diameters* and rule a thick line across the page to separate each group.

*Column 2.*—Copied from Form 2.

*Column 3.*—Filled up from a table of diameters and basal areas. Thus take the top figure 0.115 sq. metres. The basal area corresponding to a diameter of 27 centimetres is 0.0575 sq. metres. There are 2 diameters of this size so the amount filled in in column 3 is 0.115 sq. metres.

*Column 4.*—This is the number of diameters in the group that is the total of column 2.

*Column 5.*—This is the total basal area of the group, that is the addition of column 3.

*Column 6.*—This is the basal area of the arithmetical mean tree of the group, that is column 5 divided by column 4.  $\frac{2.153}{50} = 0.0416$ .

*Column 7.*—This is the diameter corresponding to a basal area of 0.0416 sq. metres and is got from a table.

11. Having got the above particulars for each separate group the total of the crop (whether main crop or trees removed in thinnings) is required.

*Columns 1, 4 and 5.*—Additions of the classes.

*Column 6.*—This is column 5 divided by column 4 and is the arithmetical mean basal area of the crop.  $\frac{4.312}{178} = 0.02422$ .

*Column 7.*—This is the diameter corresponding to a basal area of 0.02422 sq. metres and is got from a table. It is the arithmetical mean diameter of the crop.

*Form 3, 1911. Columns 1 to 7. Crop removed in thinning.*

12. This is done in exactly the same way as for the main crop.

*Form 3, 1905, Main Crop. Columns 1 to 7.*

13. Exactly the same as the 1911 main crop but using the 1905 measurements on Form 2.

*Form 3, 1905. Columns 1 to 7, Crop removed in thinning.*

14. Exactly the same method.

*Form 3, 1905. Columns 1 to 7.—Main Crop, Line c.*

15. The real main crop in 1905 was composed of the trees forming the main crop in 1911 and also the trees removed in thinning at 1911. That is everything on both sides of the 1905 Form 3. Lines *a* and *b* are the totals of what was written down as main crop and crop removed in thinnings. Line *c* is got as follows.

*Column 1.*—Is obvious.

*Column 4.*—The addition of lines *a* and *b*.  $178 + 160 = 338$ .

*Column 5.*—The addition of lines *a* and *b*.  $3'515 + 2'476 = 5'991$ .

*Column 6.*—The arithmetical mean basal area of the real 1905 main crop: Column 5 divided by column 4.  $\frac{5'991}{338} = 0'1772$  sq. metres.

*Column 7.*—The diameter corresponding to a basal area of 0'1772 sq. metres is 15'0. c.m. This is looked up in a table and represents the arithmetical mean diameter of the 1905 real main crop.

16. In order to fill in Columns 8, 9, 10, 11 and 12 of Form 3 using both the sample trees felled in 1911 and those previously felled in 1905 it is necessary first of all to find what the 1905 sample trees would have become if they had grown on till 1911. This is done on Form 4. It is, however, first necessary to draw a diameter increment curve and a height increment curve.

#### *Diameter Increment Curve.*

17. As the principal object is the calculation of the volume of the main crop naturally trees in the main crop give the proper samples, especially of diameter growth. On Form 3 the trees have been carefully kept as main crop and crop removed in thinnings. Also the trees have been arranged in groups with both 1905 and 1911 measurements that is Group 1 of the 1911 measurements is composed of the same trees as Group 1 of the 1905 measurements. The groups for the 1911 main crop have as arithmetical mean diameters 22'9, 17'9 and 12'8 (Form 3, Column 7). Turning to Form 3, 1905 main crop, it is found that these same groups had arithmetical mean diameters of 20'6, 16'1 and 11'7 (Form 3, Column 7). Substraction shows the diameter increment since 1905 and it is found that 20'6 has increased by 2'3, 16'1 by 1'8 and 11'7 by 1'1. (The figures will be found at the bottom of Form 4.)

From these figures the diameter increment curve is plotted showing the increment since 1905 for any 1905 diameter. (*See curves at the end.*)

*N. B.*—This curve and all others in the example are not quite accurate and the figures in the example are not taken from them, they were read off from more accurate curves. These, however, are near enough to show the method.

#### *Height Increment Curve.*

18. The figures in italics on the reverse of Form 2 give data for this curve. These figures in italics are the averages of the felled sample trees.

Column 8 gives the diameters in 1911 and column 5 gives the actual measured height increment since 1905.

The figures are—

22'5	diameter	has	had	a	height	increment	since	1905	of	2'3
18'2	"	"	"	"	"	"	"	"	"	2'0
14'1	"	"	"	"	"	"	"	"	"	1'9
10'3	"	"	"	"	"	"	"	"	"	1'5

From these a height increment curve can be drawn showing the height increment since 1905 of trees of any diameter in 1911. (*See curves at the end.*)

Form 4 can now be filled up.

Form 4.

19. *Column 1.*—Is obvious.  
*Column 2.*—The diameter of the 1905 sample trees, as it was in 1905, is filled in from the old Form 2 prepared in 1905.  
*Column 3.*—This is read off from the diameter increment curve. Thus a tree 19.0 diameter in 1905 would have a diameter increment of 2.1 up to 1911.  
*Column 4.*—The addition of columns 2 and 3, i.e.,  $19.0 + 2.1 = 21.1$ . This column then gives the diameter which the 1905 sample trees would have had if they had grown on till 1911.  
*Column 5.*—The height of the 1905 sample trees obtained from the old 1905 measurements.  
*Column 6.*—Column 4 gives what the present diameters of the 1905 sample trees would have become by 1911. From the height increment curve the height increment since 1905 of trees of that diameter can be read off. Thus a tree of 21.1 diameter has had a height increment of 2.2.  
*Column 7.*—This is the addition of columns 5 and 6 and shows what the height of the 1905 sample trees would have become by 1911 if they had been allowed to grow.  
*Columns 8 and 9.*—These are the total timber and small-wood form factors of the 1905 sample trees. They are either copied from the 1905 records or, if tables are available showing the change in form factors for age, they are corrected accordingly.

Form 4 thus gives the 1905 sample trees as they would have become if they had grown on till 1911. Column 4 gives their 1911 diameter, column 7 their 1911 height and columns 8 and 9 their 1911 form factors.

*Height curve 1911.*

20. In order to fill in column 8 of Form 3, 1911 it is necessary to draw a curve showing height in 1911 for any diameter in 1911. There are seven dots available as data for this curve. On the reverse of Form 2, taking the figures in italics, column 8 gives diameters in 1911 and column 4 the equivalent height. On Form 4 columns 4 and 7 also give the 1911 diameters and heights of the old sample trees brought up to date. A height curve constructed on these 7 points eliminates errors in sample tree selection at either measurement. (See curves at the end.)

*Total timber form factor and small-wood form factor curves.*

21. In the same way 7 points from a combination of both the 1905 and the 1911 sample trees are available from which total timber and small-wood form factor curves can be drawn showing the form factors for any diameter in 1911. The data are on Reverse Form 2 and Form 4. Note that only the total timber form factor curve is inserted to simplify the example. The small-wood form factor curve is done in the same way.

*Form 3, 1911, Columns 8, 9, 10, 11 and 12.*

22. *Column 8.*—The arithmetical mean diameter of the first group of the main crop is 22.9. Looking this up on the 1911 height curve the equivalent height is found to be 18.1 metres. The proper arithmetical mean height is filled in thus for all groups of both main crop and crop removed in thinnings. The roman figures on the example are the heights, the figures in italics will be explained later. *The total lines are not filled from the curves.*  
*Columns 9 and 10.*—These are filled up from the form factor curves just as column 8 was filled up from the height curve.  
*Column 11.*—This is column 5  $\times$  column 8  $\times$  column 9, e.g.,  $2.053$  (sq. metres)  $\times$   $18.1$  (metres)  $\times$   $4.76 = 17.69$  cubic metres.  
*Column 12.*—This is column 5  $\times$  column 8  $\times$  column 10.  
 23. *Columns 8, 9, 10, 11 and 12 of the total line.*  
*Columns 11 and 12,* merely the addition of the volumes of the several groups, e.g.,  $17.69 + 10.27 + 6.17 = 34.13$ .

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Column 8.—A well known formula is

$$\frac{s^1 h^1 + s^2 h^2 + \dots \text{etc.}}{S} = H$$

or in words, the sum of the products of basal area by height for each group divided by the total basal area of the crop, gives the arithmetical mean height of the crop. In order to find the total timber volume of each group it was necessary to multiply basal area by height by form factor. The addition of the results of basal area by height for each group gives the top line of the above equation. The bottom line is simply the figure already in column 5 total line so that the result H is easily obtained and column 8 filled in. *Column 8 of the total line is not filled up from the height curve but after calculating it, it can be checked by looking up the diameter 17.6 on the height curve and seeing what figure is obtained.*

Column 9.—It is well known that

$$\text{form factor} = \frac{\text{volume}}{\text{basal area} \times \text{height}}$$

$$\text{therefore column 9} = \frac{\text{Column 10}}{\text{Column 5} \times \text{Column 8}}$$

$$\text{or in figures column 9} = \frac{34.13}{4.312 \times 16.7} = 475.$$

Column 10.—This is filled in by the same method as column 9.

The same is done for the crop removed in thinnings in 1911.

24. There are then on Form 3, 1911 all the data for filling Form 5 so far as it concerns 1911 measurements and these measurements are worked out on a combination of both the 1905 sample trees and the 1911 sample trees.

Form 5 of course contains already the entries made in 1905 at the first measurement. They are the figures on Form 5 which are crossed out. These 1905 measurements, being the first, are now to be corrected by recalculation. This is being done on Form 3, 1905 which, however, is so far only complete as far as column 7 (see paragraphs 13, 14 and 15).

As the 1905 figures are not yet corrected the last four columns for 1911 could not yet be filled as they depend on the 1905 figures. The complete filling of Form 5 will be explained later.

*Form 3, 1905, Columns 8, 9, 10, 11 and 12.*

25. In order to fill column 8 a height curve is needed showing the height in 1905 for any 1905 diameter.

(i) On the height increment curve look up the height increment since 1905 for the arithmetical mean diameter of each 1911 group. Thus the arithmetical mean diameter of the first group main crop of 1911 is 22.9. Look this up on the height increment curve and it is found that that sized tree has had a height increment of 2.3 metres since 1905. The present height of this tree of 22.9 diameter is 18.1 metres so in 1905 its height was  $18.1 - 2.3 = 15.8$  metres. *These are the italic figures on Form 3, 1911, Column 8.* Thus for each group the following 1905 heights are obtained, 15.8, 14.4, 12.2, 15.4, 12.7, 10.6. The crop removed in thinning in 1911 is included because that was main crop in 1905. The italic figure for the total line of the main crop 1911 is not used for this curve; that figure will be explained later.

(ii) This tree of diameter 22.9 in 1911 had a diameter in 1905 of 20.6 (see Form 3, 1905). This is known to be correct because the trees have been all along kept in the same groups for this very purpose. So the tree of diameter 20.6 in 1905 had a height of 15.8 in 1905. Doing the same for all the groups the following points are got for the 1905 height curve:—

Diameter.	Height.
20.6	15.8
16.1	14.4
11.7	12.2
19.3	15.4
12.9	12.7
8.8	10.6

Draw this height curve (See dotted curve at the end). It may prove wrong as the method corrects errors automatically. It did actually prove wrong on these figures and the dotted 1905 height curve which the above gives will be finally rejected.

(iii) Columns 8, 9 and 11 of Form 3, 1905 can now be filled up. They should be filled up *in pencil* only as the 1905 height curve just drawn may eventually prove wrong.

Column 8.—On the 1905 height curve just drawn the arithmetical mean diameter of each group (column 7) is looked out and its corresponding height entered. Thus in this example the figures are:—

Diameter.	Height from dotted 1905 curve (just drawn).
20.6	15.8 *
16.1	14.4
11.7	12.2
19.3	15.4
12.9	12.8
8.8	10.4

Column 9.—This can be filled up from the form factor curve drawn in 1905, corrected if necessary and data are available.

Column 11.—This is simply the product of column 5 X column 8 X column 9 as explained in paragraph 22.

Columns 8, 9 and 11 of the total line.

Column 10 is the addition of the volumes of each group.

Column 8 is got by the same formula

$$\frac{s^2 h^2 + s^2 h^2 + \dots}{s} = H \text{ as explained in paragraph 23.}$$

$$\text{Column 9} = \frac{\text{column 10}}{\text{column 5} \times \text{column 8}} \text{ as explained in paragraph 23.}$$

All the above is filled in *in pencil* only and column 8 of the total line is the average height of the 1905 main crop based on a backward calculation of the height increments of the separate groups. I worked this out in pencil from the figures got from the dotted 1905 height curve and got as the average height of the 1905 crop 14.3 metres.

26. This same figure namely the average height of the 1905 main crop can be got in a different manner. If the average diameter of the main 1911 crop is taken, the height increment since 1905 for a tree of that diameter can be got from the height increment curve.

The average diameter of the main crop 1911 is in column 7 of Form 3, 1911 and is 17.6.

A diameter of 17.6 has had a height increment since 1905 of 2.0 (see height increment curve).

Its height in 1911 is 16.7 (see column 8, Form 3, 1911). Therefore its height in 1905 was  $16.7 - 2.0 = 14.7$ . These are the italic figures in column 8 of the total line Form 3, 1911.

27. Under paragraphs 25 and 26 I have got two different average heights for the same 1905 main crop one 14.3 metres and one 14.7 calculated in different ways. They cannot both be right and the error is too large. The 1905 height curve must therefore be redrawn till a position is found which gives the same average height for the 1905 main crop under both methods of calculation.

This is the curve called real 1905 height curve. (See curves at the end.)

This is not a difficult thing to do. With a little practice the proper curve can be drawn straight away once the amount of error is found as shown above.

28. The pencil figures in columns 8, 9 and 11 and also columns 10 and 12 can now be filled in ink; column 8 from this real 1905 height curve and columns 9, 10, 11 and 12 in the usual way and the total line in the usual way.

#### Form 5.

29. This form is that for entries of periodical measurements from the sample plots and is always filled up per unit of area in this example one hectare in India one acre. It contained before this 1911 measurement simply the 1905 figures which are crossed out as already stated in paragraph 24.

At this 1911 measurement two copies of Form 3 have been filled in, the one giving the 1911 calculations of volume, etc., based on both the 1905 and the 1911 sample trees, and the other giving the recalculation of the 1905 main crop volume, etc.



We have therefore now to fill in on Form 5 the 1911 measurements and also to correct the 1905 entries in the light of the recalculation.

I have only worked through the entries for the Pine but the crop also contained Spruce, which was done in exactly the same way, and on this Form 5 I have filled in both species for the sake of example.

*Entry of the 1911 measurements.*

30. All the information is found in the total lines of both main crop and crop removed in thinnings of Form 3, 1911. All through we have been working with two diameters for each tree and considering them as single trees. Consequently these entries on Form 3 are *double* the real amount in the case of number of trees, total basal area and volumes. Height, form factor, average diameter, etc., are of course unaffected by the use of double diameters. Therefore before entering the figures on Form 5 we must first divide all data which are affected by two.

But the size of the plot was, as a fact, one quarter of a hectare and as the data are wanted per hectare it means that the true figures when found must be multiplied by four. Multiplying by four and dividing by two gives a net result of multiplying by two so that in entering up on Form 5 such figures as are affected are simply doubled before entry.

Column 1.—Obvious.

Column 2.—Obvious.

Column 3.—Can be got from Reverse Form 2, from records, etc.

Column 4.—Obvious.

Column 5.—From Form 3 column 4. This figure 178 is affected by the double diameters so the real figure is  $\frac{178}{2} = 89$  trees on a quarter of a hectare or per hectare  $89 \times 4 = 356$  trees.

Column 6.—From Form 3. The average height of the group of largest trees is 18.1 and this is entered.

Column 7.—From Form 3 in the total line column 8.

Column 8.—From Form 3, column 9 the total line.

Column 9.—From Form 3, column 10 the total line.

Column 10.—From Form 3, column 1.

Column 11.—From Form 3, column 1.

Column 12.—From Form 3, column 7 the total line.

Column 13.—From Form 3, column 5 the total line. But this figure is affected by the double diameters so instead of 4.312 it is entered as 8.62.

Column 14.—Form 3, column 11 the total line. Again an affected figure and therefore 34.13 is not entered but 68.3.

Column 15.—Form 3, column 12 the total line. This is also an affected figure.

Column 16.—The addition of columns 14 and 15.

Columns 17—25.—These are filled in the same way but using the figures of the crop removed in thinnings instead of those for the main crop.

Column 26.—The addition of columns 13 and 22, e.g.,  $8.62 + 5.71 = 14.33$ .

Column 27.—The addition of columns 14 and 23, e.g.,  $68.3 + 42.4 = 110.7$ .

Columns 28—31.—These depend on the 1905 measurements and therefore cannot be filled till the 1905 figures have been corrected; the correction will be explained directly but once made these columns are filled as follows.

Column 28.—This is the amount of basal area increment put on by the crop left in 1905 grow on. Column 13 for 1905 shows what was left to go on namely 11.98. It amounted by 1911 to everything then on the ground that is both the main crop and the crop removed in thinnings in 1911. This total basal area is found in column 26 and is 14.33. Therefore column 28 =  $14.33 - 11.98 = 2.35$ .

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*Column 29.*—This is the same as column 28 but timber instead of basal area. It is column 27—column 14 =  $110 \cdot 7 - 82 \cdot 2 = 28 \cdot 5$ .

*Column 30.*—The increase in basal area during the period is in column 28 and is 2.35. The period is 7 years so the periodic mean annual increment is  $\frac{2 \cdot 35}{7} = .336$ .

*Column 31.* Exactly the same as column 30 but with the timber figures i.e.,  $\frac{28 \cdot 5}{7} = 4 \cdot 07$ .

*Correction of the 1905 entries.*

31. On form 3, 1905 all the data are available for filling in 1905 just as for 1911. The old figures actually entered in 1905 are therefore crossed out and the new ones entered.

We have, however, only recalculated the main 1905 crop so only that can be altered. The thinning having been already removed we cannot recalculate it and the original figures cannot be altered. Many of the columns cannot possibly be affected by any recalculation and the following notes show only those which could be affected.

*Column 3.*—It might be affected but it is unlikely.

*Columns 6 and 7.*—The average of the largest trees found in 1905 was 15.4 and the average of the crop 14.3. By recalculation different figures have been found namely 16.2 and 14.6 and the figures are altered accordingly.

*Column 13.*—This is not really a correction. It is only a difference of .05 in the case of the Pine. It must of course be made to agree with what is on Form 3, 1905 as recalculated but the small difference is probably due to a very slight difference in grouping or rounding off of basal area figures. It might be a larger correction if some tree had actually disappeared altogether between the measurements.

*Columns 14, 15 and 16.*—These of course will usually get corrected as their correction is the real point of the whole method. Note, however, the smallness of the correction in this case but till the calculation was made nobody could tell how large or small the correction would be and sometimes it is very large.

*Columns 17—25.*—Cannot be corrected as the trees were removed 7 years previously.

*Columns 26 and 27.*—If columns 13 and 14 have been corrected these will be affected by such correction.

*Columns 28 to 30.*—For 1905 as it was the first measurement these could not be filled up. In 1911 we were able to fill in these columns. At the next measurement, say 1916, some of the 1911 figures may get corrected and this would affect these last four columns which would then be corrected accordingly.

*Additional notes.*

32. It will be evident that the method of grouping and calculating the volume by means of form factors and heights from the sample trees felled at any given measurement is equally applicable to trees with or without annual rings.

It will also be evident that the use of the combined sample trees at a remeasurement and the back calculation necessitates a knowledge of the height increment during the years since the last measurement. In paragraph 8 it was stated that column 5 of Reverse Form 2 could only be filled direct for trees with annual rings.

For trees without rings it is suggested that at the first measurement ten trees of various diameters, representing fairly the range of diameters in the main crop, should be selected and their heights measured as accurately as possible. At the remeasurement the heights of these same trees would be remeasured and this would enable the height increment curve to be drawn.

From the main crop left at the remeasurement ten more trees would be selected to furnish the required data at the next measurement.

These ten trees should not be of ten different diameters. They should be in five pairs each pair of as nearly as possible the same diameter and the average of the pair should be used to obtain one point for the curve. This would give five points from which to draw the height increment curve and should be enough. This number ten is not laid down as a fixed number but as a minimum. It should be sufficient in most cases.

33. The table showing how to arrange the groups was drawn up by the writer, with Mr. Gent's assistance, in accordance with the wishes of the conference who preferred this to a standard grouping per unit of area, because it was pointed out that with mature light demanders in India sometimes only 50 trees or so exist per acre. Under the writer's original suggestion of grouping, which began with 40 of the largest trees per acre for the first group, this would mean in some cases only one group all of large trees.

The inaccuracy which might thus be caused could, however, be equally well avoided by selecting rather more than the normal number of sample trees for such an exceptional group and taking care that these sample trees represented fairly the range of diameters in the group. By so doing the necessity for adopting various groups for different numbers of trees would be avoided, the results would be equally accurate and the development of the various groups could be compared throughout the life of the wood—a distinct advantage.

The employment of various groups is accurate—though not more accurate than a standard grouping per unit of area—but the writer disagrees with it as unnecessary, and hopes that at the next meeting of the conference this point will be reconsidered.

There is no magic in the numbers of the groups, the only point is they should be small enough to be accurate and yet not so small that the number of groups becomes unnecessarily excessive when a large number of trees occurs in a plot.

35. As trees below 8" in diameter at breast height contain no timber (by definition) the grouping in the table applies to each type of tree separately. There comes, however, the case when some trees are over and some under 8" diameter. Thus assume that after measuring a sample plot it is found to contain 350 trees of which 200 are 8" diameter and over and 150 trees are under 8".

The two sets would be treated as follows; the 200 trees would be grouped as 30, 30, 30, 30, 80 (like a plot of 200 trees only) and the 150 as 60, 60, 30.

Please note that 150 trees in the table are grouped as 30, 30, 30, 60 but as, in this case, the 150 are simply the tail end of a plot of 350 trees, there is no need to group more accurately than the tail trees of such a plot would be grouped if all had been timber trees.

The grouping of the tail end of a plot is not very important and the above is simply a suggestion. This small point can well be left to the individual investigators.

36. From what has been written the work at a first measurement, when only the one lot of sample trees are available, is evidently as follows:—

Form 1 is filled as usual.

Form 2 is filled but naturally only contains the one set of measurements as no others are available.

Form 3 is filled for the one set of measurements only as described in paragraphs 10 to 12 for columns 1 to 7.

*Height and form factor curves* are drawn as described in paragraphs 20 and 21 but the only dots available are those got from the felled sample trees. There being no old sample trees the drawing of the diameter increment curve, height increment curve and the filling of Form 4 is impossible.

Form 3 is then completed in the usual way from the height curve and form factor curves drawn above.

All work in paragraphs 25 to 28 drops out as that only concerns back calculation which is impossible at a first measurement.

Form 5 is filled as described in paragraph 30.

**SIZES OF GROUPS FOR VARYING NUMBERS OF TREES (FOR INDIA) (SEE PARAGRAPHS 7 AND 35).**

*N.B.—Sometimes the minimum number of sample trees will not be available. In that case it should be remembered that groups of large trees are most important and a nice distribution of dots for curves.*

THE PLOT.		THE GROUPS.		Minimum number of sample trees.	THE PLOT.		THE GROUPS.		Minimum number of sample trees.		
Number of trees.	Equivalent number of diameters.	Number of trees.	Equivalent number of diameters.		Number of trees.	Equivalent number of diameters.	Number of trees.	Equivalent number of diameters.			
50	100	20	40	2	400	800	30	60	2		
		30	60	2			30	60	2		
100	200	30	60	2			30	60	2		
		30	60	2			30	60	2		
		40	80	2			60	120	3		
150	300	30	60	2			60	120	3		
		30	60	2			60	120	3		
		30	60	2			100	200	3		
		60	120	3							
200	400	30	60	2			450	900	30	60	2
		30	60	2					30	60	2
		30	60	2					30	60	2
		30	60	2	60	120			3		
		80	160	3	60	120			3		
		30	60	2	60	130			3		
250	500	30	60	2			150	300	3		
		30	60	2							
		30	60	2	500	1000	30	60	2		
		30	60	2			30	60	2		
		60	120	3			30	60	2		
70	140	3	30	60			2				
30	60	2	60	120			3				
300	600	30	60	2	60	120	3				
		30	60	2	60	120	3				
		30	60	2	60	120	3				
		30	60	2	60	120	3				
		60	120	3	200	400	3				
		60	120	3							
		60	120	3	700	1400	30	60	2		
		60	120	3			30	60	2		
30	60	2	30	60			2				
30	60	2	30	60			2				
60	120	3	60	120			3				
60	120	3	60	120			3				
60	120	3	60	120			3				
50	100	3	300	600			3				
350	700				100	200	3				



---

Form No. 2.

---

36RAD

MAIN CORP.

SPRUCE

1911 measurements.

E. LIND

1905 measurements.

1911

1905

Diameter cms.	Number in each class.	Double stem number.	Diameter cms.	Number in each class.	Double stem number.	Diameter cms.	Number in each class.	Double stem number.	Diameter cms.	Number in each class.	Double stem number.		
7	::	4	7	Group 3 78 diameters	4								
8	—	...	8			3							
9	1:	5	9			3							
10	::	3	10			3							
11	::	4	11			19							
12	☒ :: Group 3 78 diameters	14	12			25							
13	☒ ☒	19	13			9							
14	etc.	15	14			18							
15		12	15			9							
16		13	16		Group 2 50 diameters	14							
17		11	17				19						
18	Group 2 50 diameters	12	18				8						
19		7	19			12							
20		9	20			12							
21		6	21			3							
22		12	22	Group 1 50 diameters	10								
23	Group 1 50 diameters	12	23			5							
24		6	24			...							
25		5	25			2							
26		2	26			...							
27		2	27		...								
		178			178								

5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27

Group 3  
60 diameters

Group 2  
50 diameters

Group 1  
50 diameters

2  
3  
11  
8  
17  
13  
10  
10  
11  
9  
12  
10  
5  
4  
4  
6  
3  
2  
6  
5  
4  
2  
3

160

160 diameters=80 trees

5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27

Group 3  
60 diameters

Group 2  
50 diameters

Group 1  
50 diameters

1  
4  
11  
7  
19  
10  
13  
17  
13  
12  
8  
6  
6  
7  
4  
6  
7  
3  
2  
1  
2  
1  
...

160

160 diameters=80 trees



Reverse Form 2.

Sample tree No.	Species.	Age.	Total height.	Length of shoot of last 7 years.	DIAMETERS AT 1'3 METRES.			Basal area at 1'3 metres.	VOLUME MEASUREMENTS			Volume of cylinder.	FORM FACTORS.		
					At right angles.		Average		Stem.	Total timber	Smallwood.		Stem.	Total timber.	Smallwood.
					6	7	8								
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
		Years.	Metres.	Metres.			Cms.	Sq. metres.							
3	Pine	38	16.6	1.8	220	222	221	.0384	...	.2675	...	.6374	...	420	...
6	"	40	18.1	2.8	228	230	229	.0412	...	.3638	...	.7457	...	488	...
...	...	39	17.4	2.3	...	...	22.5	...	...	...	...	...	...	454	...
2	Pine	40	16.6	1.4	180	184	18.2	.0260	...	.2399	...	.4316	...	533	...
7	"	37	17.0	2.9	181	183	18.2	.0260	...	.2377	...	.4420	...	538	...
15	"	42	16.7	1.6	184	183	18.3	.0263	...	.1742	...	.4392	...	397	...
...	...	40	16.8	2.0	...	...	18.2	...	...	...	...	...	...	459	...
4	Pine	42	13.4	2.0	145	143	14.4	.0163	...	.1048	...	.2184	...	480	...
8	"	42	13.0	1.6	149	141	14.5	.0165	...	.1019	...	.2.45	...	475	...
14	"	42	15.2	2.0	132	138	13.5	.0143	...	.1007	...	.2174	...	463	...
...	...	42	13.9	1.9	...	...	14.1	...	...	...	...	...	...	473	...
1	Pine	42	13.7	1.2	105	107	10.6	.0088	...	.0346	...	.1206	...	287	...
	"	42	13.7	1.7	101	99	10.0	.0079	...	.0408	...	.1084	...	377	...
17	"	42	13.9	1.5	101	103	10.2	.0082	...	.0470	...	.1140	...	412	...
...	...	42	13.8	1.5	...	...	10.3	...	...	...	...	...	...	359	...

17 23

Form 3.

(Two diameters and double calculation throughout).

PINE

1911.

BY DIAMETER CLASSES.			BY GROUPS.		CALCULATED MEAN SAMPLE TREE.		CORRECTED MEAN.			VOLUME.	
Diameter.	Number of diameters.	Basal area.	Number of diameters.	Basal area.	Basal area.	Diameter.	Height.	FORM FACTORS.		Total timber.	Small-wood.
								Total timber.	Small-wood.		
1	2	3	4	5	6	7	8	9	10	11	12
				<i>Main Crops.</i>							
27	2	0'115									
26	2	0'106									
25	5	0'245									
24	6	0'271									
23	12	0'499									
22	12	0'456									
21	5	0'173									
20	6	0'188	50	2'053	'0416	22'9	18'1	476	...	17'69	...
20	9	0'283					$\frac{23}{158}$				
19	7	0'198									
18	12	0'305									
17	11	0'250									
16	11	0'221	50	1'257	'02514	17'9	16'4	498	...	10'27	...
16	2	0'040					$\frac{20}{144}$				
15	12	0'212									
14	15	0'231									
13	19	0'252									
12	14	0'158									
11	4	0'038									
10	3	0'024									
9	5	0'032					$\frac{122}{18}$				
7	4	0'015	78	1'002	'02184	12'8	14'0	440	...	6'17	...
7-27	...	...	178	4'312	'02422	17'6	16'7	475	...	34'13	...
							$\frac{20}{147}$				

1854

Form 3.

(Two diameters and double calculation throughout.)

1911.

BY DIAMETER CLASSES.			BY GROUPS.		CALCULATED MEAN SAMPLE TREE.		CORRECTED MEAN.			VOLUME.	
Diameter.	Number of diameters.	Basal area.	Number of diameters.	Basal area.	Basal area.	Diameter.	Height.	FORM FACTORS.		Total timber.	Small-wood.
								Total timber.	Small-wood.		
1	2	3	4	5	6	7	8	9	10	11	12
27	3	0.172									
26	2	0.106									
25	4	0.196									
24	5	0.226									
23	6	0.249									
22	2	0.076									
21	3	0.164									
20	6	0.188									
19	4	0.113									
18	4	0.102									
17	5	0.113									
16	6	0.121	50	1.766	.03532	21.2	17.6	497	...	15.45	...
16	4	0.080					$\frac{2.2}{15.4}$				
15	12	0.212									
14	9	0.139									
13	11	0.146									
12	10	0.113									
11	4	0.038	50	0.728	.01456	13.6	14.5	454	...	4.79	...
11	6	0.057					$\frac{1.8}{12.7}$				
10	13	0.102									
9	17	0.108									
8	8	0.040									
7	11	0.042									
6	3	0.008					$\frac{1.06}{1.4}$				
5	2	0.004	60	0.361	.00602	8.8	12.0	220	...	0.95	...
5-27	...	...	160	2.855	.01784	15.1	16.1	...	...	21.19	...

19-55  
Form 3.

(Two diameters and double calculation throughout.)

PINE.

1905.

BY DIAMETER CLASSES.			BY GROUPS.		CALCULATED MEAN SAMPLE TREE.		CORRECTED MEAN.			VOLUME.	
Diameter.	Number of diameters.	Basal area.	Number of diameters.	Basal area.	Basal area.	Diameter.	Height.	FORM FACTORS.		Total timber.	Small-wood.
								Total timber.	Small-wood.		
1	2	3	4	5	6	7	8	9	10	11	12
25	2	0'098									
23	5	0'208									
22	10	0'380									
21	3	0'104									
20	12	0'377									
19	12	0'340									
18	6	0'153	50	1'660	0'3320	20'6	16'2	500	...	13'45	...
18	2	0'051									
17	19	0'431									
16	14	0'281									
15	9	0'159									
14	6	0'092	50	1'014	0'2028	16'1	14'7	490	...	7'30	...
14	12	0'185									
13	9	0'119									
12	25	0'283									
11	19	0'181									
10	3	0'024									
9	3	0'019									
8	3	0'015									
7	4	0'015	78	0'841	0'0108	11'7	12'4	414	...	4'32	...
(a) 7-25			178	3'515						25'07	
(b) 5-26			160	2'476						16'02	
(c) 5-26			338	5'991	0'1772	15'0	14'6	471	...	41'09	...

20 5850

Form 3.

(Two diameters and double calculation throughout.)

PINE.

1905.

BY DIAMETER CLASSES.			BY GROUPS.		CALCULATED MEAN SAMPLE TREE.		CORRECTED MEAN.			VOLUME.	
Diameter.	Number of diameters.	Basal area.	Number of diameters	Basal area.	Basal area.	Diameter.	Height.	FORM FACTORS.		Total timber.	Small wood.
								Total timber.	Small-wood.		
1	2	3	4	5	6	7	8	9	10	11	12
				<i>Thinning.</i>							
26	1	0.053									
25	2	0.098									
24	1	0.045									
23	2	0.083									
22	3	0.114									
21	7	0.242									
20	6	0.188									
19	4	0.113									
18	7	0.178									
17	6	0.136									
16	6	0.121									
15	5	0.008	50	1.459	0.0292	19.3	15.6	500	...	11.38	...
15	3	0.053									
14	12	0.185									
13	13	0.173									
12	17	0.192									
11	5	0.048	50	0.65	0.01302	12.9	13.2	444	...	3.82	...
11	8	0.076									
10	10	0.079									
9	19	0.121									
8	7	0.035									
7	11	0.042									
6	4	0.011									
5	1	0.002	60	0.366	0.0061	8.8	10.2	220	...	0.82	...
5-26			160	2.476						16.02	

57 58  
21

**Form 4.**

Sample Tree No.	Original diameter 1905. cm.	Diameter increment. cm.	Present diameter 1911. cm.	Original height 1905. m.	Height increment. m.	Present height 1911. m.	Present Total timber form factor. del.	Present small-wood form factor. del.
1	2	3	4	5	6	7	8	9
	19'0	2'1	21'1	15'3	2'2	17'5	505	...
	15'0	1'6	16'6	13'7	2'0	15'7	416	...
	11'9	1'1	13'0	12'5	1'7	14'2	430	...

To get diameter increment curve.

PINE.

22'9	17'9	12'8
<u>20'6</u>	<u>16'1</u>	<u>11'7</u>
2'3	1'8	1'1

**Form 5.**

*Record from Periodic Measurements per unit of area (one hectare here but in India one acre).*

MEASUREMENT.		Age.	Species.	I.—MAIN CROP.											II.—CROP REMOVED IN THINNINGS.						TOTAL CROP.		INCREMENT OF FINAL CROP.							
Year.	Month.			Number of trees.	HEIGHTS.		FORM FACTORS.		DIAMETERS.			Total basal area of crop after thinning.	VOLUMES.			Number of trees.	Average height.	DIAMETERS.			VOLUMES.			Basal area.	Timber.	PERIODIC.		PERIODIC MEAN ANNUAL.		
					Average of largest trees.	Average of crop.	Timber.	Small-wood.	Min.	Max.	Average.		Total timber.	Small-wood.	Total.			Min.	Max.	Average.	Total basal area.	Timber.	Small-wood.			Total.	Basal area.	Timber.	Basal area.	Timber.
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1905	V	35	Pine	From Form 3 Col. 4.	From Form 3 Col. 8.	Form 3 Col. 8.	Form 3 Col. 9.	Form 3 Col. 10.	Form 3 Col. 1.	Form 3 Col. 1.	Form 3 Col. 7.	Form 3 Col. 5.	Form 3 Col. 11.	Form 3 Col. 12.		Form 3 Col. 4.	Form 3 Col. 8.	Form 3 Col. 1.	Form 3 Col. 1.	Form 3 Col. 7.	Form 3 Col. 5.	Form 3 Col. 11.	Form 3 Col. 12.	Cols. 13+22	Cols. 14+23	Col 26—Col 13.	Col. 27—Col. 14.			
				676	$\frac{16.2}{15.4}$	$\frac{14.6}{14.3}$	471	...	5	26	15.0	$\frac{11.98}{12.03}$	$\frac{82.2}{82.4}$	...	$\frac{82.2}{82.4}$	52	12.4	7	15	10.8	0.48	2.4	...	2.4	$\frac{12.40}{12.51}$	$\frac{84.6}{84.8}$	...	...	...	...
		38	Spruce	1,632	$\frac{17.9}{16.2}$	$\frac{12.5}{12.0}$	442	...	4	30	9.7	$\frac{11.94}{11.85}$	$\frac{66.3}{68.1}$	...	$\frac{66.3}{68.1}$	124	...	7	31	13.6	1.80	12.5	...	12.3	$\frac{12.74}{13.65}$	$\frac{78.6}{80.4}$	...	...	...	...
				2,308	...	...	...	...	4	30	11.5	$\frac{23.92}{23.88}$	$\frac{148.5}{150.5}$	...	$\frac{148.5}{150.5}$	176	...	7	31	12.9	2.28	14.7	...	14.7	$\frac{26.20}{26.15}$	$\frac{163.2}{165.2}$	...	...	...	...
1911	IX	42	Pine	356	18.1	16.7	475	...	7	27	17.6	8.62	68.3	...	68.3	320	16.1	5	27	15.1	5.71	42.4	...	42.4	14.33	110.7	2.35	28.5	336	4.07
		45	Spruce	1,372	19.2	14.4	469	...	4	36	11.5	14.15	95.4	...	95.4	260	12.0	4	19	9.4	1.81	9.1	...	9.1	15.96	104.5	4.02	38.2	574	5.46
				1,728	...	...	...	...	...	...	...	22.7	163.7	...	163.7	580	...	...	...	...	7.52	51.5	...	51.5	30.29	215.2	6.37	66.7	910	9.53

*Note on "Sample Plot Calculations."*

The reasons for the rejection of the former methods of calculation and the adoption of the methods detailed in the above pamphlet are not given in the pamphlet itself though they were gone into fully at the Sylvicultural Conference in Dehra last October.

The reasons are briefly repeated here. These will be given with reference to the former method adopted in the Forest Research Institute namely the "method of several groups" but the same arguments apply to the other methods in Schlich as well.

2. The greatest source of error in all these methods is faulty sample tree selection. Under the "method of several groups" the individual made his own groups and in almost every case these contained an awkward number of trees for subsequent multiplication (see F. R. I. groups), his groups were entirely his individual choice. He then calculated what his normal sample tree for each group should be and felled sample trees of the girth calculated. He had to find trees of the exact calculated normal sample girth and also of typical growth. Usually these could not be found and he calculated the volume of the plot by assuming that the volume of his actual felled sample tree was to the volume of his calculated sample tree as the basal area of his actual felled sample tree was to the basal area of his calculated sample tree. This assumption is of course wrong and the size of the error depends on how near the girth or diameter of the actual felled sample tree is to the girth of the calculated sample tree. A small difference introduced a small error, a large difference a larger error but always an error.

3. The faults then of the method of several groups are—

- (i) awkward numbers for the groups and consequently tediousness and a greater possibility of arithmetical errors;
- (ii) everything depended on the "individual," and personality should be as far as possible eliminated from scientific investigations;
- (iii) there were too many conditions to be fulfilled by the sample tree felled namely *exact* calculated girth and absolutely typical growth.
- (iv) if the *exact* tree could not be found the further calculation rested on an erroneous assumption. This therefore limited the available sample trees and usually ended in the girth condition being fairly closely fulfilled but in partial neglect of the far more important condition of typical growth.

4. The result of the above faults is that in plots calculated in that way it is frequently found at a remeasurement that one measurement must have been wrong. This has actually happened in the case of plots in the Forest Research Institute and must almost always happen under the above methods of calculation.

For one case, however, where there is some obvious discrepancy there are many where discrepancy exists but is not obvious—these latter cases are naturally more dangerous than the former.

5. The method in "sample plot calculations" eliminates most of the above errors.

- (i) the groups are fixed and not at the will of the individual the numbers are such as render calculation far quicker,
- (ii) the sample trees for the groups are calculated but the felled sample trees are picked out with reference to their typical growth only. Naturally they should be as near as possible to the calculated sample tree diameter but it is not as essential in this method as it was in the former. This allows of a larger number of possible sample trees to select from.



- (iii) from the felled sample trees the form factor and height are calculated and curves drawn showing each of these for any given diameter. The form factor and height of the calculated sample trees are then read off from these.

Thus here there is no erroneous assumption of the relation between basal area and volume and that error is eliminated.

- (iv) the measurement volume of the felled sample trees is broken up into its component parts of diameter, form factor and height because form factors for whole crops are extremely constant over long periods (see any quality of any recognised yield table for any species Volume III Schlich). This means that practically speaking the investigator has to look for one point namely typical height growth.
- (v) Two diameters at right angles are measured and not the girth. This gives much greater accuracy.

6. As regards ease of calculation. The field work is practically the same under both methods but the advantage is with the method advocated in "sample plot calculations" as diameters are more quickly measured than girths, more sample trees are available to choose from making their selection easier and consequently quicker, the investigator is only materially concerned with one point and therefore selects more easily and quickly. When it comes to calculation this method again gains slightly. Most of the work is identical under both methods but the numbers are easier in the method proposed.

7. Although the method eliminates many of the errors which existed under the method of several groups it still does not entirely do away with the errors of sample tree selection.

8. In order to reduce this still further the calculations at a remeasurement are all made with reference to *both* lots of sample trees namely those felled at first measurement and those felled at the remeasurement. The apparent complications in the method are all connected with this point.

These complications are more apparent than real but the gain in accuracy is very great. It may be thought that this combination only *distributes* the error in sample tree selection and does not eliminate it. Even this would be an advantage over the old method but this method actually eliminates the errors and corrects the calculations, it does not merely distribute. A careful study of the figures and curves will show this.

9. By this "backward reckoning" the idiosyncracies of the individual are done away with as far as is possible.

10. Under the old methods of calculation it has been repeatedly asserted that proper yield tables cannot be produced till the plots have been under observation for a long period, usually put 15 to 20 years.

Under this method the writer will guarantee to give approximate yield tables for kail, chir, deodar and teak (if regular crops exist) a year after the first remeasurement. These would be something far better than anything at present in existence in India as far as the writer knows and at any rate would be very useful to Working Plan Officers.

A year after the second remeasurement good yield tables could be produced and sal could be included in the above list and probably other species.

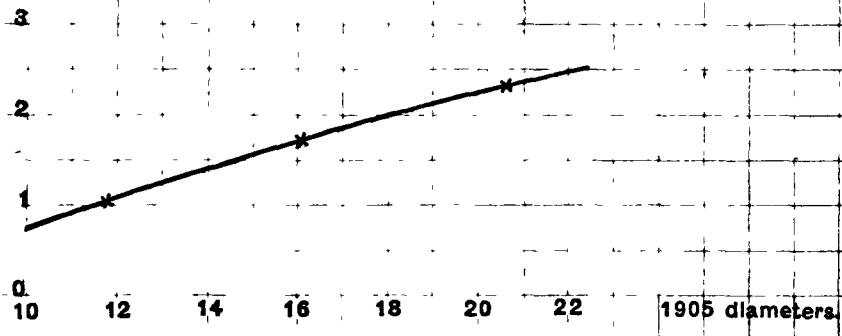
How this could be done is not detailed in the pamphlet as it is really a matter of experience with the method but any one working with this method should easily gain this experience for himself in a year or two.

11. The methods in Schlich are accurate enough for measuring the volume of large areas of whole woods, though neither as quick nor as accurate as the method here detailed, but for yield tables where the data are given per acre the greatest possible accuracy is needed otherwise when any other error in the figures per acre is multiplied by the area of a division of 300,000 acres the error introduced thereby would be enormous.

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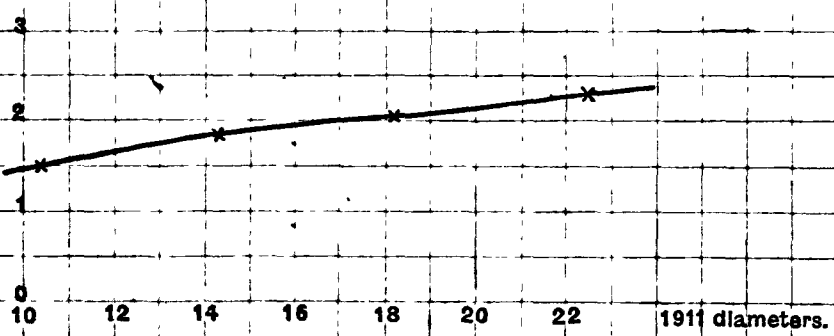
DIAMETER INCREMENT CURVE.

Diameter Increment 1905-1911.



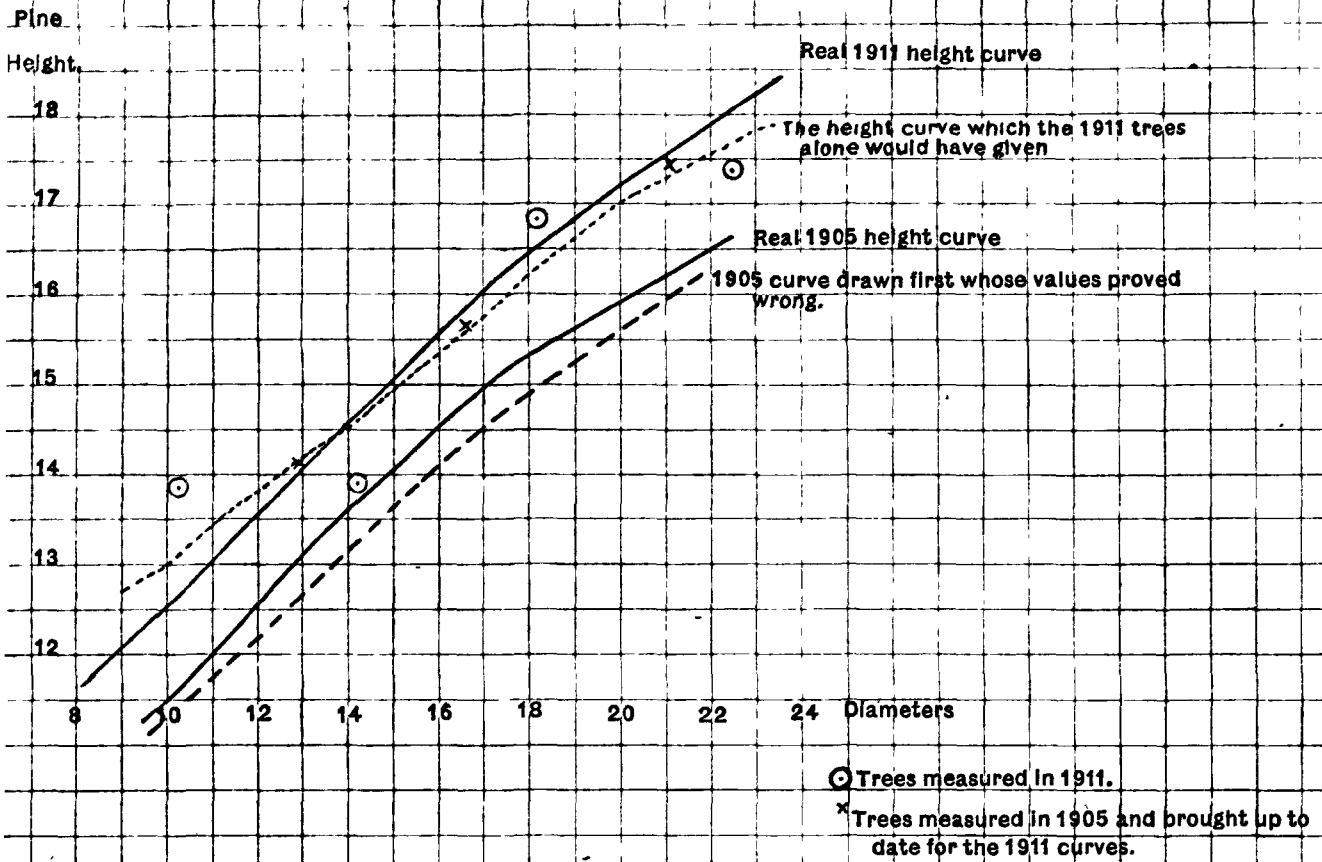
HEIGHT INCREMENT CURVE.

Height Increment 1905-1911.

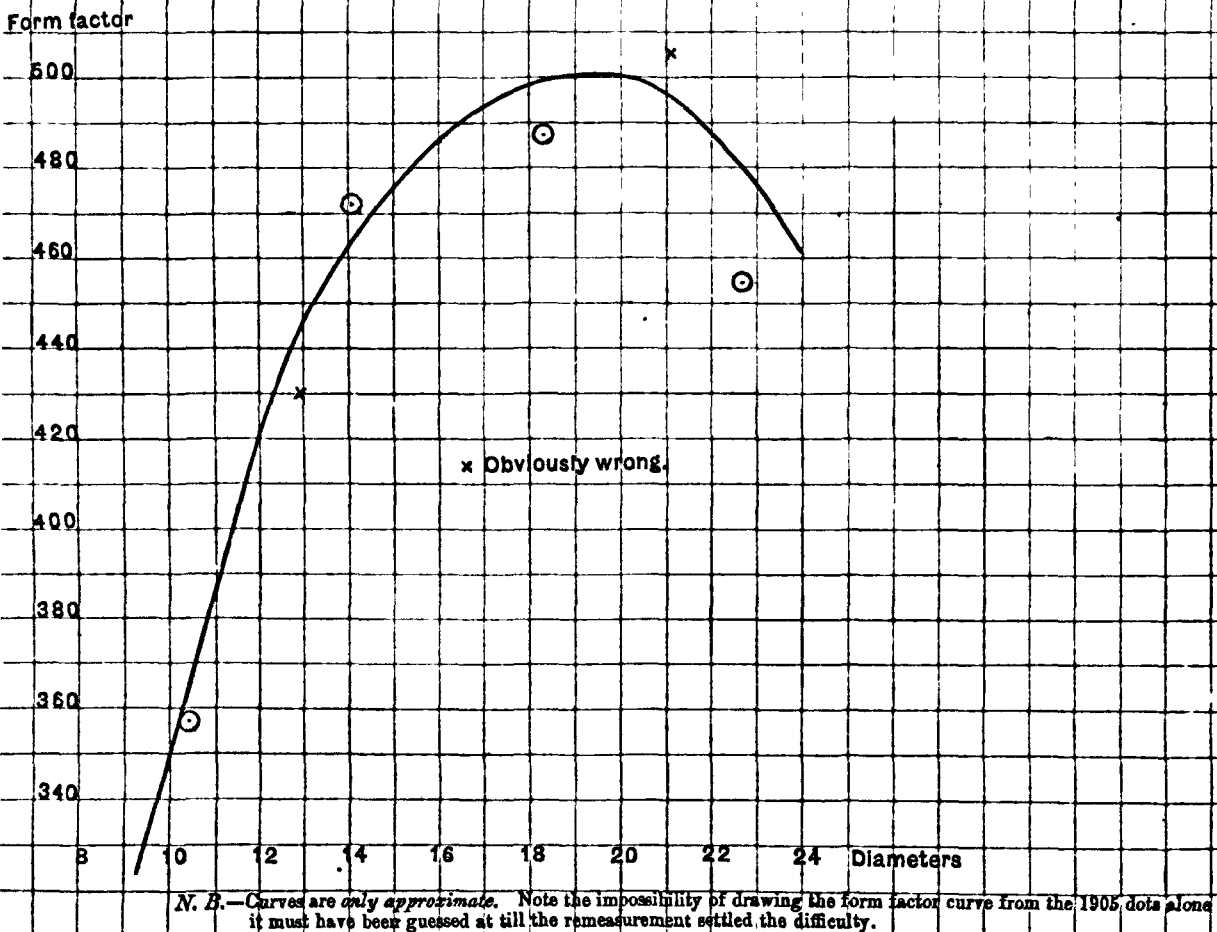


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BACKWARD RECKONING. HEIGHT CURVES.



FORM FACTOR CURVE.



## APPENDIX D.

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## Suggestions for future Forest Colleges.

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As the number of Forest Colleges throughout the Indian Empire is likely to be considerably increased in the near future some suggestions and reflections on their organisation and administration may perhaps be regarded as relevant at the present juncture.

2. It would seem fitting that the term College be reserved for institutions designed for the production of trained Extra Assistant Conservators or Rangers, while those intended for the instruction of future Deputy Rangers or men of lower grade might be denominated Forest Schools. Similarly the designations, President, Principal and Director might be held to connote the head of a Research Institute, Forest College, and Forest School respectively. By custom these terms already prevail, but for the sake of uniformity it might be perhaps desirable to fix them by official accord.

3. My suggestions in this memorandum refer mainly to Forest Colleges.

4. Every Forest College should be under a Board of Control or Board of Visitors, the President of whom should be the Head of the Forest Department in the Province or Provinces—preferably a Chief Conservator. Not less than three Conservators besides the President should have seats on the Board. The admission of officers from other Departments seems hardly called for. It is less easy to arrive at a decision as to whether the Principal should or should not be a member of the Board. I incline to the view that he should have this privilege—but would couple with it the proviso that he should be of such seniority and repute as would bring him within 4 years of a Conservatorship. Incidentally I would lay down that the Presidentship of a Provincial Research Institute should always be held by a Conservator.

5. The Board of Visitors should meet at least once a year—perhaps more frequently during the first few years of the College's existence—to discuss such issues or problems of administration as are considered to be beyond the scope of the Principal alone.\* The Board would also exercise a general supervision over the Final Examinations† and would award the certificates and prizes on the recommendation of the Principal. The individual members of the Board should not intervene directly with the management of the College, which should be vested in the Principal under the control of the President of the Board. The President—but not the members—should also have the right to inspect and visit the College at any time, the members—and *a fortiori* the President—should be entitled to examine the work of the College while touring in their circles.

6. The Staff must be regarded as a Corps d'Elite and should be in receipt of such special allowances as will make the appointments sought after by the Officers best suited for the purpose. It must be remembered that deputation to the College is not likely to be popular at first. An Instructor has to forego to a great extent the independence to which he has been accustomed, and to place himself entirely under the orders of the Principal. His working hours, his touring periods and his leisure are rigidly fixed by rule and time table, and punctuality must be the key note of his routine. On the other hand *approved service at the College ought to be recognised as giving a claim for accelerated promotion*. The emoluments of the Principal should be on a scale sufficient to induce him to waive his title to *acting* promotion as Conservator.

7. I would put the allowances at the following rates:—Principal Rs. 150 per mensem plus a free house and Conservator's Travelling allowance; Imperial Instructors Rs. 100 per mensem and travelling allowance at 25 per cent above that of their rank; Provincial Instructors Rs. 75 per mensem, travelling allowance 25 per cent above that of their rank. All officers of the College should be allowed free shooting while on tour.

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\*The resolutions of the Board should be read out before the meeting breaks up.

†Preside at the orals, at which the Instructors concerned should also be present.

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The House Tutor should also be given a free house. His duties will be multifarious and to a great extent indefinable. He will have to visit daily the latrines, menials, quarters and Hostels—the latter often at night also. He will be the channel of communication between the students and Principal, and his finger should be always on the pulse of the former—and perhaps of the latter too. His vigilance must be unceasing, his tact unfailing, and his responsibility unending. Only an exceptional member of the Provincial Service can do justice to the position, and such a man is well worth a free house.

8. Officers should be deputed to the Staff for not less than 4 years, *i. e.*, two complete sessions. An Instructor can thus carry his subject through the whole course for two complete sets of students—taking each set as Juniors in the first year and as Seniors in the second year. Every Instructor should be required to fit himself to teach on an emergency at least one other subject besides those allotted to him. Future members of the Staff should be warned of their prospective appointment not less than six months in advance.

During the 1st year an Instructor is learning his job and the forests in which he has to conduct the students. In the 2nd year his utility is greatly increased: in the 3rd and 4th years he should be invaluable.

9. The numbers of the Staff would of course depend on those of the students, and the latter should be equal to the needs of the Province *plus those of the adjacent Native States*. For it is of special importance to train up a body of Rangers to administer the forests of States that march with the borders of the Province. To permit the continuance of ill-managed, badly protected, and devastated forests along the borders of the scientifically organised reserves of British Territory, without an effort to remedy the former, is almost analogous to allowing unchecked a healthy body of men to be surrounded by or to remain in close communication with an infected and contaminated community. Every Native State [and Ceylon] should have the opportunity of training a proportion of its men at the nearest Forest College.

Private students should also if possible be provided for and appointed direct by the Principal. They will work at least not less industriously than the Government and State students, and will form a valuable recruiting ground for additional trained Rangers when opportunities for employment present themselves. Such students after having satisfied the age, health, educational, and conduct tests should be attached for six months to selected *healthy* Ranges for six months preliminary training before joining the College.

The number of students of all classes to be trained annually at each Provincial Forest College will under these circumstances probably be not less than 30 or 35. The latter number should not usually be exceeded for while it is possible to do justice in the Lecture room to perhaps 40 students, in the Field 35 is the extreme limit of the personal influence of the Sylvicultural, the Botanical, or the Engineering Demonstrator.

If 35 students are taken it is probable, judging from the average experience at the Madras Forest College, that the numbers will be reduced to 30 by eliminations within the first six months.

10. Assuming that the course is two years—and it should be longer rather than shorter—the staff of the College for 70 students might consist of the Principal, two Imperial Instructors, two Provincial Instructors. Mr. K. Venkataramana Iyer, Extra Deputy Conservator suggests that the Provincial Instructors should always have held charge of a Division previously to joining the College staff. This very desirable prescription should apply to the Imperial Staff, also. A Museum Curator might if necessary lecture on Science and other minor subjects. A subordinate Medical Officer may, and a Havildar also will, be required for each "Year" *i. e.*, batch of students annually admitted.

11. The Principal will be so fully occupied with the thousand and one petty problems of administration of almost hourly occurrence, *the solution of each of which will form a precedent for years to come*, that he probably will not have time to lecture regularly. He should occasionally give short courses on definite subjects, *e. g.*, the influence of Forestry on Agriculture, Fire Protection on the payment-by-results system, Control of Jungle Tribes, etc.

For the first year with only one batch of students, 2 Instructors, and a small Establishment to deal with the Principal might be able to lecture in silviculture—but not afterwards.

With a full College of say 70 students, 4 Instructors and say 60 Government and private servants and Establishment, not only will the Principal not have time for lecturing, but by doing so he will lose status, limit his scope and perspective, and deaden his initiative.

On tour he should make a point of meeting the Students daily if possible during Excursions. Both at Headquarters and on tour he should either frequently or occasionally be present at lectures; to enable him to afford direction and guidance to the Instructors privately when required *e. g.*, any tendency towards dictation of lectures should be checked.

One of his functions will be the inception and annual maintenance of the History of the College—an important and by no means difficult task if undertaken in the first year, but delayed for too long the record is bound to suffer in accuracy and thoroughness. The History should be printed.

The Principal will also have to prepare a College Calendar and to compile the Principal's Standing Orders. The former will comprise details of the Constitution, control Studies, Standards, Prizes, Qualifications and Rules of Admission, and general disciplinary regulations. Lists of past students and Prize winners, samples of Examination papers, and a detailed syllabus of the course should form appendices. The Principal's Standing Orders (printed in book form) should be divided into two portions. Part I dealing in full detail with the internal discipline of the College: while Part II should clearly state the position, responsibilities, duties, and scope of each member of the staff from the Officer in charge of a Division camp down to Clerks and Havildars. The students' Edition should contain Part I only, in which will be included the Headquarters Time Table and the allocation of each subject's marks to the various Periodical Examinations and Tours throughout the course. As a general principle everything possible connected with the College should be printed. It is the only safeguard for the permanency of a record.

The Principal should be entrusted with the power of sanctioning printing charges at the local Press.

The College bounds should be clearly defined and should always exclude, for all students the office and Store-keeper's room:—the stores on cash payment being issued through a guichet.

An annual allotment for the purchase of library books should be entrusted to the Principal.

The College will tend more and more to become the depository of the Forest History and Records of the Province. Efforts should be made to collect old Lists, Codes, Manuals, Maps, etc. Thirty years hence they will prove of great interest.

12. A considerable proportion of the Principal's spare time should be devoted to the investigation or scrutiny of any research problems presented to him. Although perhaps not recognised officially as such each College will in effect form the nucleus of an eventual Research Institute for the Province. In this matter the Curator of the Museum should be of great assistance. He should maintain a comprehensive Ledger of information—the embryo of future Forest Bulletins. An Assistant Curator may also be required—the latter being entrusted with the minor duties of the Museum charge, and (under expert guidance) with the execution and maintenance of the College Estate, *e. g.*, Demonstration Block, Arboretum, Nurseries, Avenues, Windbelts, Students' Gardens, etc., unless and preferably an Estate Overseer is sanctioned.

[Further experience leads me to the conclusion that an Overseer is essential. It would be better to term him Estate and Sanitary Superintendent. He should be a Retired trained Ranger on a pay of Rs. 50 plus his actual pension (*vide* paragraph 38). A Forest Guard will also be required if the Estate is declared a reserved Forest (*vide* paragraph 17), and a Demonstration Forest (*vide* paragraph 13) is formed.]



13. The importance of teaching by the eye rather than by the ear cannot be over-estimated. For this reason at Nancy, at Les Barres (the Extra Assistant Conservators' and Rangers' School for France), at Vallombrosa (the former Italian Forest College), and at similar Colleges in Germany, Ireland, etc., the Museum and the Demonstration areas are prominent features in the educational system. Lectures should often be given in the Museum—which should be so situated that the students have to pass through it to and from the lecture rooms. Models of every kind of Forest Bridge Slide, Shoot, Tramway, Rest house, of Forests under the various Sylvicultural system (with diagrams and photographs), of the reboisement of denuded hills and unstable areas, should all find a place in the Museum, besides labelled and unlabelled specimens of timbers with and without bark. I do not recommend that stuffed birds (unless in really airtight glass cases) should be admitted to an Indian Museum—they inevitably tend to become centres of infection. Forest tools, implements, and mechanical contrivances should be fully represented. Botanical specimens, and even thin sections of timber, may be mounted between two sheets of glass. Pinecones with loose scales may be exhibited in net bags. Photographs of denuded areas before and after treatment are of great educational value. A really good full plate camera is an essential item of the College equipment. The Instructional intention should be regarded as of first importance in the Museum which should never be allowed to degenerate into a mere Wonder House or glorified Toy-shop. At Nancy nearly every important reboisement area of the Alps, the Pyrenees, and Landes country has been admirably modelled in plaster of Paris. At Les Barres great stress is laid on the nursery plot, which every student has to maintain for the whole of his course. The fact that it is labelled with his name introduces a salutary competitive element. Each student should also have a garden, close to his quarters, to be cultivated under the incentive of marks or other rewards. At Vallombrosa the College was situated in the centre of a scientifically managed instructive Forest. This advantage will seldom be available in India, but the College grounds should always contain a Demonstration area (60—80 acres) of quick growing species divided into annual coupes under a short rotation. With the exception of this area all species growing on the estate should be labelled.

The Demonstration Forest will be under the surveillance of a College forest guard, but nearly all work in it, i.e., cairn building, line clearing, fire protection, charcoal burning, road making, sowing, planting, marking, felling, valuation, control book maintenance, pruning, clearing, thinning, soil wounding, valuation surveys, volume estimation, calculation of tests of dryage and shrinkage, preparation of Working plans, Hay-making, Survey and Engineering (*vide* also paragraph 38), etc., should be carried out by the students themselves on Field Days during Headquarter terms.

14. A Tramway in the college grounds is advantageous and a nullah or ravine for bridge-building an essential. The whole should form an Engineering park which should include Rope way, Sledge road, Fuel slide, Water shoot, Timber slide with Turn-table, Derrick shears, etc.

During the recess the Engineering Instructors should be deputed to a short course at a Sappers and Miners School or at an Engineering College. Manual labour, as the basis of all practical work, should be resorted to freely. The students should knead clay, fashion and make bricks, dig trenches, plant, build bridges and revetments, and undertake themselves at the College site every kind of work that they will eventually have to supervise and assume responsibility for. All new buildings of a simple nature, e.g., Carpenter's shop, Pavilion, etc., that are found to be a desirable adjunct to the original scheme of the College, might well be constructed, as regards foundations and masonry, by the students themselves.

15. Too much importance again cannot be laid on Survey. It has often been the reproach that trained Rangers were lamentably deficient in both Survey and Engineering knowledge and proficiency. The first is in great measure the foundation of the second, and together they form 50 per cent of a Ranger's work in the present stage of Forest administration in India. I would advocate therefore that one day a week during the Headquarter terms be devoted to practical Survey and Engineering at the College site. By the Senior Division for part of the year a timber bridge of a different pattern might be built across the nullah

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every alternate Saturday under supervision; on the intervening Saturdays the same bridge should be built by the students without instruction.

Permanent Brick and Charcoal Kilns of the latest type should be maintained at the College.

The Junior Division would be similarly employed on all kinds of simple Surveys and in *measuring and estimating earth work*. A not unimportant point is that students should be constantly practised in map-reading. The untrained Ranger is often incapable of reading even a simple map.

16. It is desirable that the Principal should be given the financial responsibilities and authority of a Superintending or Senior Executive Engineer with reference to the College Property and Estate, for the maintenance of which he should be in receipt of a contract grant. The whole estate might well be declared a Reserved Forest under the control of the Principal.

Mr. F. A. Lodge, C.I.E., late I.F.S., suggests that the area required for the Forest College should be prescribed. I should put it at not less than 175 and preferably 200 acres.

17. On tour there will of course be full scope for practical work in Forestry, Engineering, Survey, and Botany. The projects chosen should be selected for their desirability from an instructional point of view and for their utility to the Forest Division in which the tour is being made. It should not be forgotten that the Forest College tours must necessarily throw a good deal of extra work and trouble on to the local District staff. It is therefore only fair to benefit the Forest Division as far as possible by such work as surveying and marking next year's coupes, aligning roads and traces, constructing timber bridges, slides, dams, Irish bridges, blasting river beds, marking and executing Improvement Fellings, etc., etc. In return the Divisional Forest Officer should be under an authorised obligation to supply all labour necessary for erecting camps, assistance in obtaining carts, guides, supplies and so forth. No friction is justifiable or need be anticipated.

At times—especially during the first tours of the College—tact on the part of both the Officer in Charge of Camp and of the District Forest Officer is called for.

18. The college 'years' should usually tour separately—35 is the outside limit for which transport and supply arrangements can be conveniently made. But at least one combined camp per annum of the two 'years' together under the general control of the Principal is desirable. Such an opportunity should be taken for running of the Marathon race in which every student in the college should be compelled to take part. Throughout the touring season each 'year' should be in charge of an Imperial officer to be styled "O. C. Division camp" who should be endowed with considerable independence of powers (administrative and penal) and of financial responsibility. It will be his duty to make all arrangements *well in advance* with Divisional Forest officers for locality and preparation of camps, transport, etc.

The 2nd Officer in the Camp may suitably be termed Assistant Instructor, as at Dehra.

Standing Camps should not be constructed until the final touring programme has been definitely fixed—this may require the experience of several touring seasons.

19. The several best types of Forest all over the Province should be visited—the same camps being used every year—and where possible standing camps should be permanently maintained [as soon as the Touring Programme has been standardised]. The latter will be of considerable use to Divisional Forest officers also. But D. P. W. estimates will probably prove a formidable obstacle. The touring programme should be laid down and printed as a permanent regulation. It will be decidedly advantageous for the senior 'year' to revisit certain of the areas that they have already studied as juniors. The Principal should visit each 'year' while on tour throughout the season and exercise a general, but not too conspicuous, control over the details of work. Opportunity on tour should always be taken to examine Saw Mills, Timber Yards, Industrial Schools, Tile works, Factories, etc., to

encourage hobbies such as Natural History, Geology, or even Shikar, and generally to leaven the routine of the College life with a tinge of versatility. Similarly with the object of developing powers of observation ants' nests may be opened and examined, and attention should be drawn to instances of protective mimicry and warning coloration. Free-hand drawing should form part of the College curriculum and should be liberally encouraged. A few lectures on Astronomy might occasionally be given at night—a subject that the Ranger will have abundant opportunities later on to pursue for himself and one that may be the means of preventing him being benighted in his own forests. All students should be taught swimming. During the touring season two or three lectures on camp Hygiene should always be given by the medical officer—to emphasise the importance of quinine, mosquito curtains, covering the legs in the evening, taking food and a dry shirt out on Field Days, pure drinking water (boiled), cots raised off the ground for both students and servants, boiled milk, and clean latrines. These points should also be insisted on in a College Standing Order and their non-observance made penal. In Headquarters the subject will be expanded in the First Aid course for the senior "year"—for the final examination of which the co-operation of the District Medical Officer may be solicited, and St. John Ambulance certificates awarded to successful candidates. Opportunity should be taken on tour to study elephant work—capturing, dragging, harnessing, etc. : and lectures on the care, treatment, and ailments of elephants should be given by a qualified Veterinary officer.

20. The dates of commencing and completing the College course and the touring programme must of course vary according to the local conditions of each Province—but four main principles seem indicated:—

- (i) The first term of not less than 2—or if possible 3—months should be spent at Headquarters. This arrangement will enable the students to settle down, find their level, be grounded in the elements of the subjects to be demonstrated on tour, be accurately sized up by the staff, learn manners and assimilate the discipline and routine of the College, and develop the athletic side of their education. But during this term the junior 'year' might at the end of the first month be taken out to camp in adjoining forest for 10 days—to familiarise them with the fundamental and basic ideas and nomenclature of Forestry.

At the Madras Forest College it is significant that breaches of good manners usually occur only in the first month or so. It is impressed upon the Senior Division that it is up to them not only to set—but also to enforce—the tone of the College.

- (ii) Fire Protection in all its branches (with plenty of practice in counter-firing) must be thoroughly and scientifically demonstrated at the proper season.
- (iii) The Fire Protection course should be followed by a Hill tour, to be devoted mainly to out door work. At an elevation of 6000' to 7000' the students might well be kept in the Field from 7-30 A.M. till 3-30 P.M., and lectures should mainly take the form of demonstration and explanations in the Forest. This tour should be of great physical and mental benefit to staff and students alike, and should go far to render the senior 'year' fit and physically efficient for the Final Examinations.
- (iv) The latter should be preceded by a refresher course of about one month at Headquarters.

It will probably be found economical in every way to make the touring and Headquarter terms of each Division synchronise, and to avoid short terms of either category.

Frequent departures from and returns to Headquarters involve wear and tear, loss of kit, absence of servants, disturbance of routine and discipline, and much waste of time and money.

To start on tour 70 students, 60 servants, 100 tents, and equipage involves no slight advance bundobust, disturbance of equilibrium, and temporary loss of comfort and efficiency.

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21. At the Madras Forest College after some years of experience the following annual programme has been standardised.

August 1st to September 30th	Rains term at Headquarters.
October 1st to February 20th	Plains tour.
February 21st to April 14th	Spring term at Headquarters.
April 15th to May 20th	Hill tour.
May 21st to June 30th	Summer term at Headquarters. The majority of the Final examinations are held in June.
July 1st to 31st	Vacation for students.

An official vacation was found to be disadvantageous for the staff.

The local Accountant General promptly ruled that the Staff being in a vacation Department was not eligible for Privilege Leave.

Absence during a portion of the month of July is therefore to be regarded as a matter of arrangement between the Principal and Instructors. In November both 'years' and in June the Juniors have Periodical Examinations.

For the November Periodical Examinations the students return to Headquarters with light kit for 10 days. This break is appreciated by all and enables a move between distant camps to be most conveniently carried out. The actual date of commencing or completing a tour is liable to slight variations by the Principal: as a matter of fact it is inconvenient to start or move a camp on the 1st of the month, pay day, or on a festival day.

22. During the Plains tour the students are usually out in the Forest from 7-30 till 11 or 12 with one afternoon lecture. Lectures on tour are confined mainly to Forestry, Botany, Engineering, and Survey. To discourage a tendency to profit by absence from Field operations, in order to work up indoor subjects, it proved necessary to prescribe that a student absent from Field work, even on medical certificate, would draw no travelling allowance for that day. By reason of the climate at Coimbatore during the Headquarters terms it has been found convenient to deliver all lectures between 7 A. M. and 12 noon: the afternoons being thereby available for Private study, Drill, Gymnastics, Compulsory Games, Matches, etc. The lectures vary from 1 hour to 1½ hours: a longer period is found too great a strain for both lecturer and students in a semitropical climate. But for such subjects as Forestry, Engineering Survey Drawing or Plates or Laboratory work two consecutive lectures are allotted to provide the time necessary for such work. These lectures are usually the 1st two hours of the day to enable the time to be spent on Field work instead if necessary. At Nancy and Les Barres the lecture hours are 1½ hours each and are admitted to be too long for practical benefit.

During the Headquarter term the subjects and hours per week (5 days) allotted to them are roughly as follows:—

				<i>Seniors.</i>	<i>Juniors.</i>
Sylviculture	...	...	...	3½ hrs.	6 hrs.
Utilization	...	...	...	2½ "	—
Working Plans	...	...	...	2½ "	—
Engineering	...	...	...	6 "	4½ "
Range administration and law	...	...	...	5½ "	2 "
Survey and Drawing	...	...	...	—	5½ "
Botany	...	...	...	2 "	2½ "
Science	...	...	...	—	2½ "
First Aid	...	...	...	1 "	—

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In addition to the above three to four hours every Saturday are devoted to Practical Forestry, Engineering, Survey, and Botany.

The Working Plans Course might be shortened.

The Working Plans course at the Madras Forest College is at present perhaps too advanced for Rangers; it should suffice if they are taught Mensuration, the maintenance of Control Books, and the preparation of simple plans for copies with standards.

The Science course might be shortened.

The Botany course might be lengthened.

23. Forestry (in its three branches), Range administration and law, Engineering and Survey are regarded as major subjects. Range administration at the Madras Forest College is considered to be of great importance, and comprises—besides Accounts, Procedure, Correspondence, etc.—demonstration and lessons on the essential qualifications of a good Ranger, *e.g.*, Tact, Firmness, Power of control, Physical energy, Knowledge of the Vernacular, prompt and personal payment, readiness of resource, etc. Range offices are examined while on Tour. In the final examination a problem paper is set—the details of gross maladministration in a Range being given, the student has to indicate the remedies he would apply and the order in which he would tackle the components of the problem. The students are also taken to Magistrates' Courts to watch Forest cases, and are encouraged to hold practice trials while on tour.

Special stress is laid on systematic Botany rather than on Physiology or Pathology. Botany should be a major subject (*i.e.*, with a prescribed minimum for qualifying).

24. The marks for the course are allotted as follows:—

Forestry	{	Sylviculture	600	}	..	..	..	1,100
		Utilization	300					
		Working Plans	200					
Engineering	..	..	..	..	..	..	..	600
Range administration and Law	..	..	..	..	..	..	..	500
Survey and Drawing	..	..	..	..	..	..	..	350
Botany	..	..	..	..	..	..	..	300
Science	..	..	..	..	..	..	..	200
First Aid	..	..	..	..	..	..	..	50
Drill and Gymnastics	..	..	..	..	..	..	..	50
Conduct, and practical efficiency	..	..	..	..	..	..	..	100
								3,250

Science might be reduced to 150.

It is almost impossible to mark Drill except by deductions from Efficiency marks.

The marks are (with the exception of Gymnastics, Drill and Conduct) fairly equally divided between the Periodical and Final Examinations. Practical and Oral Tests are held continuously throughout the touring Seasons and at the Final examinations—about half of the total marks in each case being awarded for practical knowledge. On tour, Forestry, Engineering and Survey journals are written by each student and count for 'Practical' marks. They are to be retained by the student on leaving the College (instead of being sold to the next generation—as was the tendency) and should prove of considerable value in his subsequent career.

College Tour journals should also be maintained by the Instructors in Forestry and in Survey and Engineering. Details of work and areas visited, records of all sample plots or individual trees measured, miscellaneous information as to camping grounds, weather, transport or other local points will render such journals of great value to future members of the staff. It is important that the College sample plots should always be accurately localised and permanently demarcated. The College Tour journals and sample Plot Registers are eventually typed.

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The Survey Final Practical Examination consists of an elaborate project executed in camp. Excepting on this occasion Drawing Boards are not taken to camp—the drawing of Fair Plates being confined to Headquarters. The number of such plates is strictly limited to five for the course. Four plates would perhaps suffice.

Two of the plates also involve the preparation of detailed Estimates.

To prevent students from spoiling their eye-sight by drawing at night Drawing Boards may not be taken to the Hostels: but students may draw in the College during afternoons, and certain lecture hours are also allotted for the purpose. All plates drawn by each student should be suitably bound and presented to him at the end of his course—with the proviso that any plate of very exceptional merit may be retained by the Principal for permanent exhibition on the walls of the College.

In all subjects the employment of outside Examiners at a suitable fee is eminently desirable. At the Madras Forest College the fee is Rs. 100 per subject (Forestry embraces 3 subjects and therefore 3 fees.)

The trend of instruction in all subjects should be primarily and essentially practical. The constant endeavour should be to arouse professional enthusiasm and pride for the service; and to eradicate the tendency of students to allow, after a very few years of Range charge, nearly all knowledge and zeal for Forestry, Engineering etc., to be stifled by the deadening routine of crime and Revenue work.

Botanical collections are made by each student and at the end of the course are *destroyed* by the Botany Instructor.

Conduct marks are a most valuable adjunct to the maintenance of discipline. For all except the most serious offences students are either reprimanded or fined conduct marks. *Students are never fined in money.*

A progress report of each student is sent twice a year to his Conservator or guardian. The final Progress report is really an epitome of his career at the College, giving besides details of marks, his place in order of merit for the whole course, Honours Prizes, 1st, 2nd or 3rd in any subject, captain, colours, Editor, general observations on conduct work and powers of control, weight of student on joining and leaving the College, mark fines and their cause, etc., etc. A copy of this final Report is entered in the student's departmental conduct register.

25. The College certificates awarded are *Honours*—qualification: 50% of the maximum marks in each major subject and 75% of the aggregate maxima. Conduct marks should not count towards this certificate but the Principal must be fully satisfied with the student's conduct. This provision greatly raises the effective standard of the certificate which carries with it for Government students the appointment of Ranger, IV grade.

*Higher Standard*:—qualification: 50% in each major subject and 60% of the aggregate total. Government students with this certificate are appointed Ranger, VI grade.

*Lower Standard*.—qualification: 50% in Forestry: and 40% in each of the other major subjects: 45% of the aggregate total. Government students with this certificate are appointed Deputy Ranger II grade.

A considerable number of prizes are offered to both Senior and Junior students. I would here offer for the consideration of future Forest College three points in this connection:—

(i) that Honours men should receive Gold Medals:

(ii) that the prize list should always include a prize for the best all-round man and one for the best man at Field work:

(iii) that the smaller the number of prizes the greater is their relative value: at the Madras Forest College there are now perhaps too many Prizes.

26. Compulsory games at the Madras Forest College: Hockey in the Second and Football in the First half year—are played twice a week under the supervision of an Imperial Instructor. Those declared unfit to play the above games may be permitted to substitute Tennis. Cricket is regarded as a voluntary game, as it has been considered less suitable than either Hockey or Football for developing in a short space of time the qualities of leadership, self-control, combination and discipline. The Athletic Sports are held towards the end of the Rains Term. A system of College Colours has been instituted, whereby Colours are only awarded to those who have played consistently in the College Teams and have attained a recognised standard, or who have won a certain number of prizes at the Athletic Sports. Usually not more than four or five colours for each team are awarded. The actual Colours consist in certain ornamental additions to the College Blazer. Athletic affairs are controlled by a committee of selected 'Colours' men, one Instructor, and the Principal. The names of Captains are recorded on the College Walls similarly to those of Honours men.

27. The college uniform should be compulsory for all students—and should consist of a Working kit and "Walking out" uniform. The latter should be sufficiently attractive to prove an incentive to "smartness" of appearance and demeanour in and out of the College.

A kit inspection should be held from time to time, and always at the beginning of the Hill Tour to ensure the adequate provision of warm clothes. A waterproof is essential.

28. A very important feature of the administration should be the House Committee—composed of about four representatives for each "year" with the House Tutor as Vice-President and the Principal as President. The Committee is intended to voice public opinion, set and maintain the tone of the College, and generally to fulfil a position somewhat analogous to that of monitors. They should be accorded small privileges such as a distinctive and ornamental puggri, extension of College Bounds, or keeping lights up later than other students. All representations on the internal discipline and arrangements should come through the Committee. Individual complaints should not be admitted.

29. The College Drills and Gymnastics under a Havildar should prove a valuable aid to saluting, smartness of bearing, and to the cultivation of discipline and instant obedience. Besides simple military drill and gymnastics, signalling by whistle, Fire Drill, and Physical Exercises should be given. In camp Tent-pitching may be practised. It is desirable that all summonses to Lecture, Parades, etc., should be by Bugle call.

30. The Havildars [sappers for choice as they will thereby be trained bridge builders, etc.] will also be responsible for the care and maintenance of all tents, of all instruments on tour, and of all transport and preparation of camps. The cost of clearing a camping site should be debited to the Division in which the camp is situated. Charges for erecting kitchens, latrines, servants' quarters, etc., on tour should be paid for out of College Funds. This item will require careful scrutiny.

The Havildars must be competent to act as Clerks to the Officer in Charge, Division: or this duty must be carried out by the Assistant Instructor.

31. It must be admitted that while the aim of a Forest College is to ascertain the relative powers of control of each student and to cultivate such powers in all students, it is one of the most difficult of tasks to undertake. Dividing the 'year' into small sections for Field work and constantly changing the section leader—or utilizing the Vernacular Training School men if they happen to be touring near the College camp—give perhaps the most hopeful line on which such efforts should be guided. But success cannot be anticipated without the most constant and patient watchfulness and fertility of resource; and until this problem has been solved a Forest College will hardly have fulfilled its *raison d'être*.

32. Another general principle that I would lay stress on is that whatever pay is considered necessary to meet the expenses of the College life, it should be identical for all students whether Government, Native State or Private, *irrespective of their salaries before joining the College*. Durbars and Guardians should

be required to deposit the necessary funds with the Principal in the case of all students deputed by them. At the Madras Forest College experience has shown that Rs. 50 per month is a suitable stipend—it should be payable at the rate of Rs. 45 during Head-quarter terms and Rs. 55 while on tour [*i.e.*, Rs. 45 plus Rs. 10 T. A.]. Travelling allowance in some form is essential. An initial deposit of Rs. 150 is also absolutely necessary for purchasing uniforms, camp kit, warm clothing, etc.

At the Madras Forest College an agitation to show that Rs. 50 is insufficient has lately arisen. After very careful investigation I am convinced that the claim is ill-founded. Even were the facts as stated, I consider that parents should pay the very trifling monthly deficit over the stipend of Rs. 50. In most other Colleges the parents have to find Rs. 600 or so per year to meet the Educational and Boarding Expenses.

Students will never put by any portion of their stipends in Head-quarter terms. Therefore it must be done for them. But Government might pay Railway Fares over long distances.

33. For all candidates, Government, Native States or Private, the maximum age of entrance should not exceed 25 years—with the proviso that for the first three or four years of the existence of the College this limit may be exceeded for Rangers and Deputy Rangers already in the service. Within that period it should be possible to work off all untrained *suitable* men under 35 years of age in the Province. Under no circumstances should any man over that age be admitted. 25 years has been fixed as the ordinary limit for the reason that above that age a man is too set and stiff in body and mind to fully appreciate or benefit by the mental and physical discipline of the College Life. Moreover by reason of habits and traditions acquired in their previous environment it is disadvantageous both to the College and to the Department to take as a general rule men over that limit.

Europeans I would debar from eligibility for the College, unless a special case arises of a European being likely to obtain honours. A lower salary than Rs. 80 is insufficient for the proper maintenance of a European and it is therefore unwise to take in this class with the prospect of several years on Rs. 50 and Rs. 60.

It is further extremely unlikely that their educational qualifications will be higher than those of Indian candidates for admission. The standard should be fixed at not less than that of Matriculation with good marks in Mathematics, as this subject should not be taught at the College—the full two years being required for the curriculum already specified. The educational qualifications may in doubtful cases be tested by an Entrance Examination, and the Principal should always have the power of removing a man during the first year either for deficiencies in general education or for lack of progress or application in the College course.

The pruning should be unsparing—especially in the first few years of the College existence—for the Principal has to consider not the prospects of the individual but the status of the College, *i.e.*, the future standard and efficiency of the Service.

34. All students should live in the College. It will generally be found advisable to let them cater for themselves, but the frequenting of 'Hotels' in the town should be discouraged. At the Madras Forest College the students are quartered in ten imposing Hostels each accommodating six students and provided with a bath-room, dining room and kitchen. This arrangement is perhaps unnecessarily luxurious. A two-storeyed block or line, with kitchens and dining rooms for each caste and latrines close at hand should suffice. The Seniors would occupy the upper storey the Juniors the lower.

35. Besides the Hostels and the Museum the essential buildings of the Forest College may be confined to two lecture rooms, one large drawing hall, one laboratory, one central hall capable of accommodating 150 people on Prize Day, one store-keeper's room, Office room for Principal. Near, but out of ear-shot of the Principal's room, should be a suitably furnished Visitors' Room, ditto for Manager, ditto for clerks, one Library (ornately and attractively



furnished), one common room for Imperial Instructors, ditto for Provincial Instructors, one Dispensary, one Tent godown, one Store-room, dark room for photography, good bungalows for all members of the staff, quarters for Clerks, Havildars, College servants, etc., all necessary latrines in convenient situations, and a students' Recreation Room close to the Hostels. This latter is important, for if the students have not means of recreation close at hand they will assuredly seek less desirable amusements in the town. An Athletic ground is of course a necessity, and a gymnasium almost so. A Government subsidy for the Athletic Club would be a judicious investment of Public Funds. A Dhole Khana will usually be advantageous, as also a co-operative Fuel and Provision Store. A telephone system will prove an undoubted economy.

A Carpenter's shop will be required for the maintenance of the equipment and furniture.\* A Swimming Bath (near the Athletic Ground) is undoubtedly desirable, but it may be constructed to a great extent by the students in the course of their training. With the exception of staff-quarters, clerks, servants and menials lines all buildings should be fairly near each other: the House Tutor's residence should never be far from the Hostels.

36. The main College building and Museum should be of a design that is capable of subsequent expansion without detriment to the symmetry of the whole:



is approved.

a quadrangle or H type has obvious advantages: the water supply should be guaranteed, and also the capacity of the land to produce tree growth, before the site

37. Instruction in riding although difficult to arrange for is decidedly advantageous. A student who has been taught to ride is the more likely to make his inspections from the back of a horse instead of from the inside of a bullock cart.

While at the College students will require bicycles, and probably also in most Range charges; an advance for the purpose might be sanctioned by the Local Government.

38. The whole of the Estate work (including charge of the Demonstration Forest roads, buildings and avenues and planting and of the sanitation) should be in the hands of a pensioned trained Ranger on about Rs. 50 (plus his pension). He should be given a free house (near the servants' lines) and would work under the House Tutor. The Forest Guard, Malis, and sweepers would be directly controlled by the Ranger as Estate Superintendent or Overseer.

Sanitation is of the first importance both for the sake of the health of the College and as an ideal to be retained by the students in after-life.

39. I would deprecate any lavish expenditure on elaborate exteriors. Rather should the students be inspired to become an ornament to the buildings by their conduct and reputation, than that they should be endowed with a Palace before they have been tried and found worthy of regal habitations.

But in order to secure efficiency of instruction and the highest departmental talent available, money should not be stinted on equipment, staff allowances, staff quarters and on the comparatively trifling expenditure necessary to ensure contentment and pride in the membership of the College. With this object students' quarters and tents should be entirely rent free and their tents should be also free of transport charges on tour. The houses of the staff should be equal in quality and accommodation to those they would be provided with in the ordinary line.

I would counsel that the best equipment—domestic and instructional—should be provided for the students, and in return the best of their zeal, industry, and obedience demanded of them. *Esprit de corps* should be sedulously fostered: in time of trial, difficulty and temptation in after life, pride in his College will be a safeguard and a source of strength. Old students should at all times be welcomed and particularly encouraged to revisit the College at the Annual Prize Givings, Athletic Sports, etc. At the Madras Forest College it has been decided that with this object a garden party shall be given on prize day by the Board of Visitors and Staff.

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40. A College Magazine has been found of considerable benefit in eliciting the opinion of the Ranger class on subjects with which Rangers are mainly and directly concerned. It also tends to foster the "Corporate" spirit and serves to cement the connection between the past and present students.

The Magazine should be produced by the Ranger Class for the Ranger Class, the Principal exercising merely a general supervision. Excellent ideas might be expected to—and do—materialise. The magazine should not be run by the Staff or by Imperial and Provincial Officers for students too unenterprising to make an effort themselves.

41. Discipline should not present serious difficulties. The rules should be clear, and the standard should be far above that of most Indian Educational Institutions. Prompt and absolute obedience and punctuality are essential. There should be no appeal from the Principal's decision.

The nettle must be grasped on the day of the opening of the College: probably it will not be necessary to touch it again.

Order, method and system are the foundations of discipline: hence such details as tidy uniforms, tents pitched in regular lines, punctual "Lights Out" should be insisted on.

Summonses to give evidence in Forest cases detected by the students before joining the College involve a serious dislocation of work and routine. The Board of Visitors at Coimbatore decided that the summoning of students should be discouraged, that Divisional Forest Officers should forward all summonses for students through their Conservator with the history of the case, and that the Conservator should use his discretion as to ordering the case to be withdrawn.

Leave for 'Annual ceremonies' is liable to abuse and has proved rather a thorny question in the South. While not prohibited, applications are discouraged. The students should be made to realize that during their course they are not entitled to any leave except the authorised College holidays.

No difficulty as to caste has been experienced at the Madras Forest College. The original students on joining were told any students entering the kitchen of a higher caste would be dismissed, and that the same fate would befall any student who declined to take an implement or an instrument from the hands of a student of lower caste.

Similarly owing to the strength of social and domestic ties in the South the desire to visit the 'quick and the dead' and the 'very dangerous' is liable to attain formidable dimensions. It is combated by a variety of means—Express telegram at the student's expense to the nearest medical officer is one of them.

42. (a) The Head Clerks branch should be in a different room and entirely separated from the Store-keeper's branch of the Principal's office. The Store-keeper should not be allowed access to the Head clerk's office, as the former's returns are checked by the latter. The pay of the Manager or Head Clerk must necessarily vary according to the Province. But as the responsibilities and complexity of the work are not less than in a Conservator's office the pay and status should approximate. The salary of the Store-keeper should also be adequate to attract a thoroughly reliable and capable man to this onerous post.

(b) All sections of the College Stock and Plant and of the Office should be checked once a year by the members of the staff—the Students' Vacation is a convenient time for the purpose—Result of each annual check being briefly shown in a Check Register. The Stock of a College soon becomes very extensive and apparatus has a knack of melting.

43. Some miscellaneous points of a general nature deserve consideration.

Only students of good character (*i. e.*, in the case of Government students of a clean financial record) should be deputed.

On arrival Vaccination should be compulsory but inoculation against Plague and Enteric optional.

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All students should be weighed at the beginning of each year, and at the end of their course.

No Firearms or dogs should be allowed in the College without express permission.

Eurasians should be compelled to join the local Defence corps.

No Eurasian should be allowed to marry while at the College.

A strict medical examination after a Physical Test should be imposed by the Principal as soon as the students join.

No Physical science need be taught in the 2nd year—the Final Examination in the subject should therefore preferably be held at the end of the first year.

Black boards on one side should be divided into small squares by not too prominent parallels.

Sylviculture and Utilization (especially the latter) do not lend themselves readily to Practical Tests. But experience will suggest tentative solutions. For Sylviculture Practical Examinations at the Madras Forest College two expedients are in vogue:—

(i) each student has to describe a small compartment :

(ii) each student is shown an area of a few square chains : after a quarter of an hour's study he has to give its past history, indicate the treatment for the next 10 years, (marking the trees to be removed), and to roughly forecast its subsequent and final treatment.

In the written Examinations Students—the two years being intermingled—should be placed with their backs to the Superintendent of the room.

As regards absence of a student for under or over two months the following rule is in force at the Madras Forest College:—“ A student who, owing to illness or unavoidable cause, is absent for a period not exceeding two months, may, if the Principal is satisfied with his general progress and conduct, be credited with marks for any examination which he may have missed, based on but appreciably less than the average marks obtained by him in other examinations. If his absence exceeds two months his course may terminate ; but it shall be open to the Principal to recommend that he be permitted to start again at the commencement of next year in the “ division ” corresponding to that in which he was when the absence occurred.” 10 per cent is usually deducted from the average, in some cases 25 per cent.

44. Eventually it will perhaps be realised that a Forest Education require three years rather than two. The extension would permit of students being taken younger and really educated rather than merely taught. Thereby would accrue a better chance of laying the foundations of character—the key note of all successful administration—Forest or other. The Rangers are the backbone of the Department and it is incumbent on the Department to spare no efforts on their behalf.

A thorough grounding in Elementary Mathematics and Science might well be included in this longer course. On the other hand under such circumstances, I would suggest no pay for any student—but merely a travelling allowance on tour—and in return Higher Standard men should start on Rs. 70 and Honours men on Rs. 100. The latter should be ear-marked in time for such E. A. C. vacancies as are not allocated for men trained in the Provincial Service class at Dehra.

At Les Barres the two years' course is already considered too short.

45. After three years a Forest College should be able to fix its broad principles of administration fairly definitely, but details and modifications should be liable to variation where proved by experience to be necessary. Hence elasticity of scope should never be sacrificed for too rigid an adherence to routine. An Instructor at Nancy when asked what he considered were the weak points of L'école nationale remarked:—“ nous n' avons change rien depuis quarante ans.” And yet in forty years—with its rich harvest of mechanical inventions and of the discoveries of science—how greatly must the demands of the Department and the conditions of Forest work have altered and progressed.

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At the same time it must be realised that frequent changes in College practice, in timetables, settled programmes, or general organization are to be deprecated as demoralising.

46. In conclusion let it be remembered that the greater the support accorded by the authorities the higher will be the prestige of the College, and the keener pride in its membership will be the heritage of the students with as a result a more thorough and lasting benefit to the reputation of the Department and to the welfare of the Forests.

The responsibilities and influence of the Principal of an Indian Forest College are perhaps not greatly exceeded by those of any Forest Officer in the country.

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**APPENDIX E.**

*Suggestions regarding a large and immediate increase in the establishment of the Imperial and Provincial Forest Services.*

The fact that the Imperial and Provincial Forest Services are undermanned admits—I take it—of no question ; the result is that under existing conditions the proper working and development of the forests are impossible. Matters are of course gradually improving as each Province from time to time increases its cadre, but the increases are frequently so small that by the time they are sanctioned they are to all intents and purposes obsolete, and further increases are required. Presumably the process of increasing establishment will go on until in course of time we have divisions on the European scale which can really be managed intensively by one man, but at the present rate of progress it will be many years before this desirable state of affairs is an accomplished fact. I take it that the only reason why we should not at once so increase our establishments that the attainment of the European standard will come as soon as the men can be obtained is that Government is not prepared to launch out into such immediate increase of expenditure as would be required owing to the initial deficit which might have to be faced. But if it can be shown that every increase in establishment would be paid for immediately by increased revenue the case against making the increase at once falls to the ground.

2. Now it cannot be sound political economy to allow large tracts of forest to remain unproductive, especially in the strenuous times which are coming after the war when we shall have to make the best of every portion of the Empire ; we cannot make the best of our forests until every acre of them is stocked with as many valuable trees as it can carry, and this cannot be done until we have divisions on the European scale of such size that each divisional officer can personally supervise intensive work over the whole of his charge. Why should not this state of things be brought about at once, or rather as soon as the men can be obtained ?

3. The purpose of this paper is to show that in many of our forests the cost of regeneration will be more than repaid by the sale of material which must be removed in the course of regeneration operations. During the past two years and a half I have been engaged in carrying out continuous Improvement Fellings in the Coorg Forests on a somewhat intensive scale. I have not yet discovered the ideal method of obtaining regeneration and have been obliged to do a great deal of sowing. The following is a short account of what has been done :—

The work has been carried out in three distinct classes of deciduous forest, the chief species of value being teak, *Dalbergia latifolia* and *sissoides*, and *Pterocarpus Marsupium*. In the first case the area treated lies in the best deciduous forests of the Province. Here a selection felling passed over the area in 1912 and 1913. The working plan prescribed that an improvement felling was to be carried out and that seed of the valuable species was to be sown in the blanks caused by the removal of mature trees, but it was soon found that one such operation was of very little use, and during this inspection in 1916 the Inspector General ordered that the work should be continuously repeated over limited areas until the desired results were obtained. The main idea was to free existing seedlings of injurious shade, and, in patches where there were none, to clear and burn the jungle and then to sow seed of the valuable species. The work was begun in 1916 ; it was not done with much discrimination and the Ranger cleared small patches scattered over a considerable area instead of concentrating the work, and did not pay much attention to patches where seedlings already existed. In 1917 in order not to lose sight of the seedlings raised in these patches they were weeded, and injurious shade was removed ; this absorbed nearly all the funds available, and very little new work was done. In the present year (1918) a larger allotment was obtained and much greater concentration of work was effected. The results of what has been so far done are distinctly promising ; we now have in one locality a block of about 200 acres, half of which is fully stocked and in an adjoining block of 550 acres small groups aggregating about 90 acres all fairly well stocked, while in another locality a block of 350 acres contains fairly well stocked groups aggregating about 70 acres. The cost of the work in this forest has been up to the end of June 1918 about

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Rs. 4,300 or about Rs. 16 per acre on 260 acres. On perhaps half of this area the seedlings are practically established and not much more weeding will be required ; on the rest weeding for two or three years more will be necessary.

4. In the second case the area treated is a medium class of deciduous forest ; situated near a road it has suffered considerably in the past from over-exploitation. A selection felling was carried out in 1912 and 1913. The work done was similar to that already described and the result is a block of some 400 acres fairly well stocked, another of about 150 acres more or less stocked, and small groups aggregating 100 acres scattered over about 2,500 acres fairly well stocked. Half of the 400 acres block and the 100 acres of small groups should not require much more weeding ; the rest will require weeding for two or three years, and a good deal of replacing of casualties due to the poor character of the rains of 1918. The cost up to the end of June has been about Rs. 12,500 on about 650 acres or about Rs. 20 per acre. The cost would have been less had not the work been so scattered in the first two years.

5. The third case is an example of the poorest forest in the Province. The area treated lies in a zone of light rainfall, and the height growth is poor. This forest appears to have been handed over to the tender mercies of a contractor some 45 years ago, who, with permission to remove mature teak, seems to have cut every saleable stick. Lantana had just then been introduced into Coorg, and the opening of the cover gave it a chance of getting in and spreading and it soon took complete hold of the ground. Successful fire-protection for many years further aided its growth and when fires subsequently occurred whole patches of forest were burnt out. In a paper on the eradication of lantana, which I was privileged to read before the Board of Forestry in 1916 in describing this locality, where the lantana had been cleared in 1912, I stated that a considerable quantity of regeneration of the valuable species had made its appearance. In the following year I found that this had become much more abundant or rather was much more in evidence ; it is, chiefly *Dalbergia latifolia* and *sissoides* with an admixture of *Pterocarpus* and some teak and in some places occurs in dense masses with many thousands of seedlings to the acre. In 1917 I selected an area of about 120 acres and worked it intensively removing everything likely to retard the growth of the young seedlings except good straight poles of the valuable species. Last hot weather—the worst for fires which I have seen in 16 years' experience of this part of the world—the whole area was unfortunately burnt, but the seedlings are now again growing vigorously, and a large number of them are upwards of two feet in height. Although there are many thousands to the acre I have selected seedlings six feet apart and confined my attention to these. The few blanks containing no *Dalbergia* or *Pterocarpus* have been sown up with teak. The area is now fully stocked with what are practically established seedlings ; both *Dalbergia* and *Pterocarpus* can stand a good deal of shade when young, and as they are readily browsed upon by deer if opened out it will probably be to their interest to refrain from any regular weeding and the cost of the further operations necessary should be small. The cost up to the end of June 1918 on 120 acres has been Rs. 1,447 or about Rs. 12 per acre.

6. The total cost in the three localities described has been about Rs. 18,250 on 1,030 acres or about Rs. 18 per acre. This has included a good deal of work on areas which—as only a small amount of success has been obtained—are not included in the total of 1,030 acres, and on naturally grown seedlings in the vicinity of the regenerated groups. The cost should be smaller in future owing to greater concentration, and to the experience gained.

7. The small, unsound, and crooked trees removed in the interests of the young growth have yielded timber valued at Rs. 43,500. This does not include the value of timber extracted in the selection or ordinary improvement fellings both of which had previously been carried out, except in the case of the third class of forest where there was nothing large enough to be felled in selection fellings. The area yielding this timber does not exactly coincide with the 1,030 acres regenerated ; in some cases the felling has not yet been done, while in others it has been done very lightly over the spaces between the regenerated groups, but on the whole the felling may be roughly considered as having been carried out over the same area as the regeneration work. The operations have thus resulted in a profit of Rs. 25,250 or on 1,030 acres about Rs. 24 per acre.

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8. There is still a good deal of timber on the ground, all well grown poles of the valuable species having been left standing. If an even-aged crop is desired this must come out; its value is certainly equal to that of the timber already removed. I think it is reasonable to set off the value of the timber already removed against the expenditure incurred, as it was for the most part suppressed unsound stuff which would have been left cumbering the ground and putting on no increment had intensive working not been introduced. Whether one can reasonably take credit for the timber still standing is perhaps more open to doubt, but for the purpose of my argument that intensive working will pay for itself and the additional establishment required to carry it out on a large scale, I think that it is not unfair to take it into account, because its removal will be a direct result of the operations.

9. An allowance of Rs. 10 per acre should be ample to cover the expenditure required on the young stock until it becomes self-supporting; deducting this from the profit of Rs. 24 shown in paragraph 7 the result of the operations would be a profit of Rs. 14 per acre if no account is taken for the timber still on the ground, or if this is taken into account a profit of some Rs. 50 per acre.

10. I do not know the average size of a division in Europe, but a convenient unit would be 100 square miles. In a division of this size the divisional officer could give his constant personal attention to every part of it especially if the regeneration work were concentrated on two or three localities. With close supervision on the part of the divisional officer a small executive staff would suffice, and the annual charges under "B" should not much exceed Rs. 25,000. The average area of the high forest divisions of Western and Southern India at present is about 600 square miles and their average annual charges under "B" about Rs. 54,000. My ideal hundred square miles division therefore costs at present about one-sixth of Rs. 54,000, or say Rs. 9,000, the additional expenditure would thus be about Rs. 16,000. If it is permissible to take credit for the timber left standing after the regeneration work is over, and if we assume a rotation of 100 years with an area of 640 acres to be taken in hand every year the profit derivable from the regeneration work will pay the cost of the establishment twice over. If it is not permissible to do more than credit, against the cost of the work, the value of the timber removed during its execution, a profit of Rs. 14 per acre on 640 acres would mean a total profit of about Rs. 9,000, leaving a net deficit on the division of Rs. 7,000 per annum. This would almost certainly be covered by the more efficient and economical methods of extracting large timber which with a small division it would be possible to introduce. I think, however, that for the purpose of making a case for the increase of establishment necessary for the formation of really workable divisions the value of the good timber left standing after the regeneration work is complete might fairly be taken into account, as the immediate financial result would be a profit, although possibly under the old "Selection" system it might have proved more remunerative to allow the trees concerned to grow to maturity.

11. The Coorg deciduous forests are in parts fairly valuable, but there is nothing exceptional about them, and there must be many thousands of acres of equally good or better forest situated in fairly accessible localities in the Central Provinces, in the Kanara District of Bombay, and in the North Malabar, Nilgiri, and Coimbatore Districts of Madras. The total area is probably not far short of 5,000 square miles.

12. So much for the deciduous forests of Western and Southern India. In the Kanara Districts of Bombay and Madras, and in the Malabar District of the latter Presidency as well as in Coorg there are probably 1,000 square miles or more of magnificent evergreen forest which to all intents and purposes have hitherto been untouched. The following short account of some silvicultural experiments which I have been carrying out in them for the last few years will, I think, show that the regeneration of these forests under a simple form of the Uniform Method is a comparatively easy matter. My experiments have not been carried out on a large enough scale or for a sufficient period to be absolutely conclusive, but I am very confident that the conclusion I have come to is not far amiss. One of the most valuable timbers in these forests is *Hopea parviflora*. I had long known that this species reproduced itself very abundantly, but until I came to Coorg I had no opportunity of making any systematic study of the problem of how to make use of this dispensation of nature to the best advantage. Wherever this tree occurs there is almost

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always an abundance of small seedlings which never come to anything. I wanted to discover why this was so, and whether it was not possible by favouring them to get them to grow into useful trees. Accordingly in January 1916 I cleared the undergrowth and the lower storey—i.e., trees of about 30 to 40 feet in height in three small patches where *Hopea* seedlings were abundant. In one of the patches the heights of ten seedlings were measured at the time that the clearing was done. In March 1917 the average increase in height growth was 0.8 inch. This was a poor result, but as I noticed that the seedlings in the patch appeared to have derived considerable benefit from the little light which had been let in, I made a more severe clearing, felling some of the trees in the upper storey, so that a part of each patch was exposed to direct sunlight during a few hours each day. The heights of twenty seedlings in each of the other two patches were measured, as well as those of ten seedlings in a "check" area in the untouched natural forest close by. The result in January 1918 was that the average height growth in the first patch was 6.9 inches, in the second 10.6 inches and in the third 4.6 inches, while the average growth in the check area was 0.6 inch.

13. To test the effect of letting in light on the number of seedlings on the ground I had the seedlings existing on small plots in two of the patches counted in May 1916, December 1916, May 1917, and December 1917. In one plot 11 per cent. died in the first monsoon, 6 per cent. in the succeeding dry weather, and 18 per cent. in the second monsoon; in the other 19 per cent. died in the first monsoon, 25 per cent. in the succeeding dry weather, and there was a gain in the second monsoon. The second plot was more exposed to light than the first, and the result appears to have been greater mortality in the dry weather, but an increase in natural reproduction in the rains. As there were in these plots about 17,000 seedlings to the acre the small loss is negligible.

14. I have also ascertained that where there is no *Hopea* as is the case in old *kumris* (*taungyas*) which are stocked with a poor growth of deciduous species it is comparatively easy to raise it by planting and I intended this year to try the effect of broadcast sowing in deciduous Ghat forests. Owing to a very poor seed year I was able to try this experiment only in one locality and on a very small scale, but the result so far is promising.

15. I have also tried the effect of sudden exposure by clear felling in strips two chains wide. In one case where the clearing was made in the hot weather the effect was disastrous as every seedling died, but in another case where the felling was done at the beginning of the rains a certain amount of success was obtained.

16. It has still to be ascertained at what stage in its growth *Hopea* can be fully exposed, but I think I have gone far enough to show that at all events as far as this species is concerned there is every probability that the evergreen forests can be regenerated under a simple form of the Uniform Method, the period necessary to complete the operations being probably not more than five years.

17. As regards other species *Dipterocarpus turbinatus* and *Hardwickia pinnata* reproduced themselves abundantly, and I am trying the effect on their development of opening out the canopy. *Artocarpus hirsuta* is easily raised from seed, stands exposure well, and where present naturally is very responsive to the admission of light. *Dysoxylum* and *Calophyllum* are difficult to establish and their case calls for further experimental work.

18. I have digressed somewhat from my subject; my object has been to show that from the sylvicultural point of view intensive management in the Evergreen Ghat Forests is not only possible but comparatively easy. These forests are all near the West Coast, and given intensive management which implies fellings concentrated on limited areas there is every prospect that they can be made to yield a very handsome revenue. By working on these lines it should be possible not only to cover the cost of regenerating the forest and substituting a valuable stock of timber for the existing stock, such a large proportion of which consists of timber of very little value, but also to pay for the establishment necessary to create divisions on the European scale without which owing to the climatic and physical difficulties of the forests it will not be possible to work intensively more than a minute fraction of the total area.



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19. I venture to suggest therefore that the Board of Forestry should carefully consider the question of so increasing the establishment of the Imperial and Provincial Services that in all tracts where the forests are valuable enough to cover the cost of intensive management and that of the necessary establishment forest divisions on the European scale should be formed as soon as the men required can be obtained. I further suggest that if the Board after due consideration come to the conclusion that there is a case for the immediate large increase required, it should move the Government of India to take the necessary steps. Articles appear from time to time in the "Indian Forester" urging increase of establishment, and presumably the heads of the Department in various Provinces from time to time move their Governments in the same direction, but the Board is the most authoritative body in India on subjects relating to forest management and its considered opinion cannot fail to carry more weight than individual Provincial representations or letters to the Press.

20. It may be objected that it is impossible to recruit at once such a large number of men as would be required were my suggestions given effect to, or that even were it possible it would have a bad effect on future promotion, but after the war there will be large numbers of young officers who would be willing enough to join; they surely deserve well of the Empire, and after their experiences on active service they would even without any previous training in Forestry be much more useful than no one at all. A man of average education and intellect with his mind broadened by active service should not, provided he be posted under a picked Divisional Forest Officer as Instructor, have much difficulty in picking up the main principles of forest management, and it should not be very difficult to arrange for sending a certain number of men home each year for scientific training, or to evolve a plan under which the evil effects of a future block in promotion could be avoided.

H. TIREMAN,

*Deputy Conservator of Forests, Coorg,*

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## APPENDIX F.

### Note by R. S. Pearson, Esq., Forest Economist, dated the 28th February 1919, on the Dissemination of Information by the Forest Research Institute.

A not infrequent complaint made by both Forest Officers and Commercial men is that they are out of touch with and do not know what is being done at the Forest Research Institute in the Economic and possibly also in other sections. The complaint is in many instances justifiable and is due to a combination of circumstances.

At present the channels along which information is distributed are:—

i. The annual report and programme of work, which can be studied by any interested person, are so brief that they merely summarise under stereotyped headings what has been and is to be done.

ii. The report of the Board of Scientific Advice, which is little more than a duplicate of the annual report.

iii. The publication of Forest Memoirs, Records and Bulletins, which are without doubt of very considerable value, but which from their very nature and the time taken in getting them through the press only inform the public and officials of work done in past years and not what is going on at the present time.

iv. By correspondence, which is of distinct value, but has its limitations and which generally only concerns the enquirer.

v. By Forest Officers and interested parties visiting the Research Institute.

vi. By Research Officers touring.

Of all these ways of distributing information by far the most profitable are the publication of Memoirs, Records, etc., together with visits paid by officers to Dehra and Research Officers touring.

There is an urgent need felt for other ways and means of more promptly publishing information, especially in connection with trade statistics, experiments in progress, enquiries made for Forest Produce, and about new schemes in various Provinces. At present there is no means of promptly circulating such information, except through the "Indian Forester".

To supplement the present arrangements I would suggest issuing the following:—

i. Monthly, or bimonthly leaflets briefly giving:—

a. a resumé of experiments in progress,

b. a resumé of experiments complete, which in important enquiries will be followed by the publication of Memoirs, Records or Bulletins,

c. a list of the important enquiries for timber, etc.

ii. To publish inspection notes on visits paid to sawmills and factories working on raw material obtained from forests. Such notes would be of general character and would not touch on confidential subjects.

There remains the question of issuing quotations of market rates, which at present are published in the Indian Forester: this procedure seems to meet the case and requires no alteration.

An alternative to the above would be to either utilize the Indian Forester or Trades Journal, the objection to which is that the former is circulated chiefly amongst the Department and the latter in Trades Circles.

Were the idea of issuing leaflets—a system in vogue by the way in America—to be adopted, the first step would be either to establish a small press at the Research Institute or to employ one of the local printers or to try and make arrangements with the Survey of India; in any case whichever method is adopted the success or otherwise of such an undertaking will depend on the prompt way in which the leaflets are produced.

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## APPENDIX G.

*Proposal to revise Imperial Form 10 of the Forest Department Code, 7th Edition.* File No. 157 of  
1916.  
Serial No. 1.

No. 1525—3F.-8, dated Maymyo, the 3rd May 1916.

From—C. G. ROGERS, Esq., Chief Conservator of Forests, Burma,  
To—The Inspector-General of Forests to the Government of India.

I have the honour to bring to your notice that Imperial Form 10, "Statement of Forest areas Surveyed and under Survey," is unsatisfactory both in the information which it gives and in the manner in which it shows it. Article 79 of the Forest Department Code, 7th Edition, lays down that "The total of columns 2, 3, 8, 9, 14, 15, 16 and 17 should show the work done up to date, and this total added to column 22 (work remaining to be done) should equal the total forest area shown in column 23."

2. This places topographical surveys by Local Officers on an equal footing with those made by the Survey of India. A topographical survey by a Forest Officer is at best only a makeshift. Boundary surveys are on a different footing. It is not difficult to run a traverse, and a boundary traverse by a Gazetted Forest Officer may be little less accurate, and possibly even more reliable, than one made by a subordinate of the Survey of India. There is however no great reason for recording boundary traverses made by Forest Officers. Whenever a new reserve is demarcated for the first time, a boundary survey should follow immediately as a matter of course.

3. Steps are being taken in this Province to ensure this being done and also to ensure a proper record of all such surveys when made.

3. I would therefore propose that Imperial Form 10 be restricted to a record of surveys made by the Survey of India Department and that surveys by Local Officers be recorded in a separate form which need not be printed with the Annual Report. I attach specimen drafts of both the suggested forms. In the suggested Imperial Form 10 the surveys made are divided first under the heads of "Topographical" and "Boundary." Under Rule 11 of Appendix II to the Forest Department Code, 7th edition, we are entitled to a skeleton boundary survey of demarcated forests on a scale of 4"=1 mile, and we should always insist on having it. As the Local Officers' boundary traverse is good enough to serve our purpose until the area is taken up in the ordinary course of survey there should be no occasion for calling for "special" boundary surveys. The cost of such surveys should therefore never be debited to the Forest Department and so no column for cost is inserted.

Forests Nos. A.;  
May 1910, 15-16  
File 144 of 1910.

4. The "Topographical surveys" are subdivided into "Special surveys, paid for by the Forest Department," and "Ordinary surveys, not paid for by the Forest Department." Under each of these is shown "Previous surveys" and "Surveys of the year." Under "Special surveys, paid for by the Forest Department" there is also a double column showing "cost incurred during the year" and "cost incurred to the end of the year." "Special surveys are again divided into 4"=1 mile" and "2"=1 mile," these being the only scales on which special surveys are likely to be called for in this Province. The cost of 2"=1 mile surveys is only debitable to us when they are made at our request outside the ordinary topographical programme.

"Ordinary surveys" are divided into "2"=1 mile" and "smaller scales." Of the last three columns of the suggested form that for "Total area surveyed" is new and the two others correspond to columns 22 and 23 of the present form. Under "Area remaining to be surveyed" it might be desirable to distinguish areas the surveys of which are urgent from those areas the survey of which is not urgent.

It is possible that the suggested form might, by economy of space in printing and by relegation of "remarks" to foot-notes, be made into a one-page form.

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5. Surveys by Local Officers are frequently not surveys of forest areas at all. The more common objects of such surveys may be classified as follows:—

- (i) Topographical.
- (ii) Reserve boundary traverse.
- (iii) Road alignment.
- (iv) Valuation surveys.
- (v) Surveys of plantations.
- (vi) Surveys of depôt sites.
- (vii) Surveys of cultivation in reserves.

All these, and any others that may occur, could be shown on the simple form attached. They have as a rule only local interest and it should suffice to record them in the divisional reports. Cases of special interest can always be recorded in the body of the Provincial Report.

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IMPERIAL FORM No. 10.—Statement showing forest areas surveyed, and under survey by the Survey of India Department during the year.

DIVISION.	TOPOGRAPHICAL SURVEYS.										BOUNDARY SURVEYS.		Total area surveyed.	Area remaining to be surveyed.	Total area as per form 7.	REMARKS.
	SPECIAL SURVEYS PAID FOR BY FOREST DEPARTMENT.						ORDINARY SURVEYS NOT PAID FOR BY FOREST DEPARTMENT.				Previous.	Of the year.				
	Previous.		Of the year.		Cost.		Previous.		Of the year.							
	4"=1m.	2"=1m.	4"=1m.	2"=1m.	Incurred during year.	Total to the end of year.	2"=1m.	Smaller scales.	2"=1m.	Smaller scales.						
2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
	Sq. m.	Sq. m.	Sq. m.	Sq. m.	Rs.	Rs.	Sq. m.	Sq. m.	Sq. m.	Sq. m.	L. M.	L. M.	Sq. m.	Sq. m.	Sq. m.	

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NOTE.—Columns 2, 3, 4, 5, 8, 9, 10 and 11 should show the work done up to date. This total added to column 15 should equal the total forest area in column 16.

*Surveys by Local Officers.*

Division.	Description of area surveyed or of line traversed and object of survey.	Area or length.	Scale.	Cost.
	<p>This form can speak for itself. It is the simple record of <i>all</i> surveys made by Forest Officers, <i>e.g.</i>—</p> <p>(i) Topographical ... ..</p> <p>(ii) Boundary traverse ... ..</p> <p>(iii) Road alignments ... ..</p> <p>(iv) Valuation Surveys ... ..</p> <p>(v) Plantations ... ..</p> <p>(vi) Depots ... ..</p> <p>(vii) Cultivation in reserves, etc., etc.</p> <p>Important works will be noted on in the Divisional Report and if of sufficient importance may be noted on in the Provincial Report.</p>			

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**APPENDIX H.**

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*Copy of letter No. 1240, dated Dehra Dun, the 24th March 1919, from Colonel G. P. Lenox-Conyngham, R. E., F. R. S., Superintendent of the Trigonometrical Survey, to the Inspector General of Forests.*

I have the honour to enclose a copy of a table of symbols which it is proposed to use for forest maps, and would suggest that the proposal might perhaps be considered by the Board of Forestry which is shortly due to assemble.

Forty copies of the symbol table are sent separately in case you should care to distribute them to members of the Board and other Forest Officers.

2. The proposed symbols comprise only such items as are required for use on forest maps and which are not provided for in the list of conventional signs of the Survey of India. (I enclose a copy of the latter in case you should wish to refer to it.)

3. The object in view is to standardise the symbols and thereby to facilitate both the preparation and the reading of forest maps. The principles underlying the proposals are— (i) that the Survey of India symbols should be accepted, and (ii) that the number of additional symbols should be a minimum.

4. The black, pen-drawn, symbols in group (A.) of the proposed list and the first and fifth items in group (B.), are those employed in the Survey of India, the size depending on the scale of the map, the style remaining constant. The remaining symbols in group (B.) and those in group (D.) will, it is hoped, meet the special requirements of all forest maps. No black symbol has been provided in group (C.) as these items will be conterminous with one or other of those in groups (A.) or (B.)






5. The colours proposed are :—

- (i) For fiscal boundaries, a colour approximating to a neutral tint, *viz.*—Indigo.
- (ii) For forest boundaries, the colours generally used, *i. e.*, Green and yellow for the boundaries of Reserved and Protected forests, respectively.
- (iii) For the limits of forest administration, a fairly prominent colour, *viz.*—Burnt Sienna.
- (iv) For working plan boundaries, a vivid colour, *viz.*—Carmine.


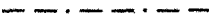



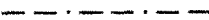
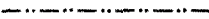

# SYMBOLS FOR FOREST MAPS.

To accompany correction slip No. 22 dated 30-4-19

**A. \*FISCAL BOUNDARIES:—**







External of India.....	
Province or State.....	
District.....	
Sub Division or Tehsil.....	
Village.....	

**B. \*FOREST BOUNDARIES:—**




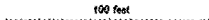
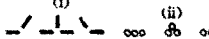
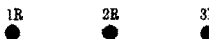
Reserved Forest with pillar.....	
„ „ Block.....	
„ „ Compartment.....	
„ „ Sub Compartment.....	
Protected Forest and Reserved Lands in the Madras Presidency.....	
„ „ Block.....	
„ „ Compartment.....	
„ „ Sub Compartment.....	

\* The size of the black symbols may be varied to suit maps on various scales.

**C. \*LIMITS OF FOREST ADMINISTRATION AND OPERATIONS:—**

Forest Circle.....	
„ Division.....	
„ Range.....	
„ Working Circle.....	
„ Felling Series.....	
„ Coupe.....	

**D. MISCELLANEOUS:—**

Head Quarters of Forest Range.....	
Forest Guards Chowki.....	
„ Rest House.....	
„ Fire Line.....	
(i) Worlies and (ii) Gotas (in C.P.).....	
Pillars on limits of areas open to the exercise of rights.....	
(The areas will be covered with a flat tint of pale red)	

† Separate black symbols are not required, these limits are continuous with one or other of those appearing in groups A or B.



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## APPENDIX J.

### Triennial Programme of work for the Forest Research Institute for the period 1919-20 to 1921-22.

#### *Programme of the Sylviculturist.*

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	REMARKS.
<b>PART I.—INVESTIGATIONS IN CONNECTION WITH SAL (SHOREA ROBUSTA).</b>			
1	<i>Sylvicultural System.</i> —The application of an approximately even-aged system of Sal forest.	In progress at Thanu, Dehra Dun Division. Elsewhere this problem has been taken up by Working Plan Officers, and the function of the Sylviculturist will be limited to observation.	Except at Thanu the Sylviculturist will investigate only by means of sample and experimental plots. It is not possible for him to control the whole management of a working section.
2	<i>Natural Regeneration.</i> —Experiments to ascertain the best methods of ensuring natural regeneration of Sal under forest conditions in various localities.	(1) Experimental plots have been laid out in the United Provinces. (2) Experimental plots will be laid out in the Sal forests of other provinces.	These plots are intended to test on a small scale ideas which have been suggested by observation or otherwise as practically applicable under forest conditions.
3	<i>Artificial Regeneration.</i> —Methods of sowing or planting Sal, with a view to the formation of forests or to filling up gaps in natural regeneration.	Various methods of propagating Sal have been tried in the experimental garden at Kaunli and are in progress there. As experience accumulates, these will be extended to application in the forest, perhaps first at Thanu.	As far as possible this work should be carried out in the forest and under as many different conditions as possible.
4	<i>Seed and seed years.</i> —Effect of age of trees and of environment on production of seed and on frequency of seed years. Fertility of Sal coppice seed and quality of resulting plants.	Sal tracts in various provinces .	Much information has been collected. Observations and experiments will be continued.
5	<i>Coppice.</i> —Experiments to find out the best methods of cutting and working Sal coppice.	Dehra Dun, Gondal and Gorakhpur Divisions. To be extended to other localities.	.. ..
6	<i>External dangers.</i> —Effects of drought, fire, frost, grazing, suppression and other dangers.	In progress in the United Provinces. Will be extended to other localities.	.....
7	<i>Rate of growth and volume increment.</i> —The establishment of sample plots in representative Sal crops. Determination of quality classes.	Plots have been made in the United Provinces, Bengal, Central Provinces and Bihar. To be extended to other localities as time and staff allow.	.....
8	<i>Thinnings.</i> —The execution of thinnings in sample plots with the object of ascertaining the optimum density under different conditions.	Ditto.	.....
9	<i>Physical conditions.</i> —The effect of climate, shelter, soil, subsoil, topography, aeration, drainage, ground fires, subterranean water-level, soil preparation and other factors on development of Sal.	In progress, chiefly in connection with sample and experimental plots	The Forest Botanist is studying some of these factors in the experimental garden. The Sylviculturist will prosecute in the forest investigations based on the Botanist's results with special reference to (1) conditions favouring the establishment of Sal seedlings, (2) conditions favouring the growth of established Sal trees.
10	<i>Miscellaneous.</i> —The collection of information on various statistical and sylvicultural matters connected with Sal, including a study of its more important companions.	In progress. Information is being collected on tour and from experiments in the sylvicultural garden, as well as from published articles, and from Reserve Journals, and Divisional Officers' sample plots.	.....
11	Investigation as to when and to what degree the cover should be opened out over young Sal seedlings <i>vide</i> para. 36 of the United Provinces Administration Report, 1916-17.	Bahraich and North Kheri (also in Haldwani, Ramnagar and Dehra Dun).	In co-operation with local Sylviculturist.
12	Investigations regarding the restocking of blanks of all kinds in Sal forest.	United Provinces, Central Provinces and elsewhere.	.....

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*Programme of the Sylviculturist—contd.*

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	REMARKS.
PART II.—MISCELLANEOUS INVESTIGATIONS.			
1	<i>Sylvicultural systems.</i> —The special conditions obtaining in different localities will be studied with the object of devising systems adopted to the sylvicultural character of the prevailing species and to the quality of climate and soil.	Investigations already in hand for <i>Pinus longifolia</i> , Deodar and Oaks in the Punjab and the United Provinces; also for <i>Picea Morinda</i> and <i>Abies Pindrow</i> in the United Provinces. Will be extended to other localities and species as time and staff allow.	<i>Pinus excelsa</i> in Himalayas demands attention.
2	<i>Plantations</i> —Completion of statistics from existing plantations with a view to framing financial forecasts; determination of the best methods of artificial regeneration, to be applied to different species and of the financial prospects of plantations.	Any plantations seen while on tour will be measured up, and all statistics available will be collected. Experiments are in progress at the experimental garden in the artificial regeneration of several species and will be continued.	<i>Eucalyptus</i> in the N. and Teak in South Ma have been dealt with.
3	<i>Bamboos.</i> —Investigation into the best method of cutting and working bamboos.	In progress for <i>Dendrocalamus strictus</i> in the United Provinces.	.....
4	<i>Miscellaneous sylvicultural investigations.</i> —The sylviculture of various trees will be studied not only in the forest but especially in the experimental garden. The investigations include the methods of germination, conditions favouring germination and natural reproduction, tending in early youth, artificial regeneration, nursery treatment, methods of propagation and transplanting, seeding and seed years, fertility of seed, development as a crop, susceptibility to external dangers and formation of crop.	In progress for Deodar and other species. To be continued and extended.	.....
5	<i>Regeneration of Picea Morinda and Abies Pindrow.</i> —Determination of the best method	Experimental plots have been laid out in the United Provinces.	Should be extended to Punjab.
6	<i>Coppice Experiments</i> —The best felling height for coppicing different species and the effect of tending.	In progress in the United Provinces, the Central Provinces, Madras, Bombay and the Punjab.	.....
7	Enquiry into the history of Deodar seedlings grown under various conditions met with in nature, during the first few years of their life.	Punjab and the United Provinces	.....
8	Some practicable means of killing climbers in Sal forests, principally <i>Bauhinia Vahlia</i> .	In progress in the United Provinces	.....
9	Sylviculture of the chief species of the evergreen forests with special reference to natural reproduction.	Coorg, South and West Madras, Assam and Bombay.	.....
10	Enquiry to ascertain the best method of treatment of <i>Anogeissus latifolia</i> and other species for the production of sumac for tanning purposes.	.....	In progress in Madras and the United Provinces.
11	Artificial regeneration of clear felled areas on a large scale. Methods and cost.	.....	In progress in several provinces. It is desirable that results should be collected and published as soon as possible.
12	Investigation to be made in regard to the burning of chir forests as soon as possible after regeneration has become established.	The United Provinces and the Punjab	.....
13	The relation of Sylviculture to resin tapping. Effects of tapping on growth of tree, effects of mixture or understorey of broad leaved trees on outturn of resin; relative productivity of old and young, large and small straight and twisted fibre trees, open and dense crops.	The United Provinces and the Punjab.	Very necessary in view of the rapidly expanding importance of the resin industry.
14	The sylviculture of <i>Quercus incana</i> ; systems of management, etc.	West Almora Division and Cantonment Forests, Ranikhet.	In Almora oak forests are insufficient under present management to supply the demand for charcoal, and it is high time, more detailed information was collected.

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Programme of the Sylviculturist—contd.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	REMARKS.
PART II.—MISCELLANEOUS INVESTIGATIONS—contd.			
15	The sylviculture of the mixture of Chir ( <i>Pinus longifolia</i> and <i>Quercus incana</i> ).	West Almora Division Cantonment Forests, Ranikhet and Naini Tal Division.	The mixture which naturally results from fire protection of chir forests. Ignorance of the correct treatment and neglect of the encroachment of oak has already given difficult problems for future management.
16	Selection of species suitable for re-forestation bare areas in Kumaon with fast growing species at elevations too high to be suitable for chir ( <i>Pinus longifolia</i> ).	Near Pauri, South Garhwal Division	The Pauri station fuel supply is a constant difficulty and the existing plantations at about 6,000' elevation have so far not been very successful.
17	Twisted fibre in <i>Pinus longifolia</i> , its causes and measures necessary to avoid it. Experiments to prove definitely whether the tendency to twist is transmitted as an hereditary factor, also to discover if the mineral constituents of the soil have any influence on the production of twist.	Pine forests in the Kumaon Circle. Preferably in the Almora District.	An outstanding matter which the Forest Research Institute have so far not dealt with. It is the most important problem in the Kumaon circle. The subject may prove to be one requiring the attention of the Sylviculturist and Entomologist in addition to the Botanist. All local attempts at solution of this problem have so far failed.
18	Chemical method for killing trees and epiphytes for improvement tellings.	Dehra Dun . . . . .	In collaboration with the Forest Chemist.
19	Study of teak. . . . .	Burma . . . . .	It is hoped that this matter will be undertaken at an early date.
20	Conditions of reproduction of the more important Burma trees.	Burma . . . . .	This matter is one of very great importance in view of probable increased utilization and certain changes in working plans.
21	(a) Determination of the rate of growth of <i>Xylia dolabriformis</i> in various localities and under various conditions. To what extent is its reproduction and subsequent development affected by fire? (b) Investigation of the factors influencing the reproduction of valuable species in heavy evergreen forest. In South Tenneserim although large trees of many species are common, present investigations tend to show that natural reproduction is either absent or nearly so.	South Tenneserim Division, Tenneserim Circle, Burma.	The valuable species referred to in (b) are chiefly— <i>Hopea</i> sp. (identification required). <i>Parashorea stellata</i> . <i>Pentaco burmanica</i> . <i>Cinnamomum inunctum</i> . <i>Cinnamomum iners</i> . <i>Sideroxylon burmanicum</i> . <i>Mitchelia champaca</i> . <i>Bassia longifolia</i> .
22	The best method of extensive regeneration of the "In" type of forest in Burma.	Selected localities . . . . .	Most important in view of the large area of this type of forest.
23	Girth and height growth of coppice shoots in the Central Provinces and the financial rotation of the species concerned.	Forest Divisions in the Central Provinces where there are coppice shoots of known age in old coupes of ten years of age and over.	... ..
24	Investigation regarding the best methods of propagating <i>Cassia auriculata</i> .	Bombay, Madras, Central Provinces and Burma.	In conjunction with Botanist.

The work connected with the above investigations must be mainly carried out by local Sylviculturists with such assistance as the Central staff may be able to afford.

Programme of the Forest Botanist.

1	Oecology of <i>Sal</i> . To be continued on lines already sanctioned on previous programmes.	United Provinces, Behar, Bengal, Assam, Central Provinces and North Madras.	Already in hand.
2	Oecology of <i>Teak</i> . To be continued on lines already sanctioned.	At Dehra Dun and in provinces where co-operation of local officers can be secured.	Ditto.
3	Study of important forest grasses. To be continued on lines already sanctioned.		

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Programme of the Forest Botanist—contd.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	REMARKS.
PART II.—MISCELLANEOUS INVESTIGATIONS—concl'd.			
4	Systematic Botany. To be continued on lines already sanctioned.	At Dehra Dun and on tours as opportunity offers.	Already in hand.
5	Spike Disease of Sandal and dying back of Sandal from other causes.	Coorg and Madras . . . . .	Ditto.
6	Root Disease of Sal . . . . .	Assam, Bengal, United Provinces and Central Provinces.	Ditto.
7	Root Disease of Sissoo . . . . .	At Dehra Dun and in the Punjab .	Ditto.
8	Cause of twisted fibre in <i>Pinus longifolia</i> and remedial measures.	United Provinces and the Punjab .	Ditto in collaboration with Sylviculturist.
9	Treatment required to produce <i>Chilka</i> or highly resinous wood in <i>Pinus longifolia</i> .	Kumaun Circle, United Provinces .	.....
10	Cause and remedy for "redwood" in Spruce which renders timber too heavy to float.	Punjab . . . . .	Already in hand.
11	Identification and control of Sal "thicket fungus"	Bihar and North Madras . . . . .	Ditto.
12	Preparation of a revised Botany Manual . . . . .	.....	Ditto.
13	Preparation of soil for transplants or dibbled seed when regenerating unevenaged high forests.	In the Dehra Dun Forest Nursery and in gaps in forests worked under the Selection System.	.....
14	Seasons and methods of collecting and preserving seeds of various species.	Wherever possible.	. . .

Programme of the Forest Economist.

1	To collect, collate and disseminate information with respect to experiments, enquiries and trade statistics and to act as liaison officer between the various local Utilization Officers.	Dehra Dun . . . . .	.....
2	To pay periodical visits to the chief industrial centres with a view of maintaining close touch with trade and to compile trade statistics, regarding imports, exports, etc.	Calcutta, Cawnpore, Bombay, etc. .	.....
3	Associate with local Utilization and Research Officers, to examine areas and prepare trade notes for the development of special forest industries.	Dehra Dun and in the field . . . . .	Such work has up to date been undertaken by the Forest Economist.
4	To undertake a survey and make an inventory of all industries dependent wholly or in part upon any item of major forest produce with special reference to :— (a) Railway sleepers. (b) Substitutes for imported timbers and manufactured articles.	India and Burma . . . . .	.....
5	In association with local Utilization Officers to prepare and maintain for periodic publication a record of the more important timber depôts and saw mills, together with a list of the names of timber merchants, indicating the supplies of timber available from various localities.	Dehra Dun . . . . .	.....
6	While carrying out the last enquiry in connection with saw mills, to collect full information regarding existing saw mills used in Indian forests, with data as to capacity, equipment, staff and running cost. Thereafter to standardise plants, both fixed and portable, suitable for varying conditions of locality.	Dehra Dun and in the field . . . . .	.....
7	Antiseptic treatment of timber, under pressure, with special reference to Railway sleepers.	Ditto . . . . .	This question is being actively taken up by two Railway Companies.

II.—WOOD TECHNOLOGIST.

8	To continue the enquiry into the seasoning of timber :— (a) by natural and (b) artificial methods. Special attention being paid to the mode of conversion and stacking.	Punjab, United Provinces, Bengal, Assam, Bihar and Orissa, Central Provinces, Bombay, Madras and Burma. (b) Dehra Dun.	Mr. Tireman, Deputy Conservator of Forests, Coorg, makes a special point of including species from evergreen forests in connection with this enquiry.
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Programme of the Forest Economist—contd.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	REMARKS.
II.—WOOD TECHNOLOGIST—concl'd.			
9	Investigation into the physical and mechanical properties of timber:— (i) Technological study of commercial Indian Timbers, combined with the preparation of microtome sections to facilitate identification. (ii) Systematic investigation of the mechanical properties of the more common timbers for general or special purposes, as regards their power of resistance to:— (a) Transverse strain, combined with modulus of elasticity. (b) Compression. (c) Shearing. (d) Hardness. (e) Shrinkage, and (f) Warping. (iii) To carry out spike pulling tests on sleeper woods.	Dehra Dun . . . . .	. . . . .
10	Enquiry into the special uses of Indian Timbers and finding indigenous substitutes for timbers imported for special purposes, e.g., Timbers suitable for:— (i) Aircraft construction, (ii) Rifle stocks, (iii) Tool handles, (iv) Essential fittings for cotton and jute mills, viz., bobbins, shuttles, picking, arms, planetree rollers, etc. (v) Casks, both for dry and liquid goods. (vi) Packing cases, (vii) Sporting requisites, (viii) Parquetting, (ix) Veneers and three ply, from wood and burrs, (x) Ornamental panelling, (xi) Leather cutting blocks, (xii) Woods suitable for boat and ship building, (xiii) Railway carriages, carts, buggies, etc., etc., (xiv) Telegraph poles, (xv) Agricultural implements, (xvi) Paving blocks, (xvii) Woods suitable for turnery and toys, (xviii) Carving. (xix) Miscellaneous enquiries which may arise from enquiry 4 (b).	Dehra Dun and manufacturing centres.	. . . . .
11	The compilation and publication of Bulletins on important timbers.	Dehra Dun . . . . .	In continuation of the bulletins already issued.
III.—PULP EXPERT.			
12	Observation and encouragement of the Bamboo and Grass pulp industries in India and Burma.	Dehra Dun . . . . .	. . . . .
13	To carry out a survey of Grass and Bamboo areas with a view of ascertaining their suitability for exploitation and erection of pulp-mills in their neighbourhood.	In the field . . . . .	. . . . .
14	To continue the examination in the laboratory of all possible grasses and bamboos and when advisable to prepare bulk samples for testing and commercial valuation.	Dehra Dun . . . . .	. . . . .

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*Programme of the Forest Economist—contd.*

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	REMARKS.
<b>III.—PULP EXPERT—concl'd.</b>			
15	To enquire into the possibility of preparing "Celtex" from Indian fibres.	Dehra Dun . . . . .	.....
16	Improvement of paper making from <i>Daphne cannabina</i> as a cottage industry in Garhwal.	Dudha Toli Reserve, Ameli Range, South Garhwal.	The present methods being crude and laborious the paper produced is, therefore, of inferior quality.
17	Utilization of twisted fibred Chir ( <i>Pinus longifolia</i> ) timber for mechanical pulp or other purposes.	.....	The possibility of using this timber for paper pulp as also for the tar, industry is worth consideration. To be carried out in part with the Chemical Branch.
18	Use of the fibres of <i>Sterculia</i> for special qualities of paper.	.....	
<b>IV.—TAN EXPERT.</b>			
<i>(i) Tans Laboratory Experiments.</i>			
19	In continuation of the enquiries already carried out at Malhar, to complete the systematic enquiry into the value of tan barks, leaves and fruits.	Dehra Dun . . . . .	.....
20	To enquire into the value of mixing tan-stuffs.	Do. . . . .	.....
21	The possibilities of Tan Extracts for local use and export.	Do. . . . .	.....
<i>(ii) Tans Field work and Field Experiments.</i>			
22	To undertake an examination of outturn and cost of extraction of such tan-stuffs as laboratory experiments have proved to be worthy of further attention.	India and Burma . . . . .	In association with Utilization Officers and the Minor Forest Products Expert.
23	Enquiry as to the best methods of collection in the forest and preparation of tan-stuffs.	Do. . . . .	In conjunction with the Minor Forest Products Expert.
24	The Tan Expert to operate in the field with the tan extract plant, to ascertain cost of production and for demonstration purposes.	Do. . . . .	.....
<b>V.—MINOR FOREST PRODUCTS EXPERT.</b>			
25	To undertake a survey and make an inventory of all industries dependent wholly or in part upon Minor Forest Products other than those dealt with by the Pulp Expert.	India and Burma . . . . .	.....
26	To enquire into the collection, cropping, outturn, value and marketing of the following Minor Products :— (i) Fibres from the bark and stem leaves and fruit. (ii) Flosses. (iii) Oil-seeds, their uses and market value. (iv) Essential oils from grasses. (v) Gums, resins, oleo-resins, gum-oleo-resins, wood oils, and natural varnishes particularly <i>Melanorrhæa usitata</i> in Burma. (vi) Drugs and spices from roots, stem, bark, fruit, seed and leaves. (vii) Lac. (viii) Canes. (ix) Chir ( <i>Pinus longifolia</i> ) tar and chir tar oils.	Do. . . . .	In conjunction with the Chemical Branch.

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Programme of the Forest Economist—concl'd.

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	REMARKS.
V.—MINOR FOREST PRODUCTS EXPERT—concl'd.			
27	A special enquiry into the economic uses of Tamarind fruit and seed.	Passim, Madras . . . . .	.....
28	Utilization of waste wood and sawdust for the preparation of tar, charcoal and briquettes.	Dehra Dun . . . . .	In conjunction with the Chemical Branch.
29	Enquiry into possible uses for <i>Eupatorium</i> and <i>Ageratum</i> spp.	Chittagong Hill Tract, Burma and Assam.	.....
30	The possible use of Lantana and <i>Adhatoda Vasica</i> for commercial purposes.	.....	In conjunction with the Forest Chemist.

Programme of the Forest Zoologist.

1	The life-histories, distribution and economics of principal insect pests of Sal ( <i>Shorea robusta</i> ). (a) The heart-wood borers. ( <i>Hoplocerambyx</i> , <i>Aeolesthes</i> , <i>Dvorthus</i> , <i>Dialeges</i> , etc.). (b) The sap-wood borers ( <i>Xylotrechus Cloroforus</i> , <i>Lamiidae</i> and <i>Anthribidae</i> , etc.). (c) The shot-hole and pin-hole borers and ambrosia beetles ( <i>Platypus</i> , <i>Crassotarsus</i> , <i>Diapus</i> , <i>Xyleborus</i> , <i>Progenius</i> , etc.). (d) The bark beetles ( <i>Sphaerotrypes</i> , <i>Cryphalus</i> , etc.). (e) The defoliators ( <i>Lymantriadae</i> , <i>Noctuidae</i> , <i>Lasiocampidae</i> ; <i>Scarabaeidae</i> , etc.). (f) The seedling pests (Seed, seedling-root and shoot borers, cockchafer grubs, cut-worms and grasshoppers, etc.).	All Sal Divisions . . . . .	Considerable progress has already been made with many of the groups and work will be continued on very similar lines. Experience has shown that it is unprofitable, if not impossible, to isolate one pest species and carry out concentrated investigations on its life history and economic importance. The insect fauna of Sal must be studied as a complex.
2	The life-histories, distribution and economics of the principal insect pests of Teak. ( <i>Tectona grandis</i> ). (a) The bee-hole borer ( <i>Duomitus ceramicus</i> ). (b) The sapling caterpillar-borers ( <i>Phassus</i> , <i>Hepialidae</i> , etc.). (c) The sapling canker grub ( <i>Haplohammus</i> ). (d) The defoliators ( <i>Noctuidae</i> , <i>Pyralidae</i> , <i>Arctiadae</i> ; <i>Coleoptera</i> , etc.).	Burma and Madras .	Item 2 (a) is already in progress and will be maintained as a special investigation on recently modified lines.  Items 2 (b) and (c) will be undertaken as enquiries subsidiary to 2 (a).  Item 2 (d) has received preliminary attention. Further work is proposed when a period of serious defoliation reoccurs in Nilambur, Madras.
3	The life histories, distribution and economics of the principal insect pests of conifers of the North-West Himalayas. (a) The Chir scale insects ( <i>Repersia</i> ). (b) The pests of the regeneration areas of forests under uniform systems of management ( <i>Ips.</i> , <i>Polygraphus</i> , <i>Scolytus</i> , etc.). (c) The pine weevils ( <i>Cryptorhynchus</i> , <i>Hyllobius</i> , etc.).	United Provinces and the Punjab .	Item 3 (b) the introduction of clear felling and evenaged crops renders an enquiry imperative.
4	The life histories, and distribution of the insect fauna of the tree species associated with Sal and with Teak in natural forests.	All Sal Divisions and Burma .	The majority of the insect species attacking, (a) Sal, (b) Teak are <i>polyphagous</i> . It is therefore necessary to determine the importance of alternate host trees, since the commonest food plant of an injurious insect is not necessarily the principal timber species. This investigation will ordinarily be incidental to items 1 and 2, but it may be advisable to extend its scope to localities in which Sal and Teak are absent.

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*Programme of the Forest Zoologist—concl'd.*

Serial No.	Subjects and details of investigations.	Localities in which investigations will first be taken in hand.	REMARKS.
5	The pests of forest nurseries . . . . .	Where required . . . . .	In conjunction with items 1 to 4.
6	Systematic entomology— Revision of the <i>Scolytidae</i> and <i>Platypodidae</i> of British India.	Dehra Dun . . . . .	This work has been at a stand-still since the commencement of the war. As apparently no specialists in Europe can take up these groups, the revision must be carried out at the Research Institute.
7	Preparation of a Students' text-book of Indian Forest Zoology.	Do. . . . .	The text book should be for Zoology generally.
8	Further investigation of the damage being done by the Bee-Hole Borer in Burma.	Burma . . . . .	.....

*Programme of the Forest Chemist.*

*1	<i>Destructive Distillation—</i> (1) Preparation and uses of chir tar and associated products. (2) Investigation of the chemical constituents of the wood of <i>Xylia xylocarpa</i> . *(3) Utilisation of waste wood and saw dust for the preparation of tar charcoal and briquettes.	Dehra Dun . . . . . North Division, Kanara, Bombay Dehra Dun . . . . .	An experimental Distillation plant is urgently required for this work. ..... In conjunction with the Minor Forest Products branch.
2	<i>Gums, Resins, Oleo-resins and Essential Oils—</i> (1) General study of essential oils . . . . . General study of gums, resins, oleo-resins, gum oleo-resins and wood oil and natural varnishes.	Ditto . . . . . Ditto . . . . .	In collaboration with Minor Forest Products Expert. Ditto ditto.
3	<i>Soil Analysis—</i> Investigations into soils in their relation to tree growth.	. . . . .	In collaboration with the Botanist and Sylviculturist.
4	<i>Miscellaneous Enquiries—</i> (1) Enquiry into the possible uses of <i>Eupatorium</i> and <i>Ageratum</i> . (2) General enquiry into oil seeds and their uses. *(3) Investigation into Indian turpentines— (a) Prevention of deterioration of turpentine oil on storage. (b) Chemistry of Indian turpentines . . . . .	Dehra Dun . . . . . Ditto . . . . . Bareilly, Jalloo and Dehra Dun . . . . .	In collaboration with the Minor Forest Products Section. In collaboration with the Minor Forest Products Expert. ..... .....
5	General investigation into the nature and value of dyes obtainable from woods, barks, fruits, flowers and leaves.	Dehra Dun . . . . .	In conjunction with the Minor Forest Products Expert so far as outturn and cost are concerned.
*6	The standardization of creosote oils . . . . .	.....	. . . . .

\* Items thus marked to be considered the major subjects of research.



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~~APPENDIX K.~~

**Business Office Methods in the Indian Forest Department.**

The war has given the Indian public more than an inkling of the vast possibilities of its Forest Department and the business now prevailing in the department has come to stay. The object of this paper is primarily to indicate how this busy-ness can be converted into business by considering the methods and appliances for dealing with correspondence and figures according to modern commercial ideas. Figures and figure work cannot be omitted in this connection. There is no business without figures. Figures have to be put down on paper and added. Values and work cannot be represented in any other way.

The problem extends far beyond the confines of the Indian Forest Department. Never in the history of modern commerce and industry was system so necessary as it is to-day. To get the maximum production out of the Empire for the next ten years has become a matter of vital importance. Many men and many firms are devoting their whole time and energies to the one problem of rapid and efficient disposal of the two main channels of commercial paper activity, namely, correspondence and accountancy. It would be presumptuous on the part of the writer to do much more than indicate to the best of his ability where the office troubles of the Forest Department mainly lie and to try and sketch briefly the methods available to remedy them. The actual application and the working out of details is the work of experts and must be left to experts. The Indian Forest Department originated with and was gradually evolved by non-business men. This was not much of a drawback while the demand for its products was small and the industries of India were undeveloped and insignificant. All this is rapidly changing. The Indian Forest Department either holds the main stocks of raw material essential to certain industries, such as timber, bamboos etc., or practically monopolises certain key-industries whose products are required in subsidiary industries, such as rosin, turpentine, etc. It is thus getting into closer touch with the commercial world every day. Now, it is not to the discredit of the department to admit quite frankly that its methods of dealing with correspondence date back to the year one and that leisureliness in disposal of the "dak" is rather a marked characteristic. Many of the methods and processes in use are not required or inefficient, there is much intermediate handling of papers before they get to the actual disposing authority, and the sum-total of the whole arrangements is that highly trained and highly paid officers are kept at their desks unnecessarily, while important constructive work, expansion schemes and work calling for expert knowledge is delayed. Any scheme for improving office work conditions with the object of giving each of the small band of trained Forest Officers in India more time for the exercise of his true vocation should therefore be welcomed.

The remedy lies in method. Goethe it was who wrote "Time flies, but method catches it." It has also been well said:—"Method is an excellent thing; but method without organisation may be compared with an opiate--its adoption pleases and allures, its after effect is wreckage." Method without organisation, although apparently a contradiction in terms, has a real existence and is responsible for 95 per cent of the "break-downs" which occur in memo-making and filing systems. "The art of a thing is first its aim—and next its manner of accomplishment." "You can standardize the sweeping of your office or the washing of the windows, provided you first determine the best and the shortest way to perform these operations."

The nation as a whole has learnt a good deal about the "best and the shortest way" in the past five years and that experience is available to all those who wish to live and learn. The "will to improvement" has to be touched on here, for unless the members of the Forest Department have the dynamic force to energise the very static state the suggestions in this paper are aimed to abolish, actual accomplishment will be conspicuous by its absence.

The general conditions now prevailing and their remedies were the subject of a brief article in the "Indian Forester" for June 1918 (page 265). It remains to consider the problem in a little more detail here. The bulk of a Divisional Forest Officer's correspondence is with his range officers, so that category of documentary activity will be reviewed first. Correspondence is by registered or unregistered memos, controlled by a system (sic) of case marks and of registration of receipts and issues. That must go by the board. Unimportant papers need not be registered at all, any action taken being supported by the sanction or authorization in original. More important papers can have carbon flimsy copies kept. Pen-carbon paper is now available of very good quality and the office copy is made while writing the original. Case marks can and should be of the simplest. The present main division of records into "A" Accounts, "B" Establishment, "C" Forest working, "D" Forest Administration, "E" Stock and Plant, "F" Miscellaneous, is suitable and the addition of a number A1, A2, A3 can be used, to indicate the sub-division. Files should be of the loose file type and annual or quarterly transfer files should be maintained so as to ensure only live matter being in the current files. The above remarks concern elementary principles, probably they are in use in some part of India, but the object of this paper is to ensure their general acceptance and introduction.

Items of routine correspondence, routine reporting and routine returns should be consolidated. There is nothing more irritating and time-losing than to get a miscellaneous daily budget from a range officer covering, say, an indent for a measuring tape, application for stamps, sanction to buy a hundredweight of nails, tree-damage report in contractor's felling work and a request for a forest guard's belt. All such work should be consolidated into standard annual, half-yearly or quarterly returns. The work of a range is generally covered by an Annual Plan of Operations or abstracts from the Divisional budget. Careful organization and detailed instructions to the range officer at the time of issue of these annual plans would reduce future routine correspondence very considerably.

Delegation of powers to range officers is outside the scope of this paper, but as a remedial measure for petty correspondence it deserves mention.

The art of report-writing, briefly and to the point, is not a subject on the curriculum of the Dehra Dun Forest College but its inclusion is worthy of consideration and, generally, office routine and accounts might be given more time at the College than at present.

With the development of communications, increase in post offices and so on it will soon be possible to concentrate most of the accounts work of a division at headquarters, relieving range officers of heavy disbursements and revenue remittances. The cheque system is in every way preferable to cash payments and if a range officer's accounts can be limited to petty disbursements to his establishment and any unavoidable daily labour expenditure there should be an improvement, in time-saving in office, and in efficiency all round. Bindings for all range cash books and registers might advantageously be of thin tough Manila board. At present the weight of bindings of cash books, correspondence registers and various forms represents a large proportion of the total weight of records carried by range officers on tour.

A reference is also necessary to Stock Form No. 16. This is a bad form. Substitution by a simple perpetual inventory, suitably grouped, and each group alphabetically arranged in loose leaf ledger form, would facilitate posting and checking very greatly.

To sum up, the recommendations as regards range correspondence are:—

- (a) To abolish the registration of correspondence.
- (b) To keep important files complete by means of pen-carbon copies, dead matter being transferred to transfer files as often as necessary.
- (c) To reduce range accounts to a minimum.
- (d) To have a rational system of range registers and forms.

There now remains the Divisional correspondence with other people, consisting of other Government departments, the administration of the department and the general public. The main time-loser and energy-waster is again the register of correspondence, assisted by bad systems of filing, both as regards arrangement and mechanical appliances.

A system is required which would enable the correspondence clerk to open the day's dak, of say up to 100 documents, and to put them up for orders with the relevant files in a couple of hours at most.

This can only be done by keeping correspondence with one individual or on one subject in a separate case and keeping that case complete by means of carbon copies of documents, every case being so filed that its tracing is a matter of seconds. The last condition pre-supposes a vertical filing system with clearly marked vertical guides. For the former conditions the only practical solution appears to be the combination of the alphabetical and numerical index of correspondence on the vertical filing system, known as the "numeralpha" system. The system combines vertical files with full size guides, thus doing away with the necessity of a separate card index. Samples of the various records and appliances will be available for inspection of the Board of Forestry, but a brief description of the scheme may also be given here.

Correspondence is arranged alphabetically in files or folders. A sub-division of the alphabet is employed sufficiently minute to ensure that not more than 8 or 10 names appear in any sub-division. It may be remarked in passing that sub-divisions of the alphabet on any American system are best avoided. They are eminently suited to that go-ahead country of cosmopolitan nationalities, but outside America they are likely to give trouble. For India is it just possible a special sub-division to suit Indian requirements may be necessary. In the numeralpha system (a name invented and adopted by the firm of "Roneo Limited," London, E. C., for its productions in this line) each sub-division of the alphabet carries with it a number as well. The guides are so tabbed that even numbers form one row and odd numbers another, so reference is very rapid, and replacing a folder quick and extremely simple. The system provides for transfer of old correspondence to transfer files, and also provides for the casual correspondent by having a special general correspondence blue folder for each guide or sub-division of the alphabet.

Finally, the category of correspondence which grows rapidly in bulk is also provided for, special main guides being used in the vertical filing drawers, the actual correspondence folders connected with these main guides being kept in special drawers. Alphabetically, these main guides appear in their proper sub-division of ordinary guides and so reference is rapid and the general classification of records not interfered with.

An inspection of the actual devices will convey an idea of their use much more effectively than the above attempt at describing them.

The advantages of the numeralpha system are many, to wit, the abolition of the cumbersome correspondence register, the quick tracing of any record and a complete record of all correspondence in each folder.

The question of accounts and the various ledgers and registers now used can only be briefly reviewed. It does not require much argument to shew how illogical is the practice of having bound registers for expanding records such as ledger accounts, forest journals, audit abstracts and stock forms in which systematic entries on a pre-arranged plan are essential, unless much time is to be wasted in looking up what should be connected entries. Take as an instance the audit abstracts of a produce form like Form 7, so much used in posting up control registers. A bound audit abstract either means a large number of blank or nearly blank pages, or entries which follow each other haphazard on no system, making reference and checking a most troublesome matter.

There are many loose-leaf ledgers on the market, some with locking devices, and their users all testify to their time-saving qualities and ease of reference.

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Labour-saving devices, such as the addressograph, the comptometer and various accounts-posting and adding type-writers are worthy of study. The object of this paper, it should be repeated, is only to draw attention to ways and means available in order that individuals may go into the question further, that discussion and interest may be stimulated, and, finally, that a decision may be arrived at as to whether the release of forest officers, from range officers upwards, from troublesome office work cannot be accomplished to an appreciable extent by means of system, organization and labour and time-saving devices as outlined in this paper. The Indian Forest Officer is unique, in so much as he has to try and combine a maximum of out-door work with an ever-increasing burden of paper-work.

An hour a day saved from avoidable office routine for each officer in the department makes a very handsome total of time made available for the exercise of the Forest Officer's legitimate duties, and for the more rapid expansion of the activities of the Indian Forest Department which, at this moment, is not only India's necessity but the Empire's need.

(Sd.) A. J. GIBSON,

*Deputy Conservator of Forests,*

*Resin and Simla Forest Divisions, Punjab.*

*27th November 1918.*

## APPENDIX L.

## NEW MEASURES FOR NEW DEMANDS IN FOREST INDUSTRIALISM.

It has already become a commonplace to observe that we are on the threshold of a new era in the world's affairs and that as far as India is concerned that era will be marked by a large expansion of industrial activity. As always happens at great crises, that which men have been thinking, or perhaps only dreaming of, for twenty or more years, suddenly becomes vocal and is translated into action. There are many special causes which tend to reinforce this present movement and among them none so potent as a general realisation of the fact that the world has been rapidly overtaking and outrunning its supplies of raw and partially manufactured materials and one of its features will be a keen search for new sources of supply. Your department has not been unmindful of its responsibilities in the past but in the face of what is, both in its character and its magnitude, greater and more insistent than anything hitherto experienced, it behoves us to take stock of our equipment for meeting it, and if we find it defective or out-of-date to boldly throw overboard the top-hammer and lumber and be prepared to face the new era with new measures for new demands in Forest Industrialism.

I come before you with some claim to speak from experience gained on both sides of the counter. For eight years I have been semi-officially connected with your department and during that period I have had considerable opportunity of observing Governmental and departmental methods of dealing with the matters I propose to discuss. Previous to it I was closely connected with the commercial and industrial community of this country for fifteen years, with frequent occasion to note how it regards you from their side of the counter. I do not propose to trouble you much with what I think, or would do, but will rather base my discourse on texts selected from the utterances of others from both sides of the counter. On their heads be it—I am merely their humble reporter and commentator and my job is only to draw conclusions from these opinions.

And first I will endeavour to give you a reflex of commercial opinion at home. When there in 1915 and 1916 I found myself almost unconsciously drawn into the position of an unofficial commercial traveller in Indian forest products. I had some experience of the working of the two Government Committees who are studying the industrial development of the Empire and I had several opportunities of addressing meetings of manufacturers and commercial men throughout the country. On all hands I found an extraordinary eagerness to hear whatever I had to say about the industrial opportunities of Indian forests, and, in the questions put to me, an equal eagerness to know how to *circumvent acts in restraint of trade committed by Government*—again I plead that the expression is not mine but that of an English editor commenting on one of these meetings. I much regret I was unable to give them any assistance in pursuing such a nefarious line of conduct. Perhaps the reference is not understood here, and I apologise if I am teaching my grandmother, but in England acts in restraint of trade are actionable at law. One rather shudders at what might be the result if they were equally so here. In this you have a collective opinion of what is thought of us at Home and it merely expresses in another way what one often hears in India, *vis.*, that the chief obstacle to commercial development has been Government.

I now quote another opinion, this time an individual one, from a Calcutta merchant well known for his wide-eyed and open-minded views. It was very brief and to the point—"if we can get what we want anywhere else in the world, or from any one else in the world we should never ask a British Indian Government for it." There must be something wrong somewhere when such a man can express such an opinion.

A third opinion I take from the other side of the counter. It is that of an eminent civil servant who has had much experience in handling commercial

matters and is remarkable for his freedom from anything like departmental prejudice and tradition. The subject of our conversation was the treatment to be meted out to industrial pioneers, and in the course of it he said—I am giving you as nearly as possible his exact words:—“The truth is we are all so desperately afraid somebody is going to make money out of us. Here we have a case of a man who has the pluck to pioneer a new industry for us and we at once set to work to plaster over his agreement with notes and amendments and hedge it in with restrictions until he throws it up in disgust—and serve us right. My view is that such a man should be grappled to our soul with hooks of steel and that we should do everything that in us lies to insure that he makes heaps of money. The more he makes the bigger the advertisement for our goods and the greater the price we can get from the next man”—and he added rather pertinently I thought—“after all the money we are so terrified he will make will not be our money. It will be his own made by an act of creation out of what is now a perfectly useless material.”

Here are three opinions from widely separated sources, one of them from the inner circle itself, which show a remarkable agreement, and, making full allowance for all exaggeration, I suggest that their utterance shows something is wrong somewhere and it is worth while trying to find out what it is.

First and foremost, the head and front of our offending is the exasperating, paralysing and petrifying slowness of Government procedure. You are all aware of the ponderous nature of the process for dealing with an application for a hitherto unexploited forest product. It takes the Local Government some weeks to take notice of the application and send it on to the department for information. You may have to wait for a suitable season to collect the information and you can rarely do it in less than six months and it may easily take twelve. Then the file goes the weary round of the Secretariat treadmill. This mandarin like machine is in itself a sufficient justification for the complaint that Government is the chief obstructionist to development. It emerges finally with fresh reference to the department, and again it paces the weary treadmill round, ultimately being referred to the Supreme Government with another opportunity for the ponderous engine to revolve. Finally, and plastered over with amendments and restrictions—many of which would be described elsewhere as in restraint of trade—in two years (and I have known it take three) after the date of application, the applicant is informed that you are in a position to treat with him. Except in China I doubt if there is any apparatus in the world as perfectly fitted to perform the function of how-not-to-do-it. Meanwhile your customer is dead or gone. No one can afford to earmark and sit on capital throughout such a process. Capital ceases to be capital if it is not used, capital dies if not fed with interest. If not wanted here a flash of the telegraph will send it to China or Peru but another flash will not bring it back. Capital is welcomed everywhere and need wait no man's pleasure. If you don't snap at it when it is offered it won't be there when you want it. So, since we have got to educate our masters let the first precept to be crammed down their necks be that, like time and tide, capital waits for no man.

Now, gentlemen, so far as these delays can be laid at the door of the Department I recognise that they are unavoidable at present because in most instances you do not know what you have to sell. I therefore desire to press upon your attention the necessity of a Forest Industrial Survey and I cannot better indicate precisely what is in my mind than by speaking to you for a few minutes on what I saw in Sweden in 1913. Being then at Home it struck me that it would be a valuable experience, and probably instructive in view of the work we were contemplating here, if I had a look at that extraordinary development of Forest Industries which had characterized Sweden during the previous ten years, but I was rather held back from it by the thought of the amount of time I would waste in hunting up what I wanted to see in what was to me an unknown country. I mentioned my difficulty to a Swedish friend in London who assured me I need feel no apprehension on that score and that he would put me in touch with all the information necessary to save time. In ten days I received from Stockholm a bunch of pamphlets, each being an expert report upon the unexploited locations where such industries were possible.

Each contained a map, with such localities indicated, as also points already occupied by factories in existence. Each was complete to the last possible detail of the manufacturing facilities, and their cost, available at each location dealt with. So complete in fact from the expert point of view that a capitalist in London or elsewhere desiring to embark in any one of these industries could with confidence put his finger on the one or two locations which he considered would suit him best and go and inspect them. If he wished to do so in India he would have to explore the whole country and because that would take years he does not do it. With the aid of these reports and maps I was able to make the most of my time and had an exceedingly instructive tour. If we had such a survey here it seems clear the following advantages would ensue:—

- (a) Both you and the applicants would know what you had to sell and where and under what conditions it was to be found.
- (b) Both of you would know its approximate market value.
- (c) An immense amount of time would be saved in dealing with applications. Business you lose now because of delay would come to you.
- (d) The publication of such a survey would be the best possible advertisement of your goods.

You have, now, every time you meet with a new demand, to make such a survey or something like it and very often your work is thrown away, temporarily at least, because the demand has been met elsewhere before you can finish it.—Mr. Pearson has done some fine work in this direction but let us be ahead of the market and not invariably behind it. It would not in the end cost more than the spasmodic surveys you have to make now. If you had such a comprehensive survey based on Mr. Pearson's model but incorporated with something more of the Swedish detail and expert authority you would be prepared for any enquiry and demand the market may make on you.

That would be my remedy for these paralysing delays coupled with some speeding up in the Secretariats if there is anything under heaven capable of performing such a feat. In the last resort—and many there are who say why not in the first resort—why should not such matters be settled by the department, subject, if you cannot trust it so far, to a few simple and broad rules of policy. After all it is the forester's job and the Secretariats have to be coached by him at every step they take. I know of no official in India who has a better grip of his job, is more free from the swaddling clothes of departmental tradition and prejudice, is more open minded and willing to adapt himself to new conditions and demands, is a better man both with his hands and his brains and closer in touch with commercial affairs than the forester—so I am for giving more power to his elbow.

Another point on which I would touch lightly as having contributed to the opinions I quoted at the beginning of my address is what commercial men describe as the *autocratic monopolistic* attitude adopted by officialdom in India. That such an apprehension exists I have recently had experience of myself. Two London firms whom I was trying to induce to prospect India for what they wanted have declined because "we do not care for the monopolistic attitude exhibited by your Governments and are going elsewhere." So, gentlemen, here is some top-hammer to be got rid of which cuts no ice and for which the twentieth century has no use. Let us condescend to enter the commercial arena at the same level as everybody else. Let us frankly recognise that, except in a limited local sense, we have no monopolies. I doubt if you can mention a single unexploited product which cannot be duplicated a hundred or a thousand times over in the forests of South Eastern Asia, using that terms in its widest geographical sense and including the forests of the Indian Native States. Get your goods surveyed and valued and get them into the market during market hours.

Gentlemen, I thank you for having listened to me so patiently. I am aware I have been preaching to the converted and that any criticisms I have indulged in might have been more appropriately addressed to other quarters, although I have made doots as for their effects there, but their intention has not been to anathematize men but rather systems of which the men are usually the unconscious or unwilling victims. I would have you regard my effort as a voice from the market place and I trust it will do us no harm to have considered for a few moments the new demands and new conditions which the new era is forcing on our attention and the new attitude with which we must deal with them.

W. RAITT.