1950

NEW ZEALAND

THIRD WORLD FORESTRY CONGRESS

(REPORT OF THE NEW ZEALAND DELEGATION TO THE) AT HELSINKI, FINLAND, 10TH JULY TO 20TH JULY, 1949

Laid Before Both Houses of Parliament by Leave

By Authority: R. E. OWEN, Government Printer, Wellington.—1950

LETTER OF TRANSMITTAL FROM THE HON. MINISTER OF FORESTS TO THE RIGHT HON. THE PRIME MINISTER

The Right Hon. the PRIME MINISTER.

SIR,—

I have the honour to transmit a report by the New Zealand delegation which attended the third World Forestry Congress from the 10th to the 20th July, 1949, at Helsinki, Finland. The delegation comprised—

Mr. T. T. C. Birch, Inspector in Charge of Training and Research, New Zealand Forest Service, Chief Delegate.

Mr. K. C. A. Carter, Vice-President, Dominion Federated Sawmillers' Association, Delegate.

Mr. J. Freeman, Vice-President, New Zealand Timber Workers' Union, Delegate.

Both prior and subsequent to the Congress the delegates made separate and independent investigations into numerous matters of public interest. The chief delegate, Mr. T. T. C. Birch, concentrated his investigations on the two subjects of higher forestry education and forestry research. Mr. K. C. A. Carter not only investigated modern logging and milling developments in North America with a view to their possible adaptation to the exploitation of indigenous forests, but also studied milling and merchandising practices in the Scandinavian countries with a view to improving the production and marketing of exotic softwoods for export to Australia. Mr. J. Freeman concentrated his studies upon the working and living conditions of forest and sawmill workers both in Great Britain and in the Scandinavian countries. The results of these independent studies are embodied in separate reports which are attached as appendices to the main report of the delegation.

The purpose of the Congress itself was to review the progress of world forestry since 1936, to provide the opportunity for exchanges of technical views by personal contacts between delegates, and to make recommendations which would convey to individual Governments some idea of united world forestry opinion on all matters of crucial importance. Necessarily of a general nature, the recommendations are applicable more to those countries which have neglected forestry legislation and activities than those which have already evolved a long-term forest policy.

The message of most significance to New Zealand is the importance which the Congress attaches to forestry research. Some forestry research has been carried out ever since the inauguration of the New Zealand Forest Service in 1921, but, due to the shortage of trained personnel, the work was concentrated only on matters of immediate importance. Some long-term projects were initiated just before the commencement of World War II, but not until the post-war period when additional trained staff became available was it possible to make any progress commensurate with the importance of

these activities by setting up a Forest Research Institute at Rotorua. Some aspects of forest research have also been undertaken by the Cawthron Institute, the Department of Scientific and Industrial Research, and the University colleges.

Mr. Birch has therefore suggested that all research both in forest products and in forestry should be co-ordinated by a central advisory committee representative both of research organizations and of the principal growing, converting, and timber using interests in the Dominion. As provision for such committees was made in the Forests Act, 1949, the Director of Forestry has recommended the setting-up of a Forest Research Advisory Committee to advise me on all questions of forestry research, and so to co-ordinate the activities of the various research organizations that economy of effort is secured and duplication of work avoided.

I have, &c.,

E. B. CORBETT,
Minister of Forests.

Office of the Minister of Forests,
Wellington, New Zealand.

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PART I—REPORT ON THIRD WORLD FORESTRY CONGRESS

(Held at Helsinki, 10th to 20th July, 1949)

Submitted by the NEW ZEALAND DELEGATES

CHAPTER I—INTRODUCTION

1. *Invitation to Congress.*—The first World Forestry Congress, arranged by the International Institute of Agriculture, was held in Rome in 1926.

The second World Forestry Congress took place in Budapest in 1936.

The third Congress, which was to have been held in Finland in 1940, was cancelled on account of the war. In September, 1947, the annual Conference of the Food and Agriculture Organization of the United Nations (FAO) included in its resolutions the unanimous wish that Finland should accept the task of the host country for the World Forestry Congress planned for 1949. The Finnish Government accepted the proposal and set up an Organizing Committee which, in consultation with FAO, fixed the date, agenda, and rules, and issued invitations to representatives of forestry and forest industries in all countries to attend the third World Forestry Congress to be held in Helsinki in July, 1949.

2. *Composition of New Zealand Delegation.*—In view of the industrial as well as technical scope of the Congress, and the fact that it was to be held in Scandinavia, where advanced methods in the sawmilling industry are particularly applicable to current development in New Zealand, the Government decided to send a delegation of three representing the Forest Service, the employers, and the employees respectively of the New Zealand milling industry.

The delegates were—

(i) Mr. T. T. C. Birch, Inspector in Charge of Training and Research, New Zealand Forest Service.

(ii) Mr. K. C. A. Carter, Vice-President, Dominion Federated Sawmillers' Association.

(iii) Mr. J. Freeman, Vice-President, New Zealand Timber Workers' Union.

3. *Itineraries of Delegates.*—Mr. Birch left New Zealand on 7th May and, with Mr. Carter and Mr. Freeman, flew from London to Stockholm, *en route* to Helsinki, on 5th July. After the Congress Mr. Birch investigated forestry education and research in Scandinavia and Europe, and interviewed in London a number of applicants for professional appointments to the New Zealand Forest Service. He returned to New Zealand on 30th November.

Mr. Carter decided, instead of proceeding direct to Europe, to study briefly *en route* at his own expense the milling industry in the region of Vancouver, British Colombia. He arrived in London on 2nd July. After the Congress Mr. Carter spent four weeks investigating the sawn-timber industry in Finland, Sweden, and Norway; he returned to New Zealand on 3rd September.

Mr. Freeman left New Zealand on 14th May, proceeding direct to the United Kingdom. After the Congress he investigated the Scandinavian milling industry in general, and man-power organization and employer-employee relations in particular; he returned to New Zealand on 26th September.

CHAPTER II—ORGANIZATION AND CONDUCT OF CONGRESS

1. *General Description of the Congress.*—Delegates, assembled in Helsinki, first took part in one of a number of organized excursions on 7th, 8th, and 9th July. Each excursion of several hundred miles introduced delegates to representative Finnish forests and forest industries, and provided a valuable opportunity for informal discussion and establishment of personal contacts before commencement of formal Congress proceedings.

The total membership of the Congress was 535, representing twenty-nine countries and four international organizations, including FAO.

The most conspicuous absentee countries from the Congress were China and South Africa. Scandinavia and northern European countries were particularly well represented by forest industrialists and economists, research foresters, and educationists, which resulted in many valuable contacts being made by the members of the New Zealand delegation, greatly to the benefit of their subsequent investigations.

The first plenary session on 11th July elected the President of the Congress (Professor E. Saari, of Finland), three Co-Presidents, five Vice-Presidents, five Chairmen and ten Vice-Chairmen, a Drafting Committee of eight, and a Secretary-General (Mr. H. Leppo, of Finland). In accordance with the rules of procedure, the General Committee included the President, Co-Presidents, Vice-Presidents, Chairmen of Sections, Secretary-General, and a FAO representative.

The Congress was opened by the Prime Minister of Finland, Mr. K. A. Fagerholm, and welcomed by His Excellency, Mr. J. K. Passikivi, the President of the Republic of Finland.

Messages expressing the good wishes of the Secretary-General of the United Nations and the Director-General of the Food and Agriculture Organizations of the United Nations were brought by their respective representatives, Mr. D. Roy Cameron and Mr. Marcel Leloup.

At the *second plenary session*, in the afternoon of 11th July, Mr. Leloup presented a report on the Food and Agriculture Organization of the United Nations, the role of the Organization's Forestry and Forest Products Division, and the results expected from the third World Forestry Congress. Other general reports presented by FAO were on Forest Resources and Human Needs for Wood (Mr. Harrison), and on the Conversion of Virgin Forests into Managed Forests (Mr. Francois).

The *third plenary session* was held in the morning of the 12th July: Mr. Scarvenius (FAO) presented a paper on Silviculture and Workers, and was followed by Mr. Glesinger (FAO), who presented a report on Silviculture as Affected by Present-day Trends in the Forest Industries. Mr. Streffert, of Sweden, then presented a paper on the Effect of Industrial and Chemical Development on Silviculture and Forest Management.

Mr. Fontaine (FAO) presented a paper on Forest Combines; and, finally, Mr. Fjellstad, of Norway, gave a brief historical survey, based on his long personal experience, of the development of international co-operation in forestry.

The afternoon of the 12th July and the following four days (13th–16th July) were occupied in Section meetings. The General Committee summarized the work of Sections on 17th and 18th, and prepared the general report on the Congress for submission to the *final plenary session* on the 19th July. The report, after discussion and minor amendment, was duly adopted, and was printed and distributed before delegates left Finland.

2. *Organization of the Congress.*—The preliminary organization of the Congress was undertaken by a Committee of twenty-four Finnish foresters and industrialists appointed by the Government. A team of eight FAO officials co-operated in the organization of

Sections procedure and general conduct of the Congress. The Congress office, under the direction of the Secretary-General, provided all necessary administrative facilities, including banking, postal, information, typing pool, and interpretation.

The plenary sessions were held in the Great Hall of the University of Helsinki, but the Congress Headquarters were located, and all Section meetings conducted, in the Forestry Building, normally occupied by the School of Forestry and Forest Research Institute, a worthy and inspiring venue for a World Forestry Congress.

Delegates were accommodated in numerous hotels throughout Helsinki; the numbers involved necessitated such distribution, but imposed difficulties on delegates wishing to arrange informal meetings. The organized entertainment of delegates included receptions by the President of the Republic, City of Helsinki, and Minister of Agriculture; concerts; and invitations to the homes of Finnish foresters.

The organization of the Congress was highly efficient, and the programme, which by reason of its size and diversity imposed a severe strain on both delegates and executives, proceeded with a smoothness which reflected great credit on the President and his officials and FAO staff. The hospitality of the Government and the Finnish people reached a degree of spontaneous sincerity which deeply impressed all delegates.

3. *Proceedings of the Congress.*—The agenda for the five Sections, which worked simultaneously, were as follows:—

Section I: Silvics and Silviculture:—

(1) Development and silvicultural treatment of virgin forests—
  (*a*) In the tropics.
  (*b*) Elsewhere.
(2) Biology and technique of afforestation.
(3) Forest genetics.

Section II: Forest Surveys:—

(1) Sampling method and intensity of forestry.
(2) Different survey methods of large areas—
  (*a*) Aerial photography.
  (*b*) Other methods.
(3) Determining the increment.
(4) Co-ordination of data of large areas.

Section III: Forest Economics, Including Forest Policy:

(1) Economics and policy of exploiting virgin forests—
  (*a*) In the tropics.
  (*b*) Elsewhere.
(2) Economics and policy of afforestation.
(3) Relations of forestry to agriculture in rural economy.
(4) Measures for safeguarding sustained yield.
(5) Employment and unemployment in forestry.

Section IV: Forest Utilization:—

(1) Co-ordination of methods in research on efficiency of labour.
(2) Improvement of efficiency in logging—
  (*a*) In the tropics.
  (*b*) Elsewhere.

Section V: Forest Industries:—

(1) Prefabricated wooden houses and their component parts.
(2) Waste wood in the forest and industry.
(3) Progress in wood chemical industries.
(4) Preservation of timber.

The proceedings of Sections consisted of the reading of summarized general and special papers respectively, followed by discussion from the floor. The official languages were English and French, an interpreter translating all statements into the alternative language. One *general paper* only on each subject was permitted ; the aim of these papers was to give a short general review of the subject and to indicate a proper course and objectives for the discussion. For the oral delivery of a general paper, twenty minutes was allotted. *Special papers* dealt with any subject within the section agenda from the point of view of the author himself ; for oral delivery not more than ten minutes was allowed.

Over one hundred papers were delivered and discussed, the general conclusions therefrom forming the basis of the final report and recommendations. Printed summaries of special papers were issued to delegates as they were read ; it would add greatly to the value of discussions if, in future Congresses, papers were made available to delegates in advance, preferably before they left their respective countries. The full texts of many papers will, however, be published in the proceedings of the Congress, which will constitute a valuable addition to world forestry literature.

The New Zealand delegates attended different Sections by arrangment, and thus covered the proceedings as far as was possible, Mr. Birch attending Sections I and II, and Messrs. Carter and Freeman Sections III, IV, and V. The minutes of all Section meetings were issued daily.

CHAPTER III—GENERAL REPORT OF THE THIRD WORLD FORESTRY CONGRESS

NOTE.—In this Chapter a sequence of extracts applicable or of special interest to New Zealand are reproduced from the general report of the Congress.

Relevant comments representing the combined views of the New Zealand delegates are interpolated (printed in italics).

The marginal figures in this Chapter refer to the corresponding paragraphs in the official general report of the Congress.

9. " The Congress has provided ample opportunity for foresters, industrialists and technicians from all parts of the world to meet, exchange views and experience and to establish or renew personal relations which will stimulate and facilitate their work in the coming years."

10. " The recognition of the role of forests in modern society is no longer confined to a small group of specialists. The importance of forests for soil conservation, their protective functions as well as the vital contribution which an increasing variety of forest products makes to modern economy, are far better understood and appreciated by Governments, industries, and by the public at large than at the time of the First and Second World Forestry Congresses."

11. " One of the most striking changes of the past 13 years is the recognition of the principle that the management and conservation of forests and the manufacture and distribution of forest products must be regarded as an inseparable whole. It is the primary task of the forester to grow and produce both the amounts and the kinds of forest produce needed by industry and other consumers for the optimum satisfaction of human needs compatible with the protective role of forests and the conservation of land productivity. At the same time it is the responsibility of technical research and industrial development to provide suitable outlets for all products of the forest crop and to adjust conversion methods and uses to the limitations and requirements of sound silviculture."

The Forests Act, 1949, provides for the setting-up of advisory committees by means of which various forestry interests may express their views, decide, and co-ordinate policies. A Timber Production Advisory Committee is already functioning in New Zealand.

12. "It was generally agreed that the evolution of forestry technique and wood technology had been considerably influenced by progress made in the scientific field."

13. "It would be wrong and unrealistic to conclude that all is well in world forestry. Indeed much remains to be done. Further research is needed to widen the area of common forestry knowledge. The understanding of the role of forests among Governments and the public is not always sufficient. Hence many countries still have no proper forest policy while in others the application of sound forestry principles is defeated by numerous obstacles. Co-operation between industrialists and foresters must be considerably strengthened. There is still much destructive cutting, which ought to be stopped."

14. "Despite these shortcomings this Congress believes that since 1936 there has been progress in the right direction. Recognition of these shortcomings as well as the work of FAO, especially in implementing the specific recommendations which follow, should facilitate and speed further progress."

There has been much progress in New Zealand forestry since 1936; but it is equally true to say that much still remains to be done. Public understanding of the role of forests and their proper utilization in New Zealand is still insufficient, although appreciably greater than ten years ago.

The urgent need for research has always been recognized by the New Zealand Forest Service, and prosecuted to the limit of personnel and funds available, but both have to date been inadequate.

It is considered that immediate steps should be taken to expand and co-ordinate the work of the various research organizations dealing with forestry and forest products.

General Recommendations on Policy

15. "*The Third World Forestry Congress* affirms its belief

(*a*) "That each country should have for its territory a forest policy aiming at the maintenance of a reasonable forest area and at the conservation and use of forests on the basis of continuous and improved production.

(*b*) "That forestry legislation, research, education of forest owners and workers, and training of a sufficient number of professional foresters and technicians—all in conformity with the constitution and structure of each country—constitute essential elements of such a policy."

New Zealand has had a basically sound forest policy since the passing of the Forests Act, 1921-22, and it has been more or less under constant review ever since, culminating in its revision and consolidation in 1949.

The establishment of the Forest Research Institute at Rotorua, the provision of training for sub-professional staff and employees, and the fostering of higher forestry education to ensure that an adequate number of professional foresters are available in New Zealand in the future—all are recognized as essential and somewhat belated elements of the original policy. Higher forestry education should be undertaken by the University in the locality most suited to inspire both staff and students.

16. " *The Third World Forestry Congress* commending the work of the Food and Agriculture Organization of United Nations (FAO) Recommends

(*a*) " That FAO prepare a statement of forestry principles for the consideration of member nations,

(*b*) " That FAO assist those nations which are now formulating their forest policy,

(*c*) " That the annual Conference of FAO explore whatever further steps member Governments consider appropriate for the application of the principles stated above."

New Zealand should continue to co-operate with FAO, and its statement of forestry principles should be carefully examined when available. It should, however, be borne in mind that the problems confronting New Zealand differ very materially from those confronting Europe and other countries facing a diminishing supply of wood, and allowance made accordingly. The abnormality of age classes in exotic forests, the preponderance of which were planted in five years, is a problem peculiar to New Zealand.

17. The discussions and resolutions of the Congress are classified and summarized according to the principal subject under review as follows:—

Section I—Silvics and Silviculture

A. *Development and Silvicultural Treatment of Virgin Forests*

18. " The Congress recognizes that the natural laws regulating the evolution of vegetative associations are similar in tropical and other countries, that their evaluation should constitute the chief item of research in all countries, and that knowledge of them should everywhere form the basis of the silvicultural treatments of virgin forests."

The principle is recognized in New Zealand and is being acted upon by the Forest Research Institute to the extent of available qualified staff.

B. *Biology and Technique of Afforestation*

24. " The Congress recognizes the importance of obtaining the fullest information on the synecology of forest communities and their status in relation to natural successions and climaxes."

25. " It recognizes the importance of exact data on the evolution of the biological complex of forest soils. Further studies on root physiology and on the effect on the soil of a tree cover of the species most used in afforestation appear very desirable. The Congress recommends that the FAO and the International Union of Forest Research Organizations be asked to give special attention to this subject."

Research on forest soils in relation to tree cover is to be undertaken by the Forest Research Institute; the recommendation of the Congress emphasizes the specialized nature of this research, which calls for a knowledge of forestry as well as forest soils.

27. " The Congress desires to have more precise information on the effect of exotic species on natural forest communities and their sites. Such knowledge will provide guidance for the choice of species for afforestation, economic questions being also taken into consideration. An international documentation on this point and on the technique of afforestation in the natural regions as well as on the various cases in which reafforestation is an indispensable or complementary method for soil conservation seems to be desirable."

28. " It emphasizes the importance of mechanization in afforestation work."

As far as the mechanization of the actual work of tree-planting is concerned, New Zealand so far has done little, but it is doubtful if any country has used mechanical equipment to a greater extent for the preparation of the land for actual planting. Power-operated machines, principally American, have been used in the preparation of roads, fire-breaks, &c., for many years, and it is proposed shortly to undertake trials with various types of tree-planting machines.

29. " It seems that the general economy of a country is influenced by the proportional distribution of forest and cultivated land. This distribution has considerable influence on the total economy of water and the maintenance of soil fertility. Studies of the most suitable proportion between forests and cultivated surfaces under different climates seem to be desirable. Protection of soils and water economy, and the maintenance of climatic equilibrium justify in certain cases the creation of protective stands, even if the trees which comprise them have in themselves only slight technological value."

The maintenance and expansion of high-level protection forests are essential elements of New Zealand forest policy in the national interests of the protection of soil and water economy. (See para. 53.)

C. *Forest Genetics*

30. " The importance of genetics as an indispensable basis of forest economy cannot be questioned at the present time."

31. " The Congress RECOMMENDS

(*a*) " That the Governments should take steps to facilitate the rapid exchange of seed and living plant material in small quantities between State Forest Services or Forest Research Institutes.

(*b*) " That Governments should study the possibility of exempting such material from customs duty when accompanied by an internationally standardized declaration emanating from the above-mentioned services or institutions."

Such material is exempt from New Zealand Customs duty. The 1949 revision of the Forests Act provides for protective measures against introduction of plant diseases and insects.

34. " In the question of seed production it appears that the practical and inexpensive system of seed orchards is destined to provide tree seed in significant quantities. While awaiting the realization of this technical progress, it is recommended that, where practicable, the seed harvest should only be derived from recognized elite stands of trees."

Research on the practicability of perpetuating the best stands of exotic species has been commenced by the Forest Research Institute; in the meantime the Forest Service and enlightened private organizations may be expected to continue to practice and advocate the accepted practice of collecting seed only from the best available stands.

SECTION II—FOREST SURVEYS

35. " The general conviction was that the most effective basis of determining the yield available for utilization upon a sustained and progressive basis is the knowledge of growing stock and its increment, including problems of the accurate determination of these factors."

A. *Aerial Forest Surveys*

" The Congress considers

" That aerial photography provides a valuable aid to the preparation of forest maps and forest inventories and

" That it is of special value for the surveying of large forest areas,

" That, in the present stage of technical development, aerial surveys must be supplemented by examination of the forests on the ground, in order to secure additional information essential to forest management, and

" That the choice of aerial survey methods in each country must be governed by the nature of the forests of that country, and

40. " RECOMMENDS

(*a*) " That all countries should review their forest inventory procedures in order to ensure that the potential usefulness of aerial survey methods is being fully realized,

(*b*) " That research and development of improved methods and equipment for making and interpreting aerial photographs should be energetically pursued, and

(*c*) " That all institutions for higher forestry education should, where practicable, offer courses in photogrammetry to their students."

The national forest survey, which commenced the inventory of all New Zealand indigenous forests in 1945, has covered more than 1,600,000 acres to date.

The current progress (500,000 acres in 1948-49 year) is only made possible by co-ordinated aerial photography and the use of modern statistical methods. New Zealand is represented on a Technical Committee on Aerial Survey of Forests set up by the Government of the United Kingdom, upon the recommendation of the fifth British Empire Forestry Conference. The procedure of the survey is constantly under review to maintain the highest standards.

B. *Methods of Determining Forest Increment*

42. " The Congress, recognizing that knowledge of forest increment is essential to forest management for sustained and progressive yield, and that determination of increment entails the solution of problems of great complexity,

" RECOMMENDS

" That the International Union of Forest Research Organizations be requested to undertake, through its constituent Organizations, an investigation of methods of rapidly ascertaining the increment of forests on a regional basis."

The New Zealand Forest Research Institute is a member of the International Union of Forest Research Organizations and would be willing to co-operate in such an investigation, subject to limitations enforced by the nature of podocarp forests. The problem of regional increment in beech forests is likely to claim precedence in New Zealand.

C. *Comparative Study of Inventory Methods*

44. " The Congress reviewed the objectives of the world-wide study of forest inventory methods which had been undertaken by the Forestry and Forest Products Division of FAO."

45. " In this connection some discussion arose as to whether future silvicultural treatments should aim at production of trees of high quality or at production of maximum volume of wood. It was informally agreed that ' quality ' was not the

correct word to be used in a discussion conducted in world-wide terms, but that the forests of each country should be managed so as to secure maximum utility under the conditions actually existing in that country."

Only by a silvicultural policy aimed at the production of high-quality saw, veneer, and pole logs, together with pulpwood if practicable, does New Zealand consider that the balanced requirements of any highly civilized country can be met.

46. "The Congress recognizes the importance of forest surveys in developing reliable statistics that are prerequisite to the determination of forest policy, and

"Recognizing the complexity of forest surveys, and the wide variety of technique employed, and that a forest survey provides opportunity for formulating prescriptions for silvicultural treatments, endorses the FAO study of the principles underlying the forest surveys of the various nations, and

47. "RECOMMENDS

(*a*) "Speedy completion of this study,

(*b*) "Enunciation in suitable form by FAO of the principles and technique that are shown by the study to merit wide application,

(*c*) "Co-operation by member nations in assisting FAO to complete the study."

New Zealand has provided FAO with required information on national forest survey procedure and hopes to derive benefit from the FAO study of forest survey principles.

D. *Catchment Areas and Water-supplies*

48. "The subject of protection of catchment areas or drainage basins of streams through the maintenance of adequate protective forest cover was raised.

50. "Attention was drawn to the tendency in some quarters to assume that streams subject to alternate floods and minimum flow can be controlled satisfactorily by dams, storage basins and other engineering works, without re-establishing of forests. The Congress was in complete disagreement with this view."

53. "The Congress emphasizes that failure to protect adequate forest cover in the catchment areas of streams against fire, improper methods of cutting, uncontrolled shifting cultivation, excessive grazing or other destructive forces can have calamitous results with respect to agriculture, fresh water fisheries and industrial developments; warns against the dangers of such neglect; and

"RECOMMENDS

"That corrective measures should be undertaken wherever necessary."

The work of the Soil Conservation and Rivers Control Council and the twelve Catchment Boards (on all of which forestry interests are represented by Forest Officers) is contributing in an increased extent to the protection of catchment areas throughout New Zealand, and by combating the consequences of destroyed forest vegetation in hill country.

In pursuance of policy, the Forest Service has actively opposed uncontrolled logging in protective forests, and has been responsible in the past twelve months for returning to forestry land use seven areas totalling 46,000 acres. These submarginal areas were unsuitable for agriculture and will be locked up and regeneration encouraged by extermination of pests and exclusion of fire.

Section III—Forest Economics

B. *Economics and Policy of Afforestation*

57. "Problems of afforestation presented technical, social and economic aspects of which the relative importance varied from country to country. Technical aspects such as protection of the soil and the conservation of water-supplies are well recognized and no discussion was raised on these points."

58. "Regarding the economic aspects of the afforestation problem, the Congress noted the tendency to carry out afforestation by means of planting soft wood and fast growing broad-leaved species in order to satisfy the demand for soft wood sawn timber and wood pulp. With regard to the social aspects, the Congress stressed the role of afforestation in keeping the population on the land, stabilizing employment and raising living standards."

The future stability of the timber industry in New Zealand is dependent not only upon a healthy domestic trade, but on the maintenance and expansion of export, particularly in exotic softwoods to Australia, on an economic basis. All avenues of reducing internal costs, transport, shipping, and handling will need to be explored, to keep the industry on a sound economic basis, and provide an outlet for the increasing volume of timber which will become available.

59. "In conclusion the Congress urged the institution of long term programmes in this field and emphasized the importance which Government subsidies and publicity might have in the carrying out of such programmes."

C. *Relation of Forestry to Agriculture in Rural Economy*

60. "The discussions which took place in the Congress subsequent to the presentation of the reports demonstrated the close relationship which exists between agriculture and forestry, which might in certain cases go almost as far as to completely merge the two activities, as in certain regions, where the farmers were nearly all forest owners."

61. "This close relationship is indispensable to the maximum utilization of land areas, since it permits a harmonious balance between forestry, pasturage and agricultural production. From the social point of view, moreover, this close co-operation would be evidenced in the stability of labour: land workers would be able to find remunerative employment alternately in agricultural and forestry work including afforestation."

Whilst the relationship between farming and forestry in New Zealand is not as intimate as in Europe, the need for planning based on the allocation of each type of land for the purpose for which it is best suited is recognized in New Zealand and is provided for in the Soil Conservation and Rivers Control Act of 1941.

One aspect which is commended for more general recognition is the desirability of afforesting at least some land otherwise suitable for agriculture in order to provide timber economically for each major land district.

D. *Measures Designed to Ensure Sustained Yields*

"The Congress also noted the importance of good fiscal practice in the interests of good silviculture and considered that a reasonable allowance should be made by Governments on account of investments necessary for forest improvement until progressive yield is achieved."

The results of investigations by a Forest Economist who has visited Europe to study forest taxation will be the basis for the re-examination of taxation of private forestry operations in New Zealand. It is considered that, in view of the large areas of waste land in New Zealand, forest taxation policy should be so developed as to provide farmers and other holders of private tracts of waste land with a positive incentive to plant such areas.

Some improvement has been made during the past year in the method of taxing forest income, and the burden of taxation on farmers and afforestation companies is now more equitable than it was formerly, but anomalies still exist.

E. *Employment and Unemployment in Forestry*

64. "The situation of forest workers and technicians was discussed. It was agreed that continuous production was essential for the stability and the security of these workers."

65. "With regard to forestry workers properly so-called the Congress considered that it was desirable to give them greater stability of employment. This called for better conditions of work, housing, food and social security."

"Vocational training was also indispensable in order to secure the maximum of productivity which would in turn lead to an improvement of economic conditions."

Much has already been achieved in New Zealand towards ensuring stability of forest employment, which is recognized as a vital factor in the forest economy of the Dominion. Examples of progress made are quoted under Congress Recommendation 68.

SECTION IV—FOREST UTILIZATION

67. "The main issue concerned the economic and social conditions of forest workers and the effect of these on the application of silvicultural methods."

68. "Recognizing that there exists in many countries a necessity for improving working and living conditions in forest work and forest industries, and that in many countries the benefits to be derived by the workers are irrevocably tied up with the financial returns of the industries concerned.

"The Congress RECOMMENDS that, in considering matters pertaining to forest exploitation, both social and economic implications be borne in mind."

Recognizing the validity in New Zealand of the above principles, a hire-purchase scheme for the improved housing of sawmill workers in the indigenous-timber industry was inaugurated in 1946, resulting in the erection to date of 409 demountable-type houses and the approval for erection of a further 319 houses. (See para. 84.) The establishment of central forest communities is a further development which is gaining impetus in both private industry and State forest enterprises.

For example, Forest Products, Ltd.'s, village or small township at Kinleith when completed will be a model settlement offering permanent employment ultimately to probably 1,000 workers and their families. Similarly, the forest and logging village at Matahina established by the Whakatane Board Mills, Ltd., will offer permanent and attractive living conditions for the workers engaged permanently there in that industry.

At Kaingaroa and at Waipa (Rotorua) the Forest Service has established logging and sawmill settlements for staff and employees; in the South Island similar settlements have been established in the forests of Golden Downs, Eyrewell, and Balmoral.

Particularly satisfactory results have been achieved in the indigenous-forest settlement at Minginui near Te Whaiti, where a large group of dwellings has been completed, streets and gardens laid out, a school established, and where tennis-courts and other recreation grounds, a hall, and community centre are in process of construction or planned for early completion. The objective in both cases is to house all forest and sawmill workers for the forest itself and for a group of exotic mills in one attractive centre.

In the building of forest workers' houses in Tapanui and Hanmer Springs adjoining large exotic forests, advantage is being taken of the town or borough facilities provided, and the increase in population will materially assist these places both socially and economically.

69. "Recognizing that forest conservation and wood utilization are dominant factors in the national economy of many countries, and that there is urgent need for the improvement of working procedures,

"The Congress RECOMMENDS that schools be instituted in as many countries as necessary for the specialized training of forest labour."

For some years the Forest Service has provided training courses for selected forest workmen with a view to encouraging those with the potential qualities necessary for higher responsibilities.

70. "Recognizing the importance of improved labour efficiency in harvesting forestry products, and the need for extended time studies related to both hand tools and mechanized equipment,

"The Congress RECOMMENDS that a permanent sub-committee of the Standing Advisory Committee for Forestry and Forest Products of FAO, composed of experts from various countries, be established for the purpose of co-ordinating time studies in forest work and all other methods of study related to the various types of hand tools and mechanical harvesting devices as used in forest operations throughout the world."

71. "At the same time, the Congress urges that FAO continue its activities in gathering and distributing information regarding logging equipment and technique, as a means of implementing the preceding recommendation."

The practicability and usefulness of the recommendations contained in paragraphs 70 and 71 are doubted in New Zealand.

SECTION V—FOREST INDUSTRIES

A. *Interrelationship Between Forestry and Industry*

"The Congress RECOMMENDS

74. "That a programme of scientific, technical and economic research on wood should be carried out in all countries by means of a close co-operation between the interested parties for the purpose of co-ordinating forest production and wood-using industries,

"That silviculturists should endeavour to increase the quantity and to improve the quality of forest products, according to the needs and trends of industry, on the basis of continuous production, and in conformity with sound silvicultural practice,

"That industry should endeavour to utilise forest products in the best way possible, taking into consideration the trend towards a decrease in fuel wood consumption,

"That industry should be invited to develop further the utilization of wood from non-coniferous species, wood in small dimensions, and, if possible, bark."

It is the policy of the New Zealand Forest Service to work towards the full implementation of the above multiple recommendation, in co-operation with the wood-using industries. (See para. 11.)

B. *Wood Waste in the Forest and Industry*

"The Congress RECOMMENDS

77. "The encouragement of co-ordination or integration of the various wood-using industries,

"That efforts should be made not only to expand outlets for wood waste but also to create new ones in conformity with technical and industrial progress"

Two New Zealand companies have adopted integration as fundamental to their utilization programmes, one by combining sawmilling and boxmaking with insulating and hard board manufacture, and the other by combining sawmilling with paper-board production. Both plan further extension to their integration policies. Likewise the New Zealand Forest Service has planned an integrated sawmill and pulp and paper plant. Wherever practicable, integrated plants should use waste from adjacent small plants.

" That special attention should be given to the grading of timber in order to ensure to each product its appropriate use."

The grading of timber has received very special attention in New Zealand with the view to stimulating domestic and export demands for the exotic coniferous timbers now being sawn in considerable quantities, and also the relatively little-used indigenous hardwoods.

In this connection the operation of price control, based on costs of production rather than the true intrinsic values of various grades and species, has prevented the full achievement of this objective in New Zealand.

78. " That scientific research aiming at the utilization of wood waste should be continued and increased from the physical, chemical, mechanical and biological point of view,

" That, in order to attain these aims, the laboratories concerned are invited to co-ordinate scientific and technical research and FAO should collect and disseminate information on the result achieved in various countries."

D. *Preservation of Wood*

81. " The Congress recognizes

" The importance of wood preservation in reducing wastage caused by deterioration during storage and use, thus also making increased quantities of timber available,

" That woods which are otherwise difficult to impregnate may be satisfactorily treated by the application of high pressure, and

" The importance of boric acid in treating sapwood of broad-leaved species in order to prevent attack by *lyctus*, and

82. " The importance of structural design and the fire-proofing of timber in reducing the risks of fire."

The question of increasing facilities for wood preservation in New Zealand is now receiving active consideration from both industry and Government because of the gradual and inevitable change from the use of the naturally durable but diminishing indigenous timbers to generally non-durable exotic species. As the use of exotic timbers increases, wood preservation must of necessity be undertaken on an increasing scale.

The importance of boric acid and borax in treating sapwood of broad-leaved trees against borer attack is now generally appreciated in New Zealand and a number of plants for this purpose are expected to come into operation in 1950. Because of the large field covered by wood preservation, it is impractical for New Zealand to undertake extensive and fundamental research thereon ; to remain abreast of progress in this rapidly changing field periodic visits overseas by specialist officers would be most appropriate.

E. *Prefabricated Wooden Houses*

83. " The Congress recognizes

" The importance of prefabricated wooden houses in meeting the present housing emergency by providing a rapid means of erection and in circumventing the shortage of skilled labour which would be necessary for the construction of houses according to more orthodox methods,

" That the optimistic views previously held with regard to pre-fabricated houses have not been substantiated, and

84. " RECOMMENDS that houses must have more individuality in character, and

" That various component parts be standardized to a high degree."

Congress conclusions on prefabricated wooden houses appear to be in line with New Zealand's experience and ideas. Demand for individuality limits the acceptance in New Zealand of conventionally designed prefabricated houses. It is, however, agreed that the standardization of component parts offers considerable scope for accelerating the provision of houses, particularly in rural districts, and in reducing costs. To a considerable extent this principle has been adopted in the provision of houses under the sawmill workers' accommodation scheme (see para. 68), where the house sections are factory made in the cities and merely require erection in the rural districts. The houses are all demountable, which permits their transfer if for any reason they are no longer required at the site of original erection.

The increased adoption of " pre-cutting " at a central point and delivery of materials to the site, all ready for erection, has achieved a similar purpose in New Zealand, without the disadvantage of full prefabrication.

F. *The Tapping of Pines for Resin and Turpentine*

85. " The Congress recognizes

" That the production of resin can be stimulated by chemical treatment, and urges that research along these lines be continued,

86. " That it is also important to pursue research on the influence of tapping upon the biology and properties of pinewood."

Labour costs for collection of gum have as yet made tapping economically unattractive in New Zealand, although there is evidence of the yield from exotic conifers being satisfactory. Nor is the concentration of resins in stump wood in most pine stands in New Zealand sufficient to warrant development of distillation methods at this stage.

General

Compilation of a Multilingual Dictionary

" On the basis of a draft resolution submitted by a Working Group set up by the General Committee under the Chairmanship of Mr. Leloup,

" The Congress RECOMMENDS

" That a multilingual forestry dictionary should be prepared in the English, French, German, Italian, Russian, Spanish and Swedish languages, and that the United Nations with the help of FAO and IUFRO should give immediate consideration to this project, endeavour to arrange for international adoption of the necessary definitions, and find ways and means for the preparation and publication of such a dictionary."

CHAPTER IV—SUMMARY AND CONCLUSIONS

1. The President rightly emphasized that the Congress was " a forum where a number of the most prominent representatives of forestry and forest technology in the world met together in conference. They reached numerous conclusions which, however, will be of no practical value until they are made known to the Governments of every country, their Parliaments and all the institutions and persons engaged in the conservation and utilization of forest resources."

2. The general recommendation on policy is worthy of special consideration by the Government, particularly in regard to the elements (legislation, research, and education) considered by so influential an assembly to be essential in a national forest policy.

3. It is also of importance in providing confirmation of the basic soundness of New Zealand forest policy, which in no way deviates from the principles accepted and recommended by the Congress.

4. The New Zealand delegates are of the opinion that the following specific Congress findings are worthy of special notice in their direct bearing on New Zealand forest policy :—

(*a*) The importance of good fiscal practice in the interests of good silviculture (para. 63).

(*b*) The general economy of a country is influenced by the proportional distribution of forest and cultivated land (para. 29).

(*c*) Forests play a decisive part in stabilizing water regimes and preventing soil erosion (para. 52).

(*d*) The Congress stressed the role of afforestation in keeping the population on the land, stabilizing employment, and raising living standards (para. 58).

(*e*) Continuous production on an economic basis is essential for the stability and security of forest workers (para. 64).

(*f*) Vocational training is indispensable in order to ensure maximum of productivity (para. 65).

(*g*) A programme of scientific, technical, and economic research on wood should be carried out in all countries by means of close co-operation between the interested parties for the purpose of co-ordinating forest production and wood-using industries (para. 74).

(*h*) The evolution of vegetative associations should constitute the chief stem of research in all countries (para. 18).

(*i*) The problem of the utilization of wood waste remains one of the main pre-occupations of forest economy (para. 75).

(*j*) The Congress recognizes the importance of wood preservation in reducing wastage (para. 81).

(*k*) The Congress recognizes the importance, within limitations, of prefabricated wooden houses (para. 83).

5. A report on the Congress would not be complete without reference to the work and contribution of FAO. Its forestry representatives at the Congress were not free from criticism by delegates, who sensed a degree of detachment from realities in their formal pronouncements and a desire to expand their activities beyond the capacity of such an organization to achieve practical value.

6. The New Zealand delegates are firmly convinced that personal liaisons formed between New Zealand specialists and their overseas counterparts are of great benefit to this Dominion ; periodic association with recognized world authorities, particularly in research fields, is considered to be an essential element of progress.

PART II—A SURVEY OF EUROPEAN FORESTRY EDUCATION AND RESEARCH ORGANIZATION

(With particular reference to continental institutions)

By T. T. C. Birch, M.A. (Oxon.), New Zealand Forest Service

INTRODUCTION

Between July and September of 1949 the following countries were visited to study the administration and organization of forestry education and research : Germany, France, Switzerland, Italy, Finland, Sweden, Norway, and Denmark.

The opportunity was taken to visit two of the four British Schools of Forestry (Oxford and Edinburgh), but the primary objective was to gain an appreciation of continental forestry institutions, particularly in those countries possessing great forestry resources and long traditions in forestry education research.

Although much valuable detail was collected in these eight continental countries, the investigation was more in the nature of a comparative study of organization, and a seeking after fundamental education and research administrative principles which have been adopted as a result of experience in older countries, and which should not be overlooked or ignored in a younger country such as New Zealand, which is on the threshold of important decisions affecting forestry education and research.

The writer must record his appreciation of the opportunity to undertake this tour of duty: he has found it impossible to record in this report the benefit gained by personal contact with so many eminent European foresters, but cannot too strongly emphasize the value of overseas contacts in gaining perspective of our own national problems. The report is divided into ten Chapters, dealing in turn with the institutions in each country visited, and concluding with a Chapter summarizing conclusions and recommendations.

CHAPTER I—GERMANY

1. Perhaps in no other field of science is education and research so closely interrelated as in German forestry, which can claim to be the oldest established in the world.

There is no country where its influence has not penetrated, and the names of such great German foresters as Hartig, Coota, Hundeshagen, Pfiel, Pressler, Judeich, Gayer, and Schwappach are world renowned, apart from Schlich and Brandis, so well known to British Empire foresters. Thus, although the progress of forestry education and research has been retarded by the war, and adversely influenced by Nazi administration, German forestry must continue to claim world interest.

Pre-war Forestry Education in Germany

2. Despite the centralization of forestry authority in the German Forest Service (Reichsforstamt) since 1934, which laid down the over-all policy, the administration of each "land" (region) was completely independent as regards forestry education and research. This independence was jealously guarded and probably resulted in some lack of uniformity and even standards.

3. Before the war, higher forestry education was taught at six colleges, namely—

(1) *Forest College of Tharandt.*—Established in 1811 as a Government Forestry Institute; in 1929 became a branch of the Polytechnical University of Dresden. (Now is in Soviet Zone.)

(2) *Forest College of Eberswalde.*—Founded in 1821 as a branch of the Berlin University, but transferred in 1830 to Eberswalde as the Forest College and Research Institute for Prussia. The course of study and research included both forestry research and timber technology. (Now in Soviet Zone.)

(3) *Forest Institute of the University of Freiburg (Baden).*—This Institute was the result of the amalgamation of the Forest Institutes of Karlsruhe and Tuebingen in 1920. The Forestry Research Institute of Baden is also situated at Freiburg. (Now in French Zone.)

(4) *Forest Institute of the University of Giessen (Hessen).*—Founded in 1825, was the oldest forest school attached to a University in Germany; connected with Giessen was the Forestry Research Institute of Hessen. (Closed down as redundant in 1938.)

(5) *School of Forestry, Hann-Muenden (Hanover).*—Founded in 1868 as a separate college; became incorporated in the University of Goettingen as a faculty in 1938. (Now in British Zone.)

(6) *Forest Institute of the University of Munich (Bavaria).*—Formerly at Aschaffenburg, was removed to Munich, becoming incorporated in the University in 1910. Affiliated with the faculty is a Forestry Research Institute. (Now in American Zone.)

4. Forestry education in Germany has for many years been the subject of considerable struggle between those who favoured the separate college governed entirely by the dictates of the Forestry Administration, and those who favoured the wider field of knowledge and association offered by a University faculty. Within the last fifteen years, and originating with the establishment of the late Reichsforstamt in Berlin, there have been many cases of interference by the Forestry Administration with the educational affairs of the forestry academies or faculties and the forcing of forestry officials on to the lecturing establishment, thus infringing their independence and self-administration. Generally speaking, Northern Germany favoured the special Institute for the training of forestry officials, while South Germany favoured the wider field afforded by the University faculties concerned both in education and research.

5. It is perhaps significant that British forestry officials connected with current German forestry are inclined to the view that the standard of forestry in the southern States is higher than that of the north ; but this may be coloured by the fact that the south is more richly endowed by nature with good natural forests, whilst the northern glacial soils are poor, necessitating the introduction of exotic species.

Post-war Forestry Education in Germany

6. The only forestry educational establishments at present functioning in Western Germany are :—

(*a*) Higher forestry education—
- (1) Hann-Muenden.
- (2) Munich.
- (3) Freiburg.
- (4) Reinbek (post-graduate only).

(*b*) Middle forestry education—
- (1) Schotten, Hesse-Darmstadt.
- (2) Lohr-Main, Bavaria.
- (3) Miltenberg, in Unterfranken, Bavaria. (A private school.)
- (4) Michhausen, in Unterfranken, Bavaria. (A private school.)
- (5) Duesterntal, near Alfeld, Hanover.

Forestry Research in Germany

7. Up till recent years, research work was generally limited within the bounds of forestry science (carried out alongside forestry education) and financed, at least in part, by the Forest Administrations of the regions concerned. This arrangement caused a certain amount of struggle for the independence of research against interference of the Forestry Administration, and, apart from the issue of periodic journals and memoirs, there seems to have been a lack of co-ordination with the rest of Germany and a great deal of overlapping. Some attempt was made before the war to overcome this latter defect by the establishment of the " Hermann Goering Academy of Forestry Research " at Hann-Muenden under Professor Bader.

8. In more recent years there was a definite trend to include within this research the wider field of forest utilization and wood technology, a logical result of the closer relationship between forestry and timber *per se* within the orbit of the German Forest Service, which during the Nazi regime dictated the felling and marketing of all timber in Germany. Formerly such timber research was for the most part conducted and financed by societies and industrial groups interested, and this accounts for a large number of independent research establishments each dealing with their own particular problems.

9. Forestry and timber research in Western Germany is now mainly concentrated in the following centres : (1) Reinbek, near Hamburg ; (2) Hann-Muenden ; (3) Munich ; (4) Freiburg.

ORGANIZATIONS VISITED

10. The above résumé of German forestry education and research provides a general background to more detailed observations on the following representative organizations visited :—

(1) Central Institute of Forestry and Timber, Reinbek.
(2) Hann-Muenden School of Forestry, University of Goettingen.
(3) Duesterntal Middle Forestry School.
(4) Schotten Middle Forestry School.

Central Institute of Forestry and Timber (Reinbek)

11. Founded during the war under the name of "Colonial Forestry Research Institute," the Reinbek Institute's functions were mainly the collecting of statistical data on the world's forests and timber resources, special attention being paid to the countries intended for German domination. Much attention was also paid to the furtherance of economic research on the forest products of these countries, especially in the field of cellulose. As the war developed unfavourably for Germany, much of the statistical work and research of forest products was curtailed, and work was confined more closely to the needs of forestry and the growing economical problems at home.

12. The functions of the Institute now are twofold :—

(*a*) To undertake forestry and timber research on a national scale (in contrast to research at other German institutions, which are intended to be more on a regional basis).
(*b*) To provide post-graduate training in timber economics and forest utilization. At present twenty students are under training at the Institute.

13. Professor Franz Heske (Director of the Institute and Professor of Forestry, Hamburg University) and Professor Kollmann (Chief of the Wood Research Branch) receive salaries from Hamburg University, and the Institute buildings are owned by the University. The State, however, finances the Institute and employs all other members of the staff.

14. The Institute is organized in two branches: (*a*) Forestry, and (*b*) Wood Research.

(*a*) Branch of Forestry Research :—

(1) *Forest Policy* (Professor Heske)—

World forestry, including forestry documentation; completion of the World Forestry Handbook and Atlas.
Cartographic office (R. Torunski).
Timber statistics of European Asia (Dr. Buchholz).

(2) *Ecology and Soil Science* (Professor Dr. Grosshopf).—Investigations of root intensity of native and foreign tree species in different soil horizons and various soil types.

(3) *Botany* (Dr. E. Schmidt, acting as substitute).

(4) *Forest Protection* (Dr. H. Schmidt).—Current problems of timber pathology.

(5) *Forest Management and Silviculture* (Dr. Weck).—Management of Institute's experimental forests. Investigations on needle and foliage litter in relation to seed germination, in co-operation with Section (8).

(6) *Forest Engineering and Forest Utilization* (Professor Dr. Mayer-Wagelin).—Testing of new methods of transport and plant.

(7) *Forest Genetics and Tree-breeding* (Dr. Langner).—Undertaken at Arensburg Arboretum.

(8) *Minor Forest Products* (Professor Dr. Esdorn).—Working in co-operation with Section (5).

(*b*) Branch of Wood Research :—

(1) *Wood Anatomy* (Dr. E. Schmidt).—Tropical and, in particular, West African woods.
(2) *Cellulose Research* (Dr. Runkel).
(3) *Wood Chemistry* (Dr. Sandermann).—Resin and lignin research.
(4) *Wood Physics* (Professor Dr. Kollmann).—Problems of high-frequency glueing.
(5) *Wood Technology* (Dr. Keylwerth).—Investigations in wood seasoning.
(6) *Wood Preservation* (Dr. Francke-Grosmann).

General Comment

15. The members of the Institute's staff have been selected primarily for their research qualifications, and Dr. Heske claims that there have been very few exceptions to the contention that "a good research forester will prove to be a good lecturer." Only four to six hours a week are devoted to teaching. The work on Dr. Heske's World Forestry Atlas, as exemplified by the almost completed sheets of Europe and Russia, is impressive, and considered worthy of the full co-operation of all countries, Meteorological, topographical, and vegetational maps of New Zealand have been promised.

16. The Reinbek Institute manages for experimental purposes some 37,000 acres of private forests, and directs tree-breeding and genetics research (particularly in spruce, larch, and poplars) at its Ahrensburg Experimental Station near Hamburg; the latter was visited, and an instructive demonstration of the grafting technique practised with conifers was given by Dr. Langner.

17. The Reinbek Institute, under Dr. Heske, who unquestionably is an authority on world forestry and education, is still in a state of post-war uncertainty regarding its destiny. Its organization is of particular interest in that it is the only *central* research cum education institution in Western Germany; as such, with due regard to the quality of its research staff, the Institute appears to be worthy of headquarters more adequately equipped than at present.

18. In view of the heavy post-war demands on forestry resources in Germany, it is the view of both British and German authorities that forestry research throughout Germany will develop in the following directions :—

(1) Increasing the productive capacity of the forests by the fuller study of locality factors, careful selection of species, and introduction of fast-growing exotics to restock the large areas felled during the war and since.
(2) Improvement of soil conditions, especially in relation to the afforestation of heath lands in North-west Germany.
(3) Improve forest control methods against disease, insect attack, and fires.
(4) Improve forest nursery technique and selection of seed.
(5) Improve efficiency and technique in exploiting and processing of timber.
(6) Economy in the use of timber, and development of preservative treatment.
(7) Use of waste products for the production of wallboard, &c., and extensive development of substitute materials.

Hann-Muenden School of Forestry

19. Two main types of forestry education have for many years been represented in Germany: (*a*) that in which forestry training has been given entirely at a University, and (*b*) the type in which the school is not located in the precincts of a University, but is a faculty thereof, or otherwise associated with a University.

20. Of the three remaining schools of forestry in Western Germany, two (Freiburg and Munich) are of the first type and one (Hann-Muenden) is of the second type. Before the war (the present status of forestry education in the Eastern Zone is not known) both Tharandt and Eberswalde were of the second type, differing from Hann-Muenden in that the students of these schools took the courses of basic sciences at the nearby Universities of Dresden and Berlin respectively.

21. " As to the relative merits of one type or the other, there have been for many decades considerable differences of opinion, which were attacked and defended partly from personal and local points of view. In reality, each of these types of education has its advantages and drawbacks, which may be greater or less according to the special conditions in each individual case. *The importance and reputation of a college will depend on the standing of the professors and the provision that is made for carrying on research.* The variety of academic forestry education in Germany is not an evil, but is an advantage. Forestry itself is many-sided.

" Forestry teaching and research must rest on a basis of biology and mathematics, on the natural sciences, and on the economic and political sciences, if they are to measure up to the demands of modern forest management. None of these foundations can be omitted without giving an unnatural bias to scientific training in forestry. Besides getting this many-sided professional training that is required by the nature of the profession, it is also desirable that the young educated forester shall find opportunity to balance and supplement his purely professional training with a broad general education. This requires stimuli of the most diverse sorts, through teachers and contemporaries in other sciences and professions, and the possibility, at a receptive age, of participating in worth-while cultural and artistic pleasures. The forestry student especially needs all these things, because he will spend much of his life at isolated forest stations and will have to be the leader and counsellor of the rural population to a much greater extent than the student of most other professions. It is by no means sufficient to endow the forestry student with a lot of specific technical information ; this will always be a matter of expediency, which depends on the requirements of his future professional activities. It is much more important to acquaint him with the true nature of technical work, in addition to teaching him the methods of research in natural sciences and the spirit of scientific thought in the realms of economics and politics. For these reasons, there was an increasing tendency, during the nineteenth century, to transfer the academic study from isolated forest academies to leading universities."—HESKE in " German Forestry ".

22. The above-quoted words, written by Dr. Heske in 1937, coincide so closely with the views of the writer of this report that they are reproduced in full as a background to a more detailed description of Hann-Muenden, which may be considered more or less representative of higher forestry education in Germany at present.

23. A forest academy was founded in 1868 at Hann-Muenden in one of the most wooded (oak and beech) districts of Germany, some eighteen miles from Goettingen ; not until 1930 did it become a faculty of the University of Goettingen. The original buildings are still in use and, though impressive from the exterior, are internally obsolete ; it had been decided immediately prior to the late war to rebuild the school at Goettingen, and foundations had been laid. The war, however, interrupted this scheme, and no action has since been taken. The significance of this proposed change of location is modified by the fact that Goettingen is itself located in a forest district, and there is thus little difficulty in the accessibility of training forests.

24. Hann-Muenden is typical of the German system of intimate blending of education and research.

The staff of the faculty is nine professors and eleven lecturers of varying grades; this large establishment (which is reinforced by additional lecturers from Goettingen, when necessary) is due both to the fact that basic science subjects, as well as the professional subjects, are taught at Hann-Muenden, and to the fact that a forest research department is an integral part of the faculty.

25. It was the view of the Dean of the faculty (Professor Lemmel) that the basic sciences should be taught with a forestry bias whenever possible, and he favoured the present system; it is questionable, however, whether such a system could be economically justified in event of the school moving to Goettingen, where the facilities of other science faculties would be available.

26. *The Research Department*, which receives a State grant, consists of the following nine branches:—

(1) Soil Sciences.
(2) Botany and Mycology.
(3) Zoology.
(4) Wood Technology.
(5) Forest Management.
(6) Working Plans and Policy.
(7) Silviculture.
(8) Meteorology.
(9) Game.

Research is thus conducted by all nine professors in addition to their lecturing duties, which, though by no means onerous, claim precedence.

Entrance Qualifications to Hann-Muenden

27. After passing his final school examinations (High School Leaving Certificate) at eighteen years of age, the prospective professional forester must, if he is a State probationer, submit his school results and personal record to the Regional Forestry Headquarters (Landes-forstamt); if considered suitable he then undergoes a period (usually of one year) of practical training, during which he is to acquire at least a general conception of forestry under the supervision of specially selected forest officers who submit written reports on the apprentice. An "enrolment committee," consisting of (*a*) several Professors of the Faculty of Forestry, (*b*) representatives of the Public Service, appointed by the Minister of Education, and (*c*) an elected representative of the students (a member of the society known as Asta), makes the final selection on the evidence of scholastic and practical training records.

28. The normal annual intake of students is between twenty and thirty; so keen, however, was the post-war interest in forestry that a hundred students (mostly ex-servicemen) are expected to graduate in 1949.

The Course

29. The full forestry course occupies four years. The first two years are mainly devoted to the basic sciences; the last two years to the study of forestry and applied subjects.

The academic year is divided into two terms, April to August, and October to March. Very little lecturing is done in the winter terms of the second and fourth years, when, in preparation for preliminary and final examinations respectively, there is an increased proportion of field exercises and time for special studies and revision. At least one day and a half per week during terms are spent in adjoining forests.

Vacation tours are limited to allow students to earn wages in forest work—often necessary to meet academic expenses.

30. The syllabus, which is summarised in Table (1), indicates the proportional lecture emphasis on the various subjects.

TABLE (1)—HANN-MUENDEN SCHOOL OF FORESTRY: SYLLABUS

Subjects, First and Second Years.	Lecture Hours Per Week.			
	First Term.	Second Term.	Third Term.	Fourth Term.
Introduction to Forestry	1	..	..	Special lectures and field exercises for examinations.
Political Science—				
Economics	2	5	3	
Common Law				
Finance				
Forest Mathematics (including Statistical)	..	2	2	
Surveying Mathematics	..	2	..	
Inorganic and Organic Chemistry	3	2	..	
Meteorology (including Physics)	2	1	..	
Mineralogy and Geology	2	3	..	
Soil Science	..	4	2	2
Botany (Morphology, Systematics, Physiology)	3	3	..	..
Forest Botany (including Plant-breeding)	..	..	2	3
Forest Pathology	..	..	..	2
Zoology	4	..	..	..
Entomology	..	..	3	..

Subjects, Third and Fourth Years.	Lecture Hours Per Week.			
	Fifth Term.	Sixth Term.	Seventh Term.	Eighth Term.
Silviculture	4	4	..	Special lectures and special field exercises for examinations.
Protection	..	..	4	
Mensuration	2	..	..	
Management (Yield Tables, Working Plans, &c.)	..	3	..	
Surveying (Theory and Practice)	..	3	3	
Valuation	2	..	..	
Economics and Business Management	..	..	..	2
Administration	..	..	..	2
Utilization (Properties and Uses, Logging, &c.)	2	3	2	..
Engineering and Transport	..	..	2	..
Forest Policy	3	3	..	..
Forest Law	4	..	..	3
Game	..	2	..	..
Game Law	..	..	..	1
Forestry History	..	..	3	..

Special Subjects

In addition to a Working Plan, it is compulsory to make special studies of *two* of the following additional subjects: Agriculture, Fishery, Ornithology, Physics, Genetics.

Professional Advancement

31. Success in the final examinations earns the designation "Diplom-forstwirt"; if, however, the graduate desires to secure an appointment in the Forest Service, he must serve two and a half years in one or more forestry districts, to gain both office and field experience; he must then sit the Higher State Examination in forestry, leading to appointment as a "Forstassessor." Many trained German foresters are employed in private forests, as well as State forests, and have the same grades and ranking in both.

The Higher State Examination

32. This State examination is of particular interest in that it reflects the high standard which is required of recruits to the German Forest Service.

The written examination occupies ten days and consists of twelve general questions of a searching executive and administrative nature, four of which have a special emphasis on silviculture and management. Text-books may be referred to, as emphasis is not on technical detail but on practical problems calling for sound fundamental knowledge and power of expression. In addition to the written examination, the students are examined orally for one and a half hours on eight subjects separately. Finally the students are examined in five forest sites, being required to express opinions and criticize the management and utilization of respective stands.

Every question (written and oral) is screened by two forest officials and a rating of 1 to 5 is awarded each (1 is the highest). Thus the overall maximum possible merit marking is $\frac{12 + 8 + 5}{25} = 1$. Those getting an average exceeding 4 are rejected as being below required standard.

Middle Forestry Schools in Germany

33. Of the five middle schools functioning at present in Western Germany, those located at Scotten in Hesse Darmstadt and at Duesterntal in Hanover were visited. These schools are administered by the Forest Service, and there is little variation in the system of education; consequently it is possible to discuss them collectively.

The main purpose of these schools is to provide a practical forestry training based on sound principles as a basis for the qualifications required of a "Revierforster" (Forest Ranger). A boy of sixteen who wishes to qualify for appointment is required, pending completion of his secondary-school education, to submit to the Regional Forest Office his school, medical, and conduct certificates together with personal details. He may then be accepted for apprenticeship and undergoes two years of supervised practical forest experience which, if satisfactory, leads to nomination to a Middle Forestry School. In addition to Forest Service apprentices, private students and nominees of local bodies are eligible for such forestry training.

34. The course occupies one full year, inclusive of two short vacations in summer and winter.

Lectures are practically confined to the mornings and, although necessarily elementary, provide a thorough grounding in the following subjects:—

(1) Elements of Silviculture.
(2) Forest Protection.
(3) Timber Management and Road Construction.
(4) Use and Maintenance of Tools and Equipment.
(5) Utilization, including Felling and Logging.
(6) Forest Service and Civil Law Codes.
(7) Game, including Elements of Zoology.
(8) Forest Accounting.
(9) Botany.
(10) Administration, Workers' Wages, Timber Sales, &c.
(11) Elements of Agriculture, Horticulture, and Apiculture.

35. The main emphasis is, however, on the practical forestry skills, and the tool workshops are particularly well equipped, providing bench space for fifty students. Detailed instruction and practice is, for example, given in the cutting and setting of saws, sharpening of cutting tools, and the making of axe and bow-saw handles.

36. At Duesterntal there were fifty-eight students and four instructors; at Scotten ninety students and five instructors. The latter was recognized to be over-crowded, and was divided into three classes of thirty students.

The keenness of the students and their general bearing at both schools created a very favourable impression.

37. In addition to periodic tests, a final examination is held, and, as in the case of the Higher State Examination, a rating of 1 to 5 is awarded for each subject, and in oral tests of practical skill. A "satisfactory" (4) rating in silviculture and tools and equipment, and an over-all average of not more than 4, is the prerequisite of success in the final examination. Actually, very few fail to qualify in the examination, but those with the highest ratings naturally secure preference in subsequent application for appointments.

38. Upon completion of a middle school course and admittance to the Civil Service, three to four years' Forest Service training follows, during which time the junior officer must become fully acquainted with the work of a "Revierforster" in office and field, and during the last six months carries out the actual duties under supervision.

He then sits the "Revierforster" examination to qualify for a charge position.

Lower Forestry Education

39. In order to be accepted for the lower forestry grades in the Forest Service, candidates are required to have passed the elementary school examination, and to have had some practical forestry experience. Before sitting for a junior State examination, candidates are required to undergo two years of supervised forest work and a period of four months' study.

After a further four years' experience, the candidate is eligible to become a "special forest worker" (Waldfacharbeiter).

It is evident that the competition and standard for the equivalent of foreman status is keen, and that only relatively few forest workmen are able to gain promotion in this State Service.

Appreciation

40. The writer's movements in Western Germany during ten days were organized by the Food, Agriculture, and Forestry Group, Bipartite Control Office, Frankfurt, under the personal direction of Mr. E. Benskin (British Forestry Officer for Germany), contact with whom was first made at the World Forestry Congress, Helsinki.

Through the courtesy of Mr. Benskin, the tour, which began at Hamburg and ended at Frankfurt, was by road exclusively, and at all times in the company of either a C.C.G. forestry official or a German forestry interpreter, which resulted in the following of a route through representative forest districts to the maximum advantage.

41. A feature of the tour was the personal contacts made with many German foresters of all grades, from which the firm impression was gained that at least in the field of forestry there are many Germans of fine character and professional integrity.

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(1) "German Forestry." Franz Heske. 1938. Yale University Press.
(2) "Nazi Influence on German Forest Administration." A. L. Poole. 1947. New Zealand Science Congress.

CHAPTER II—FRANCE

42. Although as early as 1791 a law instituting a "General Conservation of Forests" was passed and a hierarchy of forestry officials appointed, it was not till 1820 that an Ordinance gave a significant degree of autonomy to a Forestry Administration in France. The later Ordinance of 26th August, 1824, created the appointment of a

" Directeur Général des Eaux et Forêts," and in the same year was authorized the foundation of a National School of Forestry (École Nationale des Eaux et Forêts) at Nancy (Lorraine).

43. The evolution of French forestry and, concurrently, forestry education has thus developed on an essentially national basis, in sharp contrast to that of Germany, which has evolved on a regional basis during the eighteenth century in the various semi-independent German States, resulting in the establishment by eminent foresters of private schools of forestry—*e.g.*, Heinrich Cotta in 1785 at Zillbach, the forerunner of Tharandt, the oldest forestry school of academic rank in the world. During the last 125 years the forest economy of France and her colonial possessions have been directed from Paris, and the excellent results achieved are due to the maintenance of a highly trained " corps forestiere," the professional prestige of which is no less than that of the armed forces.

44. Lest, however, it be erroneously assumed that French forestry in its post-war recovery is immune from administrative difficulties so familiar to younger countries, the translation of an extract from a French general information bulletin is reproduced below as much in recognition of its universally sound forest philosophy as its relevancy to French forestry :—

> " In 1947, progressively reconstructed after the world war, the forestry corps was composed of not more than 674 officers, who not only had to manage 10,000,000 acres of forest under forestry regime, but had to take over economic tasks which were essential for future development, and also the immense work of replanting 5,000,000 acres of unproductive land. Forestry officers are therefore required to manage—and to manage without adequate means by reason of their limited budget—more and more territory. This system means that the forest officer is only able to fulfil the role of direction and control, which keeps him tied to his desk, far from the forest, which has so much need of his care.
>
> " A comparison may be made between the forester and the doctor who is responsible for the health and productive work of a certain group of human beings. Such a doctor is assisted by medical students and nurses. Could one conceive of an organization which would confine the doctor to the role of pure direction and administration, and would leave to his subordinates all the responsibility of the medical examination of the individuals, of diagnosis and of treatment ? The forest also is subject to a ' treatment ' and this treatment is carried out by means of ' silvicultural operations.' It is by carrying out these operations himself, and employing all his skill, that the forester of the 19th century has made our (French) forests what they are.
>
> " To take the forester away from the forest, by depriving him of labour and adequate equipment, constitutes a grave and certain danger to our wood-lands, and at the same time an irremediable retrogression in the art of forestry, which, to be maintained and developed, must be practised."—Excerpt from " The French Forest and the Forestry Administration," Documentary Survey No. 977 (French Series CCII) 14th August, 1948.

The System of French Forestry and Timber Industry Education

45. The French Forest Administration recognizes the need for and actively sponsors the following distinct types of education :—

(*a*) Primary and elementary forestry training for sub-professional forest officers (Guards, Rangers).
(*b*) Technical education to qualify for professions in the timber industry.
(*c*) Higher forestry education to qualify for professional appointment to the French Forest Administration.

These types of forestry and timber education are represented by the following institutions :—

A. *L'École Forestière Secondaire des Barres*

46. This School was founded in 1938 at Nogent-Sur-Vernisson, some ninety miles south of Paris. It has two departments, for primary and secondary training, the former being merely a modified version of the latter for the most junior officials and "foremen" of private forests.

The main (secondary) course is for junior officers of the Forest Service, recruited on a competitive basis mainly from amongst "Gardes" and "Brigadiers" who have served for at least three years in the Forest Service. A limited number of private students are also admitted. During the abnormal post-war years ex-service appointees to the lower grades of the Forest Service have been exempted from attendance at the school—this is, however, only a temporary concession.

47. The main course occupies two years and is under the direction of a Conservator of Forests, two professional forest officers, two sub-professional assistants, and part-time lecturers in special subjects.

48. The curriculum is as follows :—

TABLE (2)

Subject.	First Year.		Second Year.	
	Lectures (One and a Half Hours).	Practical (Three to Five Hours).	Lectures (One and a Half Hours).	Practical (Three to Five Hours).
Algebra	15	..	..	..
Geometry	15	..	..	..
Trigonometry	10	..	..	..
Physics	16	5	..	..
Chemistry	14	5	..	..
French Composition	15	..	15	..
Silviculture	35	25	..	10
Forest Economics and Management	..	..	20	10
Measurement and Estimates	5	5	..	5
Utilization of Timber	..	..	20	10
Legislation Forest Law and Administration	35	..	30	..
Forest Botany	30	10	15	5
Forest Pathology	..	..	20	10
Zoology	..	..	40	10
Geology and Forest Soils	20	5	..	..
Rural Economy	..	..	20	..
Topography Surveying	25	50	15	35
Conservation of Mountains: Rainfall and Remedies	..	..	20	..
Forest Engineering	..	..	15	5
Road and Transport	..	..	20	15
Total	235	105	250	115

49. The school year is ten months. Seven and a half months are occupied in lectures and practical study in the laboratories and adjoining forests, and two and a half months of experience training in various forest regions and preparation for examinations.

The rating and "co-efficients" of respective subjects follow the system practised a Nancy.

B. *L'École Supérieure du Bois*

50. This Technical School was founded in 1934, and is located in Paris. It aims to serve the needs of the timber industry equally in the spheres of administration, finance, and specialized technique, and after a course of two years' study leads to the diploma of "Technicien des Industries et Commerces du Bois."

The syllabus covers the following groups of subjects:—

Basic Sciences, with emphasis on Mathematics.
Basic Engineering: Steam, Electricity, Materials.
Basic Law and Administration.
Forest Exploitation, Milling, Commerce.
Wood Industries: Machinery, Woodworking.
Wood Constructions, Carpentry.
Applied Law, Insurance, Labour Organization.
Foreign Language.

C. *L'École Nationale des Eaux et Forêts*

51. This School fulfils alone the national requirements for professionally trained foresters.

The aspirant to a professional career in the French Forest Service must complete the following sequence of general education leading to higher forestry education at Nancy. The State Primary schools provide first education between the ages of five and ten years. The secondary stage is completed at one of the many lycées or colleges in Paris or in the provinces. In his sixteenth year the student takes Part I of the examinations for "Bachelier Sciences" or "Lettres," and completes Part II in the seventeenth year. The examinations are of a higher standard than the New Zealand University Entrance.

52. The potential forester must then, in his seventeenth or eighteenth year, compete for inclusion in one of the following higher State schools ("Écoles Supérieures"):—

(*a*) École Polytechnique.
(*b*) Institut National Agronomique.

It is from graduates of these institutions only (there are several others) that the Forestry Administration recruits its "Ingénieurs Elèves" for Nancy. The purpose of the "Écoles Supérieures" is to provide a post-secondary education as a basis for specialized scientific training at "Écoles d'Applications," such as Mining, Engineering, Forestry, Agriculture, &c.

53. The "École Polytechnique" two-year syllabus lays special emphasis on Mathematics and Physics as a grounding for engineering professions; it is the policy of the Forestry Administration to include at least one (the proportion is one-sixth) graduate of the École Polytechnique each year amongst those selected for entry to Nancy School of Forestry.

54. The "Institut National Agronomique" three-year diploma course, which is essentially a basic education for agricultural professions, is reduced to two years in the cases of those proceeding to an "École d'Application" such as Nancy. In addition to Mathematics, Physics, and Chemistry, the biological sciences are taught.

55. Before proceeding to Nancy the forestry student has undoubtedly received a thorough grounding in basic sciences, the standard of which approximates that of the New Zealand B.Sc.

THE NATIONAL SCHOOL OF FORESTRY, NANCY

56. The School was established in 1824 in the University city of Nancy, capital of Lorraine; in addition to the 12,000 acres Forest of Haye in the outskirts of the city, the forests of the Vosges Mountains are within easy range. A residential establishment

providing for at least fifty students, the "pavillons" (named after late Directors of the School), museums, and laboratories are arranged round a central quadrangle, and flanked by the school botanic gardens.

Conditions of Enrolment

57. The maximum age of entry to the School is twenty-five years. The number of candidates admitted each year is governed by the recruitment policy of the Forestry Administration, the great majority being State nominees on a Civil Service apprentice salary and bonded to serve in the Metropolitan or Colonial Forest Service for at least five years after graduating. A small proportion of independent French and foreign students are also admitted. In 1949 there were fifty-two students in residence.

The Course

58. The forestry course at Nancy occupies two years. There are two terms in each year. The year and winter term commences in mid-October and ends in mid-April, with one week's vacation at Christmas. The students remain at Nancy during the winter term, the mornings being devoted to lectures (two one and a half hour periods) and the afternoons to laboratory and field exercises and, to lesser extent, lectures. The remaining two weeks of April are taken in vacation.

The summer term consists of tours, practical work or special studies, and examinations, and concludes at the end of July.

59. The subjects taught during the first and second years, and the relative importance attached to each subject in examinations, are shown in Table (3), which is a translation of the current year's schedule submitted to the Central Forest Administration for approval. Examinations are held at the end of the first year, and finally, at the end of the second year.

TABLE (3)—ÉCOLE NATIONALE DES EAUX ET FORÊTS, NANCY: ALLOCATION OF CO-EFFICIENTS FOR THE SCHOOL YEAR 1948–49

Subjects.	First Year.				Second Year.			
	Oral Tests.	Practical Work.	Written Examination.	Total.	Oral Tests.	Practical Work.	Written Examination.	Total.
Forestry Sciences—								
Silviculture	7	6	9	30	..	..	..	30
Regeneration	2	..			..	..	..	
Dendrology	2	2	2		..	..	..	
Forest Economics	..	..	..	..	8	8	8	
Forest Geography and Colonial Silviculture	..	..	..	..	2	..	4	
Natural Sciences—								
Botany	8	8	8	30	..	4	..	30
Pedology and Geology	2	..	2		..	..	..	
Game	..	..	2		..	..	..	
Zoology	..	..	..	..	6	6	8	
Plant Pathology	..	..	..	..	..	..	4	
Genetics	..	..	..	..	..	..	2	
Forest Engineering—								
Topography	3	6	3	20	..	3	..	20
Roads	3		3		..	.. 6	..	
Forest Buildings	..	..	2		..	..	..	
Soil and Mountain Conservation	..	..	..	..	4	3	6	
Strength of Materials; Concrete and bridges	..	..	..	..	2	..	2	
Legislation—								
Penal Law	..	..	3	3	..	..	..	20
Administrative Law	..	..	..	..	..	..	6	
Forestry Law	..	..	..	..	..	3	6	
Administrative Service	..	..	..	..	..	..	5	
Utilization—								
General Study of Wood and Its Products	3	3	4	10	6	6	8	20
Conduct; Diligence	..	..	..	10	..	..	..	10
				103				130

60. The papers of each subject examined are marked according to merit up to a maximum of 20, and multiplied by the co-efficient laid down in Table (3). The sum of the resultant markings is divided by the sum of the co-efficients (103 for first year; 130 for second year) to arrive at final average, which, in order to earn a pass, must exceed 10 (or 50 per cent.). The ratings of both years are combined to arrive at a final result. It was learnt that in the 1949 final examinations, the lowest rating was 12·7, and that only very rarely in the past have students failed to qualify for the "Diploma d'Ingénieur Civil des Eaux et Forêts." Failure to qualify incidentally involves a refund of the cost of training. Perusal of Table (3) will disclose the importance attached to the results of oral and practical tests, the final assessment in relation to written examinations.

Although not included in "allocation of co-efficients," all students are required to reach an approved standard in either the English or German language.

The Staff Establishment

61. The School and Research Station are under a common local administration, which is responsible to the Director-General of Forests in Paris. This administration consists of a Director (Inspector-General Oudin), Assistant Director (Conservator Rol), Supervisor of Studies (Inspector Reneuve), and an Accountant.

The lecturing cadre consists of the following (in addition to the administrative staff, three of whom are also in charge of forestry subjects):—

10 Conservators or Inspectors of the Forest Service.
3 Professors of the University of Nancy (Genetics, and Law).
2 Professors of the Lycee of Nancy (German and English Language).

Of the above ten forestry lecturers, six are in charge of sections of the Research Station, each having at least one (mainly two) full-time qualified research assistant.

Thus, with one minor exception, no lecturer is responsible for more than one subject, which provides ample time for research.

62. It is evident that the Forestry Administration in Paris extends a high degree of latitude and independence to the school, which has earned international prestige in the tradition of such great French educationists as Lorentz, Guinier, and Schaeffer.

The staff is, of course, appointed by the Central Forestry Administration; changes are apparently infrequent, but with the staff resources of the French Forest Service to draw upon it is reasonable to assume that a high standard is maintained and that the disadvantages of prolonged disassociation from executive forest experience is avoided.

Personal contacts with the Director (M. Oudin), Conservator Reneuve, and Inspector Pourtet created a most favourable impression. Unfortunately all students and the majority of lecturers were absent on tour.

THE FOREST RESEARCH STATION (STATION DE RECHERCHES ET EXPÉRIENCES FORESTIÈRES)

63. The work of the Station is organized in seven sections, briefly as follows:—

I. The Silviculture and Management of Indigenous Forest Stands; Direction of All French Forest Service Sample Plots; Administration of Forests Affecting or Owned by the School (Conservator Ayral and two assistants).
II. Forestry Botany; and Plant Pathology (Conservator Rol and one assistant).
III. Ecology; and the General Study of Exotic Species (Inspector Pourtet and two assistants).
IV. Properties and Uses of Wood; and Materials of Construction—Timber Testing Laboratory (Inspector Venet).
V. Forest Soils, and Chemical Research (Director Oudin and one assistant).
VI. Forest Zoology and Hydrobiology (Inspector Jolly).
VII. Conservation and Reclamation of Mountain Soils; Research on Glaciers and Mountain Rainfall (Conservator Berthelemy and one assistant).

Established in 1882, the Research Station was considered to be part of the School, the founders fully realizing that education and research were complementary (Fr. solidaires).

64. The Station now manages several forests near Nancy and in the Vosges, *the revenue from which accrues directly to the School of Forestry* as a valued supplement to State grants. It is responsible to the Forestry Administration for silvicultural research in 142 experimental areas throughout France, and the interpretation of some 250 sample plots. The Central Laboratory of Timber Testing was established at the Station in 1936 and contains much modern equipment. A well-appointed arboretum near Nancy has been managed by the Station since 1901.

65. A dual function of the School and Research Station is the publication of forestry literature, the chief media being the—

(1) " Annales de L'École Nationale des Eaux et Forêts " ;
and the less technical

(2) " Revue Forestière Française," the successor of " Revue des Eaux et Forêts," the latter having completed eighty-six annual volumes.

66. *Historical References :—*

(i) " Les Recherches Forestières en France." H. Perrin. 1928.
(ii) " Les Débuts de L'enseignement Forestier en France par Bernard Lorentz." G. Huffel. 1929.
(iii) " L'Enseignement à L'École des Eaux et Forêts et la Carrière Forestière." P. Guinier. 1932.

CHAPTER III—SWITZERLAND

67. The modern history of Swiss forestry began in the middle of the nineteenth century, following eras of systematic destruction of forests, when the Economic Society of Berne, the Society of Natural Sciences of Zurich, and such men as Hans Conrad Escher von der Linth moved public opinion and the Cantons to action. In 1843 the Swiss Forestry Society was founded, and this organization was responsible for the inclusion in 1855 of higher forestry education amongst the courses of training in the then newly formed Federal Institute of Technology at Zurich. To the same Society is owed the establishment in 1888 of the Federal Forest Research Institute, also at Zurich.

68. The forests of Switzerland, three-quarters of which are in the mountains, cover 24 per cent. of the total land area of the Confederation. Productive forest tenures are approximately as follows :—

	Per Cent.	
State forests	4·7	2,500,000 acres.
Commune and company forests	67·5	
Private forests	27·8	

Not included in the above are high mountain protection forests, totalling approximately 2,000,000 acres.

69. The legislation of 1897 gave to the Confederation the right to supervise all the forests of the country and laid down as a basis of national policy that " L'aire forestier de la Suisse ne doit pas être diminuée." The Federal law, however, grants to the 25 Swiss Cantons great liberty in the management of their respective forests, but imposes upon them the obligation of submitting returns, and of employing a sufficient number of scientifically trained foresters. Thus, whilst the Cantons to all intents and purposes have independent control of their public forests, employing some 250 professional foresters,

the Federal Department of the Interior has jurisdiction over, or is indirectly concerned in, the following special and inspectorial forestry branches, employing in all not more than forty qualified officials :—

(1) Inspection of Forests (Berne)—
Inspector-General of Forests (Dr. Emil Hess).
Eight inspectors.
Four forest engineers.
Institute of Snow and Avalanche Research (four officers).
(2) Federal Institute of Technology (School of Forestry) (Zurich) —
Nine professors and forestry lecturers.
(3) Federal Forest Research Institute (Zurich)—
Nine research foresters.
(4) Military Department—
One forest engineer.
(5) Department of Public Economics (Price Control) —
One forest engineer.

70. Swiss forest policy is traditionally conservative ; in normal times the Confederation imports about 25 per cent. of its timber requirements, and manages its forests with the object of conserving resources (which could economically be utilized) to ensure timber self-sufficiency in time of emergency.

THE SWISS FEDERAL INSTITUTE OF TECHNOLOGY (*Eidgenossische Technische Hochschule*)

71. The E.T.H., as it is known throughout Switzerland, was founded in 1854 at Zurich and is the only educational institution owned and administered by the Swiss Federal Government ; it is also the only technical school of University standing in the country. The Universities, as well as primary and secondary education, are the responsibilities of the Swiss Cantons.

72. The Institute is divided into eleven schools or faculties for professional education in the following subjects : Architecture, Civil Engineering, Chemistry, Pharmacy, Rural Engineering and Surveying, Mechanical and Electrical Engineering, Mathematics and Physics, Natural Sciences, Agriculture, Forestry, Military Sciences.

73. In addition, a general section of courses in History, Philosophy, Politics, and Economics are available to all students of E.T.H. to provide scope for broader education ; in fact all students of professional faculties are compelled to take at least one course in the general section each term.

74. The Institute comprises ten different buildings, magnificently appointed, and situated in the hilly central part of Zurich. The Schools of Agriculture and Forestry share the same block of buildings, which in recent years has resulted in congestion, and plans which are being prepared for a separate forestry building were demonstrated by the E.T.H. Architect, Dr. Dunkel.

THE SCHOOL OF FORESTRY (E.T.H.)

75. The School is administered by a " Conferenz " (Council) of E.T.H. Professors, including the Forestry Professors. The Dean is, however, never a Forestry Professor, the purpose of this apparently being to avoid domination of the School by any one school of forestry thought.

The staff of the School consists of :—

(*a*) Three forestry professors (Dr. Knuchel, Dr. Leibundgut, and Mr. Gonet).
(*b*) Four assistant lecturers in forestry.
(*c*) Two part-time lecturers (qualified foresters) from the Agriculture Faculty.
(*d*) Occasional lectures by Research Institute staff.

76. The entrance qualifications for the E.T.H. is the Federal certificate of second education (which is defined as equivalent to the Oxford and Cambridge entrance examination) and a minimum age of eighteen years. The annual quota of approximately twenty students for the forestry course is selected after perusal of academic records.

77. The forestry course occupies four years, divided into eight terms. There are three main examinations: the First, at the end of the second term, covering preliminary basic science subjects (Mathematics, Botany, Chemistry, Zoology, Climatology). The Second Examination, at the end of the fourth term (including advanced basic sciences, soils, and elementary forestry). The Third and Final Examination, at the end of the eighth term—advanced forestry subjects, including the two special subjects, (*i.e.*, working plan and a study of silviculture or forest economics)—leading to the diploma "Ingénieur Forestier."

78. Thereafter, one-year apprenticeship in forestry administration and six months in mountain forest work is a prerequisite to the State examination for those graduates who wish to qualify for appointment in the Civil Service.

79. The chief characteristics of this forestry course are:—

(*a*) A close contact with, and the use of, the general educational atmosphere and facilities of the E.T.H. as a whole. The teaching staff of other science faculties are available for basic science subjects in the forestry syllabus.

(*b*) A forestry bias is introduced into first-year subjects whenever possible.

(*c*) The forestry professors rarely spend more than six hours a week each on teaching, and consequently have ample time for research work, which is free of prescriptions in nature or extent.

(*d*) Forest and soil conservation in mountains, and mountain engineering, are emphasized, and authoritatively taught.

80. (Ref. 91.) The syllabus of the forestry course is shown in Table (4) and the emphasis on mountain forestry and engineering will be noticed therein. With this aspect in view, the writer made special inquiries regarding the conditions under which New Zealand science graduates (B.Sc. and B.E.) could take the E.T.H. forestry course, should such action be contemplated.

After discussions with Professor Leibundgut (Professor of Silviculture) and Professor Stussi (Rector of E.T.H.), the tentative conclusion was reached that a New Zealand B.Sc. would be exempted from the First Examination (end of first year), but would be required to take the Second Examination (end of second year) because it included forestry subjects, the testing of which could not reasonably be delayed until the Third Examination (at end of fourth year).

81. Thus, three years would be required to graduate, except for an outstandingly brilliant student, who, with a fluent command of German (the official language), might be able to qualify in two years. The New Zealand Bachelor of Engineering would present no difficulties if it was not intended that he should graduate in forestry; he could take a two-year course of study in forestry engineering and related subjects (including field practice) to advantage, and the E.T.H. would willingly co-operate.

82. The specialized laboratories, museums, and lecture-rooms of the Agriculture and Forestry Schools, although less impressive than those of the Engineering Schools, which leave nothing to be desired, compare favourably with the more modern Helsinki Forestry School; a new building is planned to meet necessary expansion, but in the meantime the immense teaching resources of the E.T.H. are available as required.

The Demonstration Forest

83. In 1927 the Swiss Confederation acquired a 519-acre forest situated on the northern slopes of the Uetliberg Mountain, in the immediate proximity of Zurich. This forest was placed under the management of the School of Forestry, and is now the field headquarters from which term-time practical exercises are undertaken by forestry students. The buildings are models of simple timber construction, providing a class-room, tool-sheds, offices, and general facilities for a caretaker; adjoining is a small forest experimental nursery.

84. The forest is a practical demonstration of the silvicultural principles propounded by Schadelin (former Professor of Silviculture) and now widely accepted in Swiss forestry; a natural broad-leaf forest of ash, sycamore, oak, beech, hornbeam, &c., with some introduced spruce, silver fir, Scots pine, and larch, the object of management under extensive treatment is to improve the fertility of the soil and increase production by the selection of the best trees, without following any rigid cutting system.

85. Although unable to meet Professor Knuchel (the doyen of the School of Forestry), who was absent from Zurich, the writer is deeply indebted to Professor Leibundgut (Professor of Silviculture), whose co-operation made it possible to gain a thorough appreciation of Swiss higher forestry education, and some insight into Swiss forestry in general.

FEDERAL FOREST RESEARCH INSTITUTE

86. The Research Institute is not a function of E.T.H., but is closely affiliated to that Institute and has its headquarters in the same building as the School of Forestry. The Director, Professor Hans Burger, is directly responsible to a Federal Commission which consists of—

(*a*) President of E.T.H.
(*b*) Inspector-General of Forests.
(*c*) Five forest officers representing the Cantons.

87. The staff consists of the Director, eight research foresters, and seven non-professional assistants; for office and laboratory facilities the Institute is dependent upon the co-operation of E.T.H.—an arrangement which is evidently not entirely satisfactory.

88. The Institute publishes its research results in "Annales de l'Institut Fédéral Recherches Forestières," to which the New Zealand Forest Service subscribes.

89. Dr. Burger (whom the writer first met at Helsinki) has an outstanding personality, not the least of his qualities being a quiet sense of humour, and obvious ability in directing team-work, which is a characteristic of this relatively small research organization. Switzerland was the first country in the world to undertake scientifically controlled investigations on the effect of the forest on the water complex of a catchment area, and as early as 1915 Dr. Burger was following up the pioneer erosion work of Professor Engler with his own series of hydrographic observations. The international significance of Swiss research on erosion is evidenced by the reproduction of Dr. Burger's published "Results of an Erosion Experiment from 1927–1942," in the "Indian Forest Records" (1945, Vol. 6, No. 1).

90. There can be little doubt that the intensive study of Swiss methods of soil protection and hydrographic research by a suitably qualified New Zealand graduate would prove to be of great value to this Dominion, and further consideration of this project is strongly recommended.

91.

TABLE (4)—SWISS FEDERAL INSTITUTE OF TECHNOLOGY, ZURICH: FORESTRY COURSE SYLLABUS, 1948–1952

	Hours Per Week.	
	Lectures.	Practical.
First Year—		
First Term (October to February)—		
Mathematics	5	2
Inorganic Chemistry	5	..
General Botany	4	..
Special Botany—I	1	..
Zoology	3	..
Genetics	1	..
Geology	5	..
Mineralogy	1	..
Climatology	2	..
Introduction to Silviculture	1	2
Zoological Anatomy	..	2
Forest Entomology—I	1	..
Practical Work in Entomology	..	2
Second Term (April to July)—		
Experimental Physics	3	1
Organic Chemistry	4	4
Mineralogy	3	..
Special Botany—II	5	..
Botanical Excursions	..	4
Plant Physiology	3	..
Botany (Microscopic)—I	..	2
Geology of Switzerland	3	..
Forest Entomology	2	1
Entomology Excursions	..	4
Dendrology	1	2
Recommended studies—		
Plant Identification	..	1
Geology Excursions	By arrangement	
First Examination		
Second Year—		
Third Term (October to February)—		
Experimental Physics (Mechanics, Electricity)	3	1
Ecology	2	4
Forest Legislation—I	2	..
Bacteriology	2	..
Plan Drawing	..	2
Wood Technology—I	4	3
Plant Pathology	3	2
Forest Plant Associations	1	..
Soils (Agricultural Chemistry I)	3	..
Microscopic Identification of Rocks	..	1
Surveying	2	..
Recommended studies—		
Forest History	1	..
Fourth Term (April to July)—		
Forest Legislation—II	2	..
Methods of Determining Growth and Increment (Mensuration)	3	8
Wood (Properties and Uses)	3	..
Silviculture	3	4
Exercises in Plant Associations	..	4
Forestry Buildings—II	2	2
Surveying	2	8
Forestry Buildings and Woodworking (at end of term)		3 weeks
Recommended studies—		
Geology Excursions and Practical	..	5

TABLE (4)—SWISS FEDERAL INSTITUTE OF TECHNOLOGY, ZURICH: FORESTRY COURSE SYLLABUS, 1948–1952—*continued*

	Hours Per Week.	
	Lectures.	Practical.
Second Examination		
Third Year—		
Fifth Term (October to February)—		
Forest Management	4	..
Conversion of Timber	2	4
Silviculture	2	4
Forest Policy	2	2
Wood Technology	2	6
River and Torrent Control	2	..
Elements of National Economics	4	..
Alpine Economy	1	..
Recommended studies—		
Overhead Logging (Cables)	1	..
Game	1	..
Sixth Term (April to July)—		
Forest Policy	1	2
Wood Technology	..	2
Practical Forest Management	..	8
Silviculture (Mountain Forests)	2	4
Law	3	..
Mechanics of Snow and Protection Against Avalanches	2	1
Excursions to Study Snow and Avalanche Protection Methods	..	2 days
Torrent Control	..	2
Excursions to Study Torrent Control		2 days
Roads; and Wood Superstructures	2	..
Recommended studies—		
The Constitution of Modern Switzerland	1	..
Fourth Year—		
Seventh Term (October to February)—		
Forest Policy	2	..
Silviculture	1	4
Forest Valuation	3	..
Law	3	..
Introduction to Finance	1	..
Forest Economics	2	..
Special Diploma study (Working Plan)	..	Informal
Eighth Term (April to July)—		
Forest Policy	1	..
Silviculture	1	4
Forest Economics	2	..
Special Diploma study	..	Informal
Recommended studies—		
Forestry Research Methods	1	..
Third (Final) Examination		

CHAPTER IV—ITALY

92. Higher forestry education of University standing is a relatively recent development in Italy, which has a long history of forest depletion, culminating in the vigorous counter-measures of Mussolini's Militia Nationale Forestale. Modern Italian forest policy is based on the recognition of the necessity for greatly increasing its forest resources (at present inadequate for its population of forty million) by the introduction of suitable fast-growing exotic species in supplement to its limited range of indigenous species; and on the need for a more highly trained cadre of forest technicians freed from Fascist doctrines. Some methods by which these objectives are being achieved, in comparison

with the forest countries of Northern Europe, are briefly reviewed. For many years forestry education and research was centred in the ancient forest of Vallombrosa (some thirty miles from Florence), and, as the nursery of Italian forestry tradition, must logically first be considered.

Vallombrosa

93. An experimental and training forest of 3,500 acres with an altitude range of 1,800 ft. to 4,000 ft. above sea level, Vallombrosa demonstrates typical Italian forest associations, from oak and chestnut in the lower levels, through silver fir to beech in the highest protection belt. Many small stands of exotic species have also been established, Douglas fir showing particular promise. The local annual rainfall is 35–40 in. The old monastery is now the headquarters of the Forest Officer in Charge (Inspector D. Lobina), who demonstrated his forest working plan, typical stands, and the celebrated arboretum, which was established in 1870 and contains a very wide range of exotic conifers.

94. A middle school of forestry was maintained at Vallombrosa for many years, but was discontinued in 1941 when the Florence School of Forestry was established. Training and experimental facilities at Vallombrosa include a forest nursery and a school building with lecture-room for visiting forestry students and research officers. Although the older stands were heavily over cut during the war, Vallombrosa is still an inspiring locality and is evidently to Italian foresters as Hyytiala is to Finnish foresters.

The School of Forestry, Florence

95. Forestry was united with the Faculty of Agriculture in the University of Florence in 1941, the syllabus of the first two years' training being common to both branches; the following subjects are taught:—

First Year—

(1) General Botany.
(2) General Zoology.
(3) Anatomy and Physiology of Domestic Animals.
(4) General and Inorganic Chemistry (including Analysis).
(5) Mathematics.
(6) Physics.
(7) Mineralogy and Geology.

Second Year—

(8) Systematic Botany.
(9) Agricultural Entomology.
(10) Zoology.
(11) Organic Chemistry.
(12) Principles of Political Economy and Statistics.
(13) Animal Culture; or
(14) Ecology.

96. In the third and fourth years the forestry students are taken over by the School of Forestry staff, which consists of twelve lecturers (professors).

The following subjects are taught on the basis of three hours per week :—

Third Year—

(15) Forest Botany (Professor Pavari).
(16) Apiculture (Professor Gasparini).
(17) Forest Chemistry (Professor Alinari).
(18) Forest Zoology (Professor Baldasseroni).
(19) Dendrology (Professor Benassi).
(20) Silviculture—I (Ecology and General) (Professor de Philippi).
(21) Topography (Surveying) (Professor Horatiis).
(22) Forest Constructions (Professor Horatiis).
(23) Forest Legislation (Professor Bolla).

Fourth Year—

(24) Apiculture (Technique in Mountain Regions) (Professor Bogioli).
(25) Silviculture—II (Professor de Philippi).
(26) Forest Waters.
(27) Forest Management (Professor Patrone, Dean).
(28) Wood Technology and Utilization (Professor Giordano).
(29) Forest Pathology (Professor Sibilia).
(30) Chemical Forest Industries (Professor Alinari).
(31) Economics and Forest Valuation (Professor Carloni).

97. The school year begins in November, and lectures continue (with some local field practices and Christmas recess) until June. In early July the first forestry examinations are held ; and during July and August a forest tour is conducted (in Northern Italy one year, and Southern Italy the other year). The annual vacation is in September and October. Students may take examinations in October as well as July, thus providing a second opportunity, in the event of a first failure. Upon completion of the final written examinations, candidates for the first degree in forestry must submit a thesis and be examined orally on two prepared subjects by the Professorial Board.

This system of one long term per annum is designed to enable students to be absent from Florence on field training during the hottest summer months, an arrangement which the writer has reason to appreciate.

98. There are twenty-four forestry students at present in the third and fourth years ; it was stated that not more than twelve forestry graduates can normally be absorbed in Italy each year.

Post-graduate Qualifications

99. Candidates for appointment to the Italian Forest Service and those seeking eligibility for consultant practice must, after graduation, sit a competitive State examination with particular emphasis on working plans and forest legislation.

Administration

100. The School of Forestry is administered by a Council of all the forestry professors (the lecturers in charge of subjects are entitled to the status of professor, although in most cases the appointments are reviewed annually), and the Dean of the Council is elected every three years.

101. The accommodation and facilities available to the School are not impressive, as no additional buildings were provided at the time of the faculty amalgamation, and consequently there is evidence of congestion with the Board of Agriculture.

102. Those of the teaching staff met by the writer were, however, young and enthusiastic foresters with an appreciation of the value of supplementary research made possible by the numerical strength of the staff ; and the impression was gained that under the influence of Professor Pavari, whose research work, particularly on exotics, is internationally recognized, higher forestry education in Italy was making a sound and a very commendable contribution to the country's recovery.

Forest Research Institute, Florence

103. The "Statione Sperimentale de Silvicoltura" is a State organization, linked to the University of Florence by reason of the dual functions undertaken by Professor Pavari and Dr. Allegri, who, as Director and Assistant Director respectively of the Research Institute, are honorary members of the school staff both lecturing in forestry botany, and also supervising the students' field training at Vallombrosa for one month in July/August.

104. The Institute is directly responsible to and is financed by the Ministry of Agriculture and Forestry. In addition to the Director, the Institute is staffed by—

One Assistant Director (Dr. Allegri).
One senior research officer.
Several graduate research assistants.

105. The Institute controls some 200 experimental areas scattered throughout Italy, but must of necessity limit the scope of its research until more staff becomes available. Although free to develop its research programme independently, the Institute is occasionally called upon by the Forestry Administration to investigate urgent problems, such as the chestnut canker (*Endothia parasitica*) disease.

106. During the last twenty years much research has been done on the acclimatization of exotic forest species, and as early as 1916 Professor Pavari published a bulletin entitled "Preliminary Studies on the Cultivation of Exotic Forest Species in Italy." In 1941 he published a 600-page monograph, bringing together the results of twenty years' research on exotics, and a copy of this volume has been obtained for closer study.

107. Of the many exotic species introduced into Italy, the Institute believes the following to be worthy of special attention: Douglas fir, Lawson's cypress, *Cupressus arizonica*, *Cupressus macrocarpa*, *Pinus radiata*, *Abies cephalonica*, *Cedrua atlantica*, and several species of eucalyptus. Excellent three-ply veneer has been made from eleven-year old *Eucalyptus rostrata* after forty-eight hours' steam softening; and other species are under test at the instigation of the Institute.

108. At Vallombrosa the Institute conducts limited research on seed extraction and storage, and nursery practice, and maintains a small research laboratory and museum.

109. By reason of his intimate association and long experience with both research and education, Professor Pavari (whom the writer had previously met at Helsinki) was in a better position than any other Italian forester to convey to a foreigner these functions in true perspective.

Both Professor Pavari and Dr. Allegri were most co-operative and courteous, the latter placing himself entirely at the disposal of the writer whilst in Florence, and proving to be an invaluable source of information.

CHAPTER V—FINLAND

110. Finland is essentially a country of forests and lakes, forest lands occupying over 70 per cent. of the total land area and generally being "so stony and meagre that even when considering the far future with an increase in population, profitable agriculture is not likely to use and need more than a relatively small part of it"(1); 50 per cent. of the total forest (31,000,000 acres) are owned by farmers. It is not surprising, therefore, to find that the vital importance of timber and its products to the national economy of Finland is reflected to a high degree in forestry research and education; for the people of Finland are of necessity forestry conscious and the forestry profession has developed in a worthy tradition to great achievements.

111. The scope of the writer's movements in Finland was limited to visits to—

(*a*) *Helsinki.*—For the duration of the third World Forestry Congress, and for a brief period thereafter, to study the School of Forestry and Forest Research Institute organizations.

(*b*) *South-west Finland.*—During a three-day tour (No. 9) arranged for Congress delegates, and under the guidance of the following Finnish foresters—Messrs. Kalkkinen (Forest Councillor, and General Manager of the Co-operative Society " Metsalutto "), E. E. Erkkila (Doctor of Forestry), and Professor Aaltonen (Forestry Research Institute)—a coastal route was followed from Helsinki to Turku, thence inland to Salo, and Hameenlinna, returning via the Forest Research Institute experimental area at Ruotsinkyla (Genetics Station). Some forty inspections of forest and industrial points of interest were made, chiefly in mixed stands of spruce, pine, and birch. Of unusual interest were (1) the wooden-ship-building industry (*Pinua sylvestris*) for Russian reparations, at Turku; and (2) swamp forestry practices, and the results of bog draining in 1800 at Punasuo, the earliest in Finland.

(*c*) The University Forest at Hyytiala, and the middle Forestry School at Kuru, both some 150 miles north of Helsinki, and near the industrial city of Tampere.

Higher Forestry Education

112. The teaching of forestry in Finland dates from 1860, when in the forests of Evo (70 miles north of Helsinki) a forest college was established, with a teaching staff of a headmaster, three lecturers, and two other teachers. The Evo College moved to Helsinki in 1908, and in 1923 was incorporated into the Faculty of Agriculture and Forestry of the State University of Helsinki.

113. Finland's first Professor of Silviculture (1908) was Dr A. K. Cajander, and the present high standard of forestry education is largely due to the influence of that great forester, who subsequently became Prime Minister of Finland.

114. At present the number of students in the Faculty of Agriculture and Forestry is approximately 1,500, one-third of which are forestry students. To enter the Faculty, " Matriculation " and not less than six months' practical training in forestry are prerequisites; the annual quota of students is restricted under a " numerus clausus " system, based on a scrutiny of the applicants' academic records.

115. There are twenty-two professors on the combined faculty, eight of which are forestry professors. Two professors and several associate professors and lecturers teach fundamental (basic science) subjects to both agriculture and forestry students.

116. The Faculty of Agriculture and Forestry is directly administered by a Board consisting of all the faculty professors; the Dean of the faculty is elected periodically from agriculture and forestry professors in sequence.

117. The forestry course consists of a choice of five syllabi, each requiring four years' study with practical field training during summer, winter, and spring.

The faculty recognizes a need in Finland for variations from the general forestry course to meet the special requirements of those preparing to undertake the following specialized branches of forestry:—

(i) *Swamp Forestry.*—The conversion of swamp lands to productive forest is one of Finland's major forest problems. It has been estimated that if all the forest swamps in Finland were drained, the present national timber yield of 40,000,000 cubic metres per annum could be more than doubled.

(ii) *Forest Utilization.*—Logging, floating, sawmilling mainly in private industry.

(iii) *Forest Economics.*—Mainly for research foresters and those undertaking social studies, leading to employment by the larger timber companies.

(iv) *Commerce and Marketing of Timber.*—For those intending to be professionally engaged in the export timber trade. (Reference: Appendix (I), Extract from "Finnish Trade Review.")

118. (Ref. 139.) Table (5) records, in condensed form, the five syllabi, each of which leads to the degree of "bachelor of forestry" (metsanhoitaja). Although the variations from the general course are significant, it is to be noted that the basic forestry subjects are common to all.

119. Major subjects are recognized in each of the five courses and, in addition to the submission of a thesis therein, the standard required of students in these subjects may not be below the honours grading of "cum laude approbatur" (second class). Other honours classes recognized are "Laudatur" (first class) and "Approbatur" (third class). It is possible for a student to delay his choice of course until the end of the first year, provided that he takes all the first-year preliminary subjects required of his chosen course.

120. Students usually decide at an early stage which honours class they intend to aspire to in their major subjects, since the prescribed reading for "first class" is approximately three times that for "third class" honours. Great importance is attached to this system of honours grading in Finland, and as there is keen competition for appointments after graduation, those with the highest honours classes are naturally favoured both by the Forest Service and by private employers.

121. Graduates may qualify for the degree of Master of Forestry after a further two years' study; and Masters may qualify for a Doctorate upon submission of a major thesis.

122. *The Forestry Education and Research Building,* which is situated in the centre of Helsinki, is probably the best-equipped institution of its kind in the world, and was an inspiring and worthy venue for the third World Forestry Congress. This four-story ferro-concrete building, which faces three sides of a square, is allocated as follows:—

One wing (one-third) is occupied by the Forest Research Institute. The central block and the second wing are mainly devoted to forestry education.

Sub-ground Floor—

Wood technology laboratory.

Ground Floor—

(i) Central hall; cloak-rooms; administrative offices.

(ii) Library—archives and reading-rooms were most impressive on account of both method and magnitude. Is reported to be the best forestry library in Europe.

(iii) Forest Museum: Admirably displayed.

(iv) No. 1 Lecture Room: Accommodates over two hundred and is equipped with loud-speaker system, cinema facilities, and shaded desk lights. The seating system is that of semi-circular tiers of fixed continuous desks, stepping down to an elevated lecturer's platform, behind which a blackboard system extends over the full breadth of the wall.

First Floor—

(i) Two general lecture-rooms. About half the size of No. 1 and level floor, otherwise similarly equipped.

(ii) Faculty Board rooms and Dean's suite.

(iii) Forest Utilization Department; wood collections and laboratory; draughting room; professors' and assistants' rooms; library an examination-room.

Second Floor—
Forest Survey and Swamp Forestry Departments; two draughting-rooms; professors' and assistants' rooms; two laboratories; library and examination rooms.
Third Floor—
Silviculture Department; botanical collections; professors' and assistants' rooms; laboratory; library and examination rooms.
Microbiology Section: Laboratory and offices.
Fourth Floor—
Chemistry laboratory.
Forest Economics: Professors' and assistants' rooms; library and examination room.
Two rooms for students' society; students' cafeteria.
Roof Floor—
Glasshouses and meteorological equipment.

The small library which adjoins a professor's study on each floor contains current literature and text-books and students' theses required by the respective departments. They are used for tutorial purposes and as an ante-room for students seeking interviews with the professor.

123. *The University Forest Station at Hyytiala.*—Any record of Finnish higher forestry education would be incomplete without reference to Hyytiala, which is the headquarters of the 27,200-acre University Training Forest, some 150 miles north of Helsinki. Here, first-year forestry students spend the first summer in intensive field training under the supervision of the University Forester, who at present is Dr. Kalela (son of Dr. Cajander). The Forestry Faculty attaches much importance to the traditional atmosphere at Hyytiala, which has developed since its establishment in 1904. Individual initiative is taught by such means as rotational leader experience, and the sequence of training includes swamp forestry practices and all normal silvicultural works carried out in the management of this spruce and Scots pine forest.

124. The station consists of four separate buildings (built in 1912) located round a central square:—

(1) Students' hostel (two per room);
(2) Dining-rooms and kitchen;
(3) Tools and stores and conveniences; and
(4) Garages and firewood store.

These buildings are of rough-hewn pine, roofed with spruce shingles, and upon granite foundations.

125. Dr. Kalela, who has studied *Nothofagus* in Patagonia, is an authority on root competition in relation to regeneration. The visit to Hyytiala was undertaken in the company of Mr. Moilenen (Assistant Forester to Professor Saari).

Sub-professional Forestry Education in Finland

126. There are six State middle (ranger) schools (one of which is confined to Swedish-speaking foresters); two private schools conducted by large industrial firms; and one private utilization school. Kuru Middle School is a typical example of the State schools and was inspected in the company of Mr. Sierla (in charge of State Middle Training), and Mr. Moilenen.

127. The Kuru School, located in the centre of a forest district 30 miles north of Tampere, is a four-story concrete building constructed in 1939 to accommodate forty-five students. At present sixty men are being trained there. The staff consists of manager (Mr. Latva), three graduate instructors, and an assistant instructor in utilization.

128. From 400 to 500 applicants, 120 are selected for the annual entrance examination, which consists of Mathematics, Finnish Language, Intelligence, and working skill tests, only 40-50 being finally admitted. At least one year's forest practice is a prerequisite to the two years' course; the average age of students is twenty-three to twenty-four years, all having completed the nine months' compulsory military training.

129. Students are in charge of hired workmen and other students in rotation, and after each leader period the student is criticized by the instructor and is required to defend his work in open forum. The summer syllabus is devoted almost entirely to practical training; in winter there are four hours' lectures each day. Vacations consist of two weeks in mid-summer and three weeks in the winter.

130. A feature in the modern school building is the relationship between the two lecture-rooms and their adjoining store, specimens, and map-rooms. The latter is located on the opposite side of the blackboard wall, and prepared material, maps, &c., can be passed through a sliding door immediately behind the lecturer's desk.

The students' rooms measure 20 ft. by 22 ft. and contain two beds, two desks, and a cupboard. Sliding walls separate the students' common room from the dining-room, which provides for a large hall for special occasions.

The kitchen is characterized by two pressure cookers, each 4 ft. in diameter. It was stated that at least 28,000 cubic feet of fuel wood was used by the school in a year in place of coal.

The Forest Research Institute, Helsinki

131. A comprehensive statement on the activities and research results of the Institute during the past thirty years was published in English in 1949(2) ("Communicationes Instituti Forestalis Fenniae" 37·4, 36·6) by the Council of the Research Institute, and is now available in New Zealand. A brief résumé is reproduced below.

132. "The Forest Research Institute in Finland inaugurated its activities 1 July, 1918. By decree, it is incumbent on the Research Institute to study Finnish forestry and its fundamentals through research work and experiments, and thus create the basis for the appropriate development of forestry in the country. Further, the Institute must participate in international forest research work. The results of its work are published by the Institute in its series of publications entitled 'Communicationes Instituti Forestalis Fenniae.' It produces, in addition, popular publications.

133. "The Research Institute is directly subordinated to the Ministry of Agriculture. Its activities are planned and supervised by a Council, consisting of the Professors and the Chief Forest Officer of the Institute. The Head of the Institute is appointed by the Ministry of Agriculture, on the Council's recommendation, from among the Professors of the Research Institute, for five years at a time.

134. "The Institute comprises the following six sections of study:—

"Silviculture (Professor Dr. O. Heikinheimo, Head of the Institute);
"Forest Survey (Professor Dr. Yrjo Ilvessalo, Member of the Academy of Finland);
"Forest Economy (vacant);
"Forest Technology (Professor Dr. Paavo Aro);
"Soil Science (Professor Dr. V. T. Aaltonen); and
"Swamp Drainage Research (Professor Dr. O. J. Lukkala).

"The section for Silviculture further employs a professor of Forest Biology (Dr. Viljo Kujala) and the Government Inspector for the Protection of Nature (Dr. Reino Kalliola).

" The Institute's experimental forests and nature protection areas in the different parts of the country, totalling 50,000 acres, are supervised by the Chief Forest Officer (Mr. Alvert Sandman), assisted by three district forest officers and nine forest technicians. The Professors are assisted by assistants and forest technicians for research work.

135. " The most important comprehensive investigations the Institute has carried out are the National Forest Surveys of 1922–1923 and 1936–1938, together with investigations into the wood utilization connected with them, which have enabled, *e.g.*, the working out of forest balances at certain dates for the whole country. A third survey of a corresponding kind is being planned. Other important research projects include: The various forest sites; their properties, quality and appearance; the yield of the different tree species and mixed stands; the ecologico-biological and technical qualities of the different tree species; the varieties of the most important forest trees and improvement of trees; natural and artificial regeneration of forests; improvement cuttings; biotic and climatic injuries; calculation of the volume of standing trees; drainage of swamps for forestry purposes and related technical and biological questions; acquisition of timber—with its different phases; and qualities of wood used for different purposes and their effect on its value."

136. The Institute is housed in the same building as the School of Forestry, and, whilst the latter is not dependent upon the former, the research staff delivers a certain number of lectures to the students on a co-operative and entirely voluntary basis, to mutual benefit. Each of the six sections has well-equipped laboratories and offices for the research workers.

137. Intimately associated with the Institute is the *Society of Forestry in Finland*, which was established in 1909, on the initiative of Professor A. K. Cajander, to further forestry research and closely related work in Finland. For this purpose the Society, by granting subsidies, assists its members in opportunities for research, publishes the most important results, and presents them at its meetings. The Society edits three series of publications: " Acta Forestalia Fennica, " " Silva Fennica, " and " Commentationes Forestales ". These publications appear at irregular intervals, usually one to four editions a year. The Society exchanges publications with approximately 480 foreign institutes, societies, and scientists. During the winter season the Society has one meeting a month, with one to two lectures on forest science or related sciences.

The Society has no membership fees, as it is subsidized by the State. The membership now amounts to 317, including a considerable number of foreign corresponding members and a few scientists of particular merit as honorary members.

The present officers of the Society are :—

President: Dr. Antero Piha.
Secretary: Dr. Erkki K. Kalela.
Treasurer: Mr. Leevi Miettinsen.
Librarian: Dr. P. J. Viro.

The address of the Society is Unioninkatu 40 B, Helsinki.

138. *References to Finnish Forestry Publications in English :—*

(1) " The Forests of Present-day Finland." Ilvessalo. 1949. Helsinki.
(2) " Forest Research Institute in Finland." 1918–1948. 1949. Helsinki.
(3) " State Forestry." 1949. Helsinki.
(4) " The Associations, Education and Research in the Field of Forestry in Finland." Finnish Forestry Union. 1949. Helsinki.
(5) " The Law Concerning Private Forests." Published by Finnish State Board of Forestry. 1946. Helsinki.

139.

TABLE (5)—HELSINKI SCHOOL OF FORESTRY: COMPARATIVE ANALYSIS OF SYLLABI
(Based on hours per week.)

Subjects.	I. General Course.	II. Utilization Course.	III. Economics Course.	IV. Swamp Course.	V. Marketing Course.
Fundamental subjects—					
Meteorology	2(1)	..	..	2	..
Chemistry	16	16	16	16	16
Physics	..	7	..	7	..
Botany	17	17	17	17	13
Mathematics	5(1)	5	..	5	..
Business Administration	..	..	..	..	8
Economics	4	..	4	..	..
Elementary Forestry—					
Preliminary Silviculture	4	4	4	4	4
„ Mensuration	5	5	5	5	5
Auxiliary Subjects—					
Office Technique	..	..	..	..	4
Forest Soils	4	4	4	4	..
Forest Pathology	2	} 4	4	4	4
Forest Zoology	4	}			
Agriculture	..	..	..	2	..
Land Surveying	3	3	3	3	..
Draining Technique	..	..	..	8	..
Forest Work Study	8	8	8	8	8
Machinery	..	8	..	..	..
Engineering (Roads, Buildings)	8	8	..	8	8
Wood Chemistry	..	4	..	..	4
Economic Law	4	4	4	4	4
Book-keeping	..	..	..	..	6
Timber Trade	4	4	4	..	..
Foreign Language	..	..	5	..	15
Main Subjects—					
Silviculture (by Professor)	8(2)	8	8	8	6
Dendrology (by Docents)	4	4	4	4	2
Mensuration and Working Plans	8+(2)	8+	8+	8+	8
Forest Swamps (Lecture by Prof.)	8	2	2	8(5)	..
Forest Swamps (Pract. lab.)	6	..	..	6	..
Logging and Forest Products	12	12+(3)	12+	12+	12
Economics of Forestry	12	12	12(4)	12	12
Business Administration	8	8	8(4)	..	8
Cost Accounting	6	6	6	..	6
Marketing of Forest Products	..	..	..	..	8(6)

REFERENCES

(1) Alternative subjects.
(2) (3) (4) (5) (6) " Major " subjects, requiring " Class II " honours.
(3) and (4) have alternatives.

NOTE.—A four-years course is conducted in each column ; the " hours per week " shown are therefore the sum of eight terms.

CHAPTER VI—SWEDEN

140. Pre-eminently a country of forests (56 per cent. of the total land area), Sweden's forest industries are highly developed, and occupy a vital position in the national economy. The conversion from uncontrolled exploitation to sustained production, which has been completed in many parts of the country, has been made possible by more than half a century of increasingly enlightened forestry administration and a long and impressive record of forestry education and research.

141. Under the Ministry of Agriculture, the Board of Crown Lands and Forests manages some 10,000,000 acres of productive State forests, and, in addition to other subsidiary functions, supervises six lower forestry schools comparable to those in Norway. A separate Department, the Board of Private Forestry, acts in a legal and advisory capacity in the interests of private forestry (75 per cent. of total forest area).

142. Independent of these two State Departments, and directly responsible to the Ministry of Agriculture, is the Board of Forestry Education and Research, which administers—

(a) The Royal College of Forestry.
(b) The Forest Research Institute.

The Royal College of Forestry

143. The professional training of Swedish foresters began in 1828, when the Royal College of Forestry was established. It is located in the outskirts of Stockholm in a wooded environment on high ground overlooking the lake-like inlet of Brunns. The College consists of a main three-story building, erected in 1915, and a new students' hostel capable of accommodating thirty-two of the usual total of seventy-five students, the majority of whom consequently have to board in Stockholm. Except for hostel board, students are not required to contribute anything to the cost of their forestry education.

Entry Qualifications and Sequence of Training

144. A youth who seeks to qualify for higher forestry education in Sweden must normally proceed as follows :—

(1) Secondary education to the standard of a recognized certificate in Mathematics, Physics, Chemistry, Biology, Foreign Language (German or English), and Hygiene is first completed at either a technical high school or special agricultural school at the age of nineteen or twenty years. The standard of basic science which can be thus reached within the Swedish educational system is deemed to be sufficiently high to justify the *exclusion of these subjects from the syllabus of the Royal College forestry course*, except in special or applied forms.
(2) The aspirant is then required to gain twelve months' forest working experience, which must include a two months' course in charcoal burning at a Forest Service School, and five months under the direct supervision of a professional forester. This period of apprenticeship is normally preceded by two years' military service.
(3) Application for admission to higher forestry training must then be supported by an education certificate, report on supervised forest work and performance at the charcoal school, and certificates of health and age : applicants must not exceed twenty-six years of age.
(4) The twenty-five applicants who are successful in the qualifying examination then proceed to a twelve months' preliminary course at Garpenberg, a Forest School in central Sweden administered by the Board of Education and Research.
(5) In the following year, students proceed to the Royal College of Forestry at Stockholm for three years of advanced forestry training.

The Garpenberg Course

145. An integral part of Swedish higher forestry education, Garpenberg provides intensive training in forestry practice and elementary theory under forest conditions, as a preliminary to the advanced course at Stockholm.

The following subjects are taught on a basis of approximately one-third theory and two-thirds practice :—

Subjects.	Number of Hours.
Silviculture	265
Work Methods	508
Logging	
Forest Draining	
Road Building	
Surveying	494
Map Drawing	108
Forest Mensuration	198
Agricultural Economics	82
Hunting and Fishing	171
General Exercises, including First Aid, Skiing, Athletics, Rifle Practice, Camp-making	178
Total	2,014 hours, equivalent to 252 working-days.

146. In the past there had been no direct personal contact between the Stockholm staff and the students at Garpenberg, to the detriment to subsequent continuity of teaching ; in future, forestry professors of the College will visit Garpenberg and deliver some lectures, thus bringing closer together these two phases of education. Proposals regarding a general re-organization of preparatory forestry training are summarized in Appendix (2).

The Stockholm Course

147. The academic year is organized on a two-term basis as follows :—

First, third, and fifth Terms : 10th October to 20th December.
Second, fourth, and sixth Terms : 25th January to 1st May.

The long vacations, May to October, enable students to undertake supervised tours, gain experience in forest industries, and work on special studies.

In the third year very few lectures are given ; most of the year is devoted to surveying and mensuration exercises, working plan preparation, and final tests. The syllabus is shown in Table (6).

TABLE (6)—ROYAL COLLEGE OF FORESTRY, SWEDEN : SYLLABUS
(Three-year course)

Subject.	Lectures (One-hour Periods).	Practical (One-hour Periods).	Field Excursions (Days).
Forest Soils	86	45	12
Forest Botany	115	66	14
Book-keeping	10	20	..
Law	44	..	..
Statistical Mathematics	30	..	..
Applied Chemistry	20	..	..
Building Construction	..	20	..
Zoology	78	10	3
Mensuration	50	30	13
Silviculture	102	..	59
Forest Works Methods	10	..	..
Management	50	34	14
Utilization	110	40	35
Administration	65	..	..
Forest Economics	76	34	4
Special Lectures (from F.R.I. and others)	34	..	..

148. The staff of the College consists of seven forestry professors and six lecturers, under the chairmanship of a Dean (Professor Streffert). The College is no longer dependent upon the Forest Research Institute for dual-role lecturers, although special lectures on current research practices are regularly delivered by institute staff; the contact between the two organizations is, however, close and mutually beneficial. The professors are able to undertake research and even private consultant practice, and it was the consensus of opinion that teaching staff should have time and facilities to undertake research work for not less than 50 per cent. of their time, a balance which has been reached in the majority of cases. It is significant that the present internal alterations in the College building provide for greatly improved laboratory facilities for professors.

149. *The examination system* differs radically from that of the British Universities; assessment of the standard reached in each subject is the sole responsibility of the professor in charge, and is arrived at by a series of oral and written tests, with emphasis on the former, at times and places decided by respective professors. The marking awarded for each subject is expressed in three "pass" grades only: Excellent = 3; Good = 2; Satisfactory = 1.

A student may apply in advance to qualify for a 3 rating; in such cases more advanced reading is prescribed and examined.

To graduate it is compulsory to gain at least two 2 ratings.

150. Professor Petrini, in charge of Forest Management, and a man of great personal charm, devoted much time in detailed explanation of the College organization, system of teaching, and research. Professor Bjorkman, in charge of Botany, was also most co-operative, and his views on the relationship between teaching and research were emphatically in favour of adequate time for both. His work on forest mycology and mycorrhiza was of special interest. Professor Streffert, Dean of the College, returned to Stockholm on the day the writer left, and consequently a brief meeting only was possible.

The Swedish Forest Research Institute

151. The need for a central forestry research organization under State administration was felt towards the end of the nineteenth century, and in 1902 an Institute of Experimental Forestry was established. In 1912 the Institute was reorganized, and provided with new quarters in 1915 adjoining the Royal College of Forestry, close to Stockholm. Subsequent rapid developments in Swedish forestry necessitated a great increase in research staff and resources, and in 1945 the original buildings were extended and refitted, and a new building (the present admirably equipped headquarters of the Institute) was erected.

152. The Forest Research Institute serves two main purposes. One is to ascertain the best way of managing Swedish forests under different conditions, the other is by periodical nation-wide forest surveys to determine the state of the country's forests and changes arising in their condition. In order to satisfy these purposes the work of the Institute is carried out by seven separate divisions: Forestry, Forest Survey, Science of Work, Botany and Soils, Genetics, Zoology, and Mathematical Statistics.

153. The Institute itself is led by a Director bearing the title of professor. Each division is under control of a professor who directs the work of a number of foresters or scientists in charge of sections, and also a number of scientifically trained assistants. The different divisions have a varying number of forest rangers, laboratory and other assistants, and supplementary staff.

The following (prepared in English by the Institute) is a short survey of the work done by the different divisions, and a summary of the staff establishment.

154. *Forestry Division.*—The Forestry Division deals with problems connected with silviculture and forest mensuration.

This Division is concerned primarily with the main problems of silviculture. The Division is thus to lay down the main principles along which forests should be managed, including the problems of thinning during the growing period, when and how they should be finally cut, and how reproduction—natural or artificial—is to be ensured. These problems require research within two extensive fields of investigation: yield studies and reproduction studies.

Forest mensuration aims at establishing the methods of computing the volume of individual trees and stands, the distribution of timber into different assortments and forest increment.

155. *Forest Survey Division.*—The main object of the Division for Forest Survey is to ascertain by continuous nation-wide surveys the state and condition of the forest resources and also changes occurring in them (national forest survey), and further to compute the annual cut.

156. *Science of Work Division.*—The main task of the Division will be to carry out research for further simplification and improvement of different forest operations, above all logging and transportation—*i.e.*, work operations intimately connected with the economic carrying capacity of forestry and the standard of forest workers.

157. *Botany and Soils Division.*—Research within this division is concentrated around problems of geobotany, soil biology, mycology, plant physiology, and their related problems.

Within the *geobotanical* field, investigations are made on plant associations (forest types), and especially on their connections with the nature of the soil.

Biological research aims at throwing light on the biological processes taking place in the soil which are of importance to forestry.

Mycological research is done on the fungus diseases of living trees, as well as on destructive fungi and their damage to wood products. Of importance in this connection is to find out means and methods to counteract the damage done by these fungi.

Physiological research on plants is carried out in connection with the problem indicated above.

The chief object of this Division is to extend out knowledge of the scientific possibilities of forest production. Thus the work is concentrated on investigating the often very complex processes going on in tree and soil. The results won through this basic research will serve as important starting-points in solving the numerous practical secondary problems mainly dealt with in the Forestry Division.

158. *Genetics Division.*—Research in this Division aims at solving problems connected with forest tree *breeding*, chiefly by selection. For this purpose work is done on the resistance of young trees to the attacks of parasitic fungi and injurious insects (*resistance research*). Test work is also carried out with regard to the importance of the geographical provenance of the seed (*provenance research*).

159. *Zoology Division.*—The Zoological Division aims at investigating the biology of the injurious insects attacking trees and timber, and to indicate suitable means for counteracting their damage. Attention is also given to the soil fauna and to its significance for the soil processes.

160. *Mathematical Statistics Division.*—The methods of mathematical statistics, especially regression analysis and analysis of variance, have proved almost indispensable in advanced forestry research. To meet the requirements of statistical analysis of data collected by the various divisions of the Institute, a special section of mathematical statistics has been established. In addition to standard calculating-machines, the section will have at its disposal the Institute's punched-card machines.

161. It can be seen from this survey that the separate Divisions, by their collaboration, form one big research unit. The increased knowledge of the biological processes active in the life and development of Swedish forests obtained through the scientific

work of the Division for Botany and Soils and the Genetic and Zoological Divisions will give the scientists working empirically on problems of forest yield and reforestation research within the Forestry Division increased possibilities for solving the two chief problems of silviculture: management and reforestation. A correct attitude toward the great problems of practical silviculture demands, however, also the knowledge of forest management supplied by the research carried out at the Institute, as well as the survey of forest conditions furnished by the national forest surveys. The answers to these questions are thus often obtained by a close collaboration between the Research Divisions proper and the Division for Forest Survey. The internal planning of the forest surveys likewise often requires close contact with the other Divisions.

162. Research at the Institute is mainly based on analyses and studies of observation data collected in the field. The field-work is consequently very extensive. The Institute has thousands of permanent and temporary sample plots distributed all over the country. Institutional work is also carried out in three experimental forests with a total area of 8,500 acres of forest land. These forests are situated in Halland, Dalarna, and Vasterbotten.

163. *Institute Staff Establishment:—*

	F.	FS.	SW.	BS.	G.	Z.	MS.	Total.
Director (Professor Naslund)								1
Staff in common—								
Office Staff: Secretary (1), cashier (1), registrar (1), other staff (2)								5
Experimental Forests: Trained forest rangers								3
Other Officers: Librarian (1), porters (2), telephone clerk (1), gardener (1)								5
Division staff (1)—								
In charge of Divisions	1	1	1	1	1	1	..	6
In charge of Sections	4	..	1	2	1	1	1	10
Assistants	3	7	1	3	2	2	1	19
Assistant forest staff	9	5	1	..	1	..	..	16
Laboratory staff	..	1	..	8	2	2	..	13
Head clerks ..	3	3	..	..	..	..	1	7
Other staff	17	7	3	..	..	..	5	32
In total								117

To this is added extra staff varying between 15 and 20 persons. During the field-work season (May – October) about 100 more people are employed at the Institute.

164. Mr. Bo Eklund, Chief Assistant to the Director, whose English is excellent, demonstrated to the writer the work of all the Divisions, and the equipment and design of the new Institute building. A copy of the plans of the latter was promised, and is worthy of close study in anticipation of a similar institution in New Zealand.

A discussion with Professor Romell on his geobotanical work was most instructive; his studies of root competition are along the same lines as those of Dr. Kalela of Finland.

Professor Naslund, Director of the Institute, expressed his views on the relationship between research and education, confirming those of Professor Petrini and others—namely, collaboration with minimum of dependence one upon the other.

(1) The names of the Divisions are abbreviated as follows: Forestry = F; Forest Survey = FS; Science of Work = SW; Botany and Soils = BS; Genetics = G; Zoology = Z; and the Mathematical Statistical Division = MS.

He claims that the principle of research independence from State departmental control has fully proved itself in Sweden, and recommends its adoption elsewhere—*e.g.*, he has reported to the Turkish Government, which is establishing a Forest Research Institute.

165. Important Swedish forestry contacts in other spheres were Mr. Von Stockenstrom, Director-General of the Board of Crown Lands and Forests (State Forest Service). As Chairman of the Board governing the Royal College of Forestry and the Forest Research Institute, his admission that the isolation of the College of Forestry from the broader cultural atmosphere of a University constituted a defect in the Swedish forestry education system was of particular interest.

166. Mr. Plym-Forshell, Chief of the Afforestation Division of the Board of Private Forestry, whose acquaintance was first made in Helsinki, proved to be a most valuable contact, and his unprejudiced opinions on Swedish forestry education and research provided confirmatory evidence.

References to Swedish Forestry Publications in English

(1) "The Organization and Work of the Swedish Forest Research Institute," by Bo Eklund, Unasylva. September-October, 1948.
(2) "Outline of Swedish State Forest Management." Official pamphlet, Stockholm. July, 1949.
(3) "Forest Management and Working Plans," by Bo Eklund. Paper prepared for United Nations Scientific Conference on the Conservation and Utilization of Resources. 1949.

CHAPTER VII—NORWAY

167. Although productive forests occupy 25 per cent. (nearly 19,000,000 acres) of the total area of Norway, and agriculture but 4 per cent., a very large proportion (80 per cent.) of forest lands are privately owned by farmers; indeed, "it is often the forest that forms the main source of income whilst farming must be regarded as a subsidiary matter"(1). As might be expected, therefore, agricultural and forestry education occupies an important place in the Norwegian educational system.

168. Whilst the Church and the Education Department administer the primary, intermediate, and secondary schools, the Department of Agriculture administers both higher professional and lower vocational schools in the direct and allied fields of agriculture and forestry.

169. The degree of Norwegian educational enlightenment in the sphere of agricultural science, taking into consideration a total population of only 3,000,000, is, as shown below, impressive.

170. Not the least significant feature of Norway's agricultural training system is the logical inclusion of female domestic-science training, which, although outside the scope of this report, is considered to be worthy of special investigation.

171. *Professional Education :—*

(i) Norwegian College of Agriculture.
(ii) State Training School for Teachers to Small Holders.
(iii) State Training School for Female Teachers in Domestic Science.

172. *Lower Vocational Education :—*

(iv) Agricultural Schools (35).
(v) Small Holders Schools (7).
(vi) Horticultural Schools (7).
(vii) Schools of Dairying (5).
(viii) Schools of Forestry (5).
(ix) Schools of Domestic Science (62).

Higher Forestry Education in Norway

173. The Norwegian College of Agriculture (Landbrukshogs-Kole) was established by the State in 1859 and is under the administration of the Education Branch of the Department of Agriculture. The College is located at Aas, about fifteen miles from Oslo, and consists of six major buildings (including students' hostels) widely spaced in a rural and wooded environment. The houses of married staff form a separate and well-designed village.

174. Five courses are provided: Agriculture, Forestry, Horticulture, Dairying, and Land Redistribution (Surveying).

The period of study for all courses is three years; the first year of study is for the most part common to all courses, embracing basic sciences; and a general examination is held at the end of the first year. The general administration and discipline of the College is controlled by the Rektor and Professorrad (Professorial Board). A total of 240 students were in residence in 1949.

175. *The forestry course* is governed by a Board of the forestry professors, one of whom is elected Chairman every three years. The forestry staff consists of four professors, seven lecturers (docents), and eight graduate assistants (who rarely lecture, but assist professors and lecturers in laboratory and field work). In addition, subjects common to agriculture and forestry are taught by five other professors mainly during the first year.

176. Every second year thirty forestry students are accepted by the College; this system is strongly favoured by members of the staff, who claim that better results are achieved by concentrating for one year on the second- or third-year syllabus. Furthermore, the output of thirty graduates every other year is no less than fifteen every year, which is at present the absorption quota of State and private forestry interests.

177. The entrance qualifications for forestry students are (1) Matriculation; (2) two years' forestry work; and (3) completion of the one-year course at a Middle Forestry School (see para. 191). In recent years, some 150 applicants with the above qualifications have competed for the 30 vacancies, which are allotted by the Professorial Board after careful scrutiny of both Matriculation and Forestry School results.

178. The teaching facilities were characterized by the ample space provided for laboratory work, and whilst there was evidence of a certain degree of austerity in general maintenance, no doubt due to post-war financial stringencies, there was no apparent shortage of essential equipment; for example, the botany laboratory was fitted with twenty-four new Watson microscopes, each with electric-lamp connections.

179.

Table (7)—The Syllabus

	Total Hours.
First Year—	
Plant Breeding: Genetics	40
Botany	172
Physics	158
Geology	132
Chemistry	208
Surveying	152
Mathematics	154
Microbiology	36
Economics	72
Zoology	84
Second Year—	
Building and Construction X2	156
Soils	78
Surveying	96
Microbiology	15
Protection, Pathology	60
Law	84
Hunting and Fishing	22

	Total Hours.
Second Year-*continued*	
Mathematics	72
Silviculture X3	160
Valuation: Forest Taxation X3	210
Utilization X3	138
Forest Zoology	54
Third Year—	
Book-keeping	84
Surveying	95
Methods of Education and Teaching	84
Hunting and Fishing	22
Management, Working Plan X3	73, 30
Soils	21
Forest Botany	53
Research Methods	22
Forest Policy X2	84
Silviculture X3	50
Valuation X3	42

A special subject, which must be completed in the third year, has a coefficient rating of X4.

180. *The school year* is divided into three terms :—

First Term : 20th August to Christmas.
Second Term : 10th January to early April.
Third Term : April to June.

Second-year students, upon completion of examination in June, spend two months in forest camps engaged in surveying, silviculture, and soils studies. Third-year students take the majority of their final examinations in April, completing special studies during the third term.

181. *Examinations* are based largely on oral tests, as is shown below :—

First year : One written examination ; nine oral tests.
Second year : No written examination ; nine oral tests.
Third year : Four written examinations ; five oral tests.

The maximum rating for each examination is 1·0 ; rating below 4·0 in any examination does not qualify. The average for each year is arrived at, and to qualify this average must not be below 3·25. For the final assessment the averages of the three year's examinations are added together and divided by three. The respective co-efficients, used to weight the more important subjects when calculating ratings, are shown in the syllabus. (The co-efficients of all other subjects are 1.)

182. *The first degree* earns the designation "forst kandidat." The degree of Doctor of Agriculture (approved by statute in 1920) necessitates at least two years' further study supported by a thesis ; not more than 1 per cent. of Norwegian foresters have taken this second degree.

183. *Research in relation to teaching.*—The constitution of the College provides for research as a normal function of all professors, who rarely spend more than 50 per cent. of their time teaching.

The School of Forestry is independent of the adjacent Research Institute, but there are naturally close personal liaisons, and the Director of the Institute delivers the series of lectures on research methods by mutual arrangement.

The Forest Research Institute

(Established in 1917)

184. Located in the grounds of the College of Agriculture at Aas, the Forest Research Institute is, nevertheless, a distinct non-departmental organization responsible to the Ministry of Agriculture. (Under the Ministry of Agriculture are three State Departments, the Branch of Agriculture, the Branch of Forestry, and the Branch of Agricultural Education).

185. *Administration.*—The general policy of the Institute is guided by a Board of Forestry Research, which meets once a year. The members are :—

(1) Chief of the Forest Research Institute (Chairman).
(2) Director of the Branch of State Forestry.

One representative each of the following :—

(3) Sawmilling industry.
(4) Pulp and paper industry.
(5) Forest owners.
(6) Forest labour unions.
(7) Bergen Forest Experiment Station.

186. *The staff* of the Institute is as follows: Professor Eide (Chief: since 1921), Professor Mork (Forest Biology), Professor Klem (Utilization, and Related Silvicultural Problems), Mr. Brantsig (Yield Tables; Production Studies), Mr. Ruden (Plant Breeding and Genetics), Mr. Samseth (Forest Work Studies). In addition, there are two forestry graduate assistants, three ranger research assistants, and one research bursar (for three years).

187. From Professor Eide it was learnt that the Institute's research policy was based essentially on a close integration of the work of all members of the staff under his personal direction: the Institute, in fact, worked as a team, and consequently did not recognize any distinct sections, as is usual in larger research institutions.

188. An important function of the Institute is the compilation and interpretation of the results of the second national forest survey, which started in 1938. In this and many other respects it works in close liaison and to the direct advantage of the Forest Service and of private forestry. In 1946 the Forest Owners and Industries Research Association was formed with the view to financing further forestry research, a progressive move which is a tribute to the results achieved by the Forest Research Institute. In the same year as its formation the Association imposed a voluntary research levy on its members, which yields approximately £45,000, a considerable proportion of which was allotted to the Forest Research Institute.

189. To provide adequate facilities for the Institute, plans have been approved for a new research building at Aas, incorporating the results of the experience of overseas design. It is to be a three-story brick building of simple rectangular design, and it is hoped to be able to obtain a copy of the final plan.

190. At the College of Agriculture, Professors Sandmo (Forest Utilization), Traaen (Protection), and Roll-Hansen (Botany) were most helpful and courteous; Professor Heiberg (Silviculture), whom the writer met at the Helsinki Congress, was unfortunately in Northern Norway.

The most time was spent with Professor Eide, to great advantage; he possesses an outstanding personality and it was appreciated that he has an inspiring influence on Norwegian forestry.

Middle Forestry Education at Kongsberg

191. Through the courtesy of the Director of Forestry, Mr. Langsaeter, and his Secretary, Mr. Ostbye, a visit was made to the State School of Forestry at Kongsberg, fifty miles north of Oslo. This School, establishedin 1875, is the oldest of the three middle schools which provide a one-year ranger course, and serve as preparatory schools for higher forestry education at the Norwegian College of Agriculture at Aas. In 1949 the three schools admitted 110 students out of 350 applicants. The conditions of admission are: (1) At least nineteen years of age; (2) good health certificate; (3) attestation of good character; (4) at least one year's all-round forestry practice.

The students are admitted by the Forest Service (Board of Forestry) upon the recommendation of the Principal of the School. Education is free, but a charge is made for board.

The Course

192. The theoretical part of the course lasts from the beginning of January until the end of April and from the end of August to the end of November. The practical education occupies four months, from May (when the thaw heralds the floating season) to August and includes: scaling of timber, floating, nursery and silvicultural work, land surveying and mensuration, cultivation of swamps, marking of timber for felling, logging and sawmill work, culminating in a tour to Sweden or Denmark. During this practical training students make botanical collections and keep a working journal.

193. Lectures, totalling 900 hours, are given in the following subjects, which for examination purposes are weighted as shown:—

	Weight (Co-efficient).
Silviculture	X2
Wood Technology and Utilization	X2
Land Surveying and Mensuration	X2
Arithmetic	X1
Accounting	X1
Botany and Protection	X1
Zoology	X1
Physics ¼	X1
Chemistry ¼	
Geology ¼	
Soils ¼	
Sociology and Law	X½
First Aid	

Examinations

194. All subjects are examined at the end of the year and the results of each examination are rated from 1·0 1·5 (Excellent) to 4·6–5·0 (Mediocre). The grand average ratings (after co-efficient adjustment) are: Excellent, 1·0–1·5; Very Good, 1·5–2·5; Good, 2·5–3·25.

A student who does not get 3·25 in the final average or whose poorest subject is worse than 5·0, fails. In addition to the written examinations, the following are included in the averages:—

	Weight.
Drawing	½ X1
Working Journal	½
Practical work, and ability as a foreman	X2

A printed certificate which records the detailed results of the examination is issued to each "graduate"; the standard of these certificates are of considerable significance in competing for subsequent employment or admission to the College of Agriculture.

195. The staff of the Kongsberg School consisted of the Principal, Mr. Bretteville-Hensen, and two forestry graduate assistants (Messrs. Haug and Hoem); the Principal and one assistant have married accommodation in the school building, and the thirty-three students board in the village of Kongsberg.

196. The writer accepted an invitation to address the students, and from the number of questions asked it was evident that the general standard of English was surprisingly high; the Principal stated, however, that the one-year course was considered to be short because of the rather low standard of written composition and report writing in the majority of students.

197. The practical nature of the course was evident and strongly emphasized throughout; in addition to the summer forest practice, students were required to undertake all necessary forest work in the adjoining 10,000-acre State forest which is managed by the school staff.

REFERENCE

(1) "Norwegian Agriculture." O. T. Bjanes. 1932.

CHAPTER VIII—DENMARK

198. A flat and densely populated country, which in past ages has replaced practically all its primeval forests with agriculture, Denmark presents a sharp contrast to the essentially forest countries of Scandinavia. During the last two centuries the need for a proper balance between forestry and agriculture has been realized and there are now some 870,000 acres (8 per cent. of total land area) of carefully tended forests characteristically distributed over a very large number of small isolated units, 75 per cent. of which are privately owned.

199. The main characteristic of Danish forestry (as of agriculture) is intensive utilization of the soil; to this end forestry research has been focused on the problem of optimum yield, by the selection and improvement of the most suitable species, which has resulted in a wide use (50 per cent.) of exotics.

200. Denmark has had 163 years of experience in forestry education, and an international reputation in research on the breeding of forest trees; a brief visit was therefore made to Copenhagen on the return from Sweden.

HIGHER FORESTRY EDUCATION IN DENMARK

201. Forestry was first systematically taught in Denmark at Kiel and Elsinore in 1786 as a branch of military training. From 1800 the University of Copenhagen conducted a course in forestry; later it was at the Polytechnic High School; and from 1869 to the present day has been a faculty of the Royal Veterinary and Agricultural College in Copenhagen.

202. This College, which was founded by the State in 1856, provides higher education in veterinary, agriculture, land surveying, horticulture, dairying, and forestry. The organization of the College is based on maximum centralization of resources, with as many lectures as possible common to two or more faculties.

203. The staff directly and indirectly available to the forestry course is classified as follows:—

(1) Three Professors of Forestry:—

Professor Gron (Forest Economics, Policy and Statistics).
Professor Moller (Silviculture; Mensuration).
Professor Moltesen (Management; Utilization; Marketing).

(2) Three graduate assistants for forestry subjects only.

(3) Eleven professors and three lecturers for basic sciences and special subjects, other than technical forestry.

The Forestry Course

204. The full forestry course occupies six years, including two years of superviser practical training.

Students must be over the age of seventeen years and either have passed the University Matriculation Examination (Mathematics and Science Course) or its equivalent, and, in addition, pass a competitive entrance examination in mathematics and science. The number of students accepted each year rarely exceeds ten.

205. During the *first year of practical experience* the student must take part in the various types of forest work, learn how to mark thinnings and keep accounts, and gain a general knowledge of forestry. At the end of this year the student is examined in what he has learnt in a district which must contain at least 1,200 acres of forest and be under the management of a forestry graduate. The examination includes a test in practical work and knowledge of a special text-book for forest apprentices. This year in the field is considered to be an integral part of the academic course, although the student receives no lectures at the College.

206. For the next *one and a half years* (three terms) the student attends the College, studying basic sciences, which include the following subjects :—

TABLE (8)—FIRST ACADEMIC COURSE

Subjects.	Hours Weekly.		
	First Term (1/9–31/1).	Second Term (1/2–15/5).	Third Term (1/9–31/1).
C. Genetics	..	3	..
S. Accountancy	..	3 (1/3–30/4)	2 (till 21/12)
S. Forest Botany	..	4 (from 1/4)	5
C. Physics	..	2	2
C. Geology and Soils (General)	..	..	2 (till 21/12)
S. Geology and Soils (Forest)	..	..	3 (from 7/1)
C. Chemistry	5	4	..
S. Mathematics	5	4	..
C. Meteorology and Climatology	..	..	1
C. Microbiology	..	..	2
C. Plant Physiology	4 (from 16/11)	4 (till 31/3)	..
S. Plant Pathology	..	2	2
C. Systematic Botany	4 (till 15/11)	..	..
C. Zoology	4	2	..
Practical and Laboratory			
C. Physics	..	..	3
S. Soils	..	..	9
C. Chemistry	9	9	..
C. Plant Physiology and Microbiology	..	3	6
S. Plant Pathology	..	..	6 (till 7/1)
S. Draughting	9	6	..

C = Lectures common to other faculties. S = Special lectures for forestry students.

207. The first academic course concludes with examinations, half of which are oral. To qualify, a rating of $4\frac{1}{2}$ is required.

NOTE.—The assessment of examinations follows the Orsted system, the basis of which is :—

Maximum possible	8
First-class honours	7 +
Second-class honours	$5\frac{3}{4}$ to 7
Minimum for pass	$4\frac{1}{2}$

208. The *second academic course* occupied the next *two and a half years* (four terms), the syllabus of which is as follows :—

TABLE (9)—SECOND ACADEMIC COURSE

Subjects.	Hours Weekly.			
	Fourth Term; Sixth Term (1/3–10/6).	Fifth Term; Seventh Term; (1/9–31/1).	Sixth Term; Fourth Term (1/3–10/6).	Seventh Term; Fifth Term (1/9–31/1).
S. Surveying	5	3 (from 1/10)	..	..
S. Forest Zoology	..	..	5	1
F. Forest Management	..	..	4	1
S. Land Laws	..	..	2	4
C. Social Economics	..	..	2	3
F. General Forest Economics	3	4 (till 1/10)	..	..
F. Special Forest Economics	..	4 (from 1/10)	..	..
F. Forest History	2	2	..	..
F. Forest Policy and Statistics	..	..	..	2
F. Silviculture	2	2	2	2
F. Utilization	..	..	3	2
F. Mensuration	4	2	..	..
F. Timber Marketing	2	1	..	..
Practical and Laboratory				
S. Surveying	2	2 (from 1/10)	..	..
F. Management	..	..	..	4 (till 21/12)
F. Forest Economics	..	3	..	..
F. Mensuration	..	3	..	..

F = Subjects taught by forestry professors only.

209. Additional supervised practical training between terms is arranged as follows :—

Surveying .. .. .. From 1st July to 1st August—once only.
Working Plans .. .. From 10th June to 30th June } Alternative
Mensuration .. .. .. From 10th June to 30th June } years.

It is also a feature of the course that during terms all students accompany professors to forest excursions once a week to submit and debate problems.

210. Upon completion of the *second academic course* an examination is held. Students then proceed in groups of three to approved sawmills for *one month's* training, where they are required to prepare a plan of the unit and an analysis of production from logs to final product.

211. For the next *thirteen months* the students are posted to forest districts under supervision and are required to assist the Superintendent in his administrative duties, submit a map of a completed surveying exercise covering a forest area of not less than 250 acres, prepare a working plan, and do examination tests based on mensuration and taxation problems.

212. The six years' training culminates in a final "*Applied Forestry*" *Examination*, successful candidates gaining the degree of "forst kandidat." During the last fifty years an annual average of seven graduates in forestry have completed their training at Copenhagen, and it has become the practice of the State to appoint only graduates who have gained a first-class degree.

213. The accommodation and facilities provided exclusively for forestry staff and students show evidence of financial stringency, and on Swedish or Finnish standards are barely adequate; the Professors are, however, able to carry out some research and there is a good forestry library, and basic science laboratory facilities are excellent. Furthermore, a close liaison is maintained with the Forest Research Station.

214. The Royal College administers an arboretum at Horsholm, thirty miles north of Copenhagen; here practical instruction in botany and allied subjects is given. The Curator of the arboretum is Dr. Syrach Larsen, whose research on tree breeding will subsequently be referred to.

215. Of the forestry staff, contacts were made with Professor Gron, who is President of the Nordic Forest Union, and took a prominent part in the Helsinki Congress; and with Professor Maltesen, who supplied the writer with all the data upon which this section of the report is based. A special feature of Danish higher forestry education was the commendably strong emphasis on practical qualifications.

216. Since 1908 the Ministry of Agriculture has provided middle forestry training for ranger grades which now consist of a seven months' preliminary course at an agricultural school; two years' forest apprenticeship; and, finally, a one-year course at a ranger school from which an average of twenty-seven students a year pass out. Time was not available to visit one of these schools.

Danish Forestry Research

217. Forestry research in Denmark is organized in the following manner:—

(1) Silvicultural and Mensuration Research, by the Danish Forest Research Station.
(2) Utilization and Timber Research, by the Technology Institute.
(3) Entomology and Mycology (and other special subjects),—by professors of the Forestry School.
(4) Forest Tree Breeding, by—
    (*a*) Dr. Syrach Larsen, Curator of the Horsholm Arboretum.
    (*b*) Danish Forest Service Tree Breeding Station, Krogerup.

The work carried out by (1) and (4) are briefly described.

218. *The Danish Forest Research Station.*—The Station is located in the forest suburb of Springforbii, six miles from Copenhagen. It is managed by a Director and a Research Committee consisting of—

Director of the State Forest Service (Chairman).
Technical Representative of the Forest Service (Deputy Chairman).
Director of the Station.
Two representatives of private forestry.
One representative of forestry education (Royal College of Veterinary and Agriculture).

The Committee is responsible to the Minister of Agriculture.

In addition to the Director, Mr. Lovengren, the research staff consists of two silviculturists, three sample plot officers, and several graduate assistants.

219. The main functions of the Station are the study and improvement of silvicultural practice by means of research in its many sample plots, the registration of some dating from 1850; also nursery and mensuration research, and a special section working on the afforestation of heath lands. Although a small establishment, the Station has a long record of achievement and continuity, and since its establishment in 1901* has published in its transactions over 150 papers.

220. In addition to liaison with tree breeding research undertaken elsewhere, the Station is represented on the Seed Board, which was established by the Danish Forest Society in 1937 to improve and protect the quality of the seed. Over 340 stands have been approved and registered, the seed from which is sold under a written guarantee of origin; most commercial nurserymen are reported to have pledged themselves to submit

* The first Director of the Station was Dr. A. Oppermann, who held the position until 1931; from 1887 to 1917 he was also a lecturer and professor of the Forestry School.

to this control and to give information as to origin of seed on invoices. The Station also co-operates with the State Seed Testing Station (established in 1871) which is administered by a similar Committee appointed by the Minister of Agriculture.

Forest Tree Breeding

221. A visit to Horsholm Arboretum enabled the writer to renew contact with Dr. Syrach Larsen, who was at the Helsinki Congress, and had recently been in New Zealand. A scientist of great modesty and personal charm, Dr. Larsen is a recognized world authority on genetical improvement of forest tree types.

Nominally Curator of the Arboretum, Dr. Larsen has concentrated on tree breeding research since 1924, and since 1937 his work has been increasingly supported by grants, partly from the State and partly from the Danish Forest Society and other private sources. His views on the importance of tree breeding expressed at the third World Forestry Congress, and surveys of the results which he has achieved have been published in English and are now available in New Zealand, and consequently it is only necessary to express personal impressions gained whilst in his company.

222. The technique of grafting both broad-leaf and coniferous species has been developed to a fine art at the Arboretum, and Dr. Larsen emphasized that this is routine work which can readily be taught to intelligent workmen. Glasshouse grafting was not recommended under normal circumstances, Dr. Larsen affirming that the best of his trained nurserymen have completed 100 successful *Pinus* grafts in the nursery lines in one working-day.

223. Several " seed gardens " of larch, ash, Douglas fir, and spruce which had reached or were about to reach the stage of seed production were inspected. Of particular interest were a 1-acre larch " seed-garden " consisting of widely spaced alternate rows of—

(*a*) European larch (*Larix decidue*) grafts from a single elite tree planted by Von Langen in 1769 of uncertain origin. (The grove from which this tree was selected was subsequently visited; the average total height was 110 ft., the crowns being flat with no sign of over-maturity; the diameters at breast height averaged 36 in.)

(*b*) Japanese larch (*Larix leptolepis*), offspring (F_1 generation), from one controlled pollination between two well-formed trees.

The objective was to obtain a commercial yield of controlled hybrid (***Larix eurolepis***) seed, by pollination of the European by the Japanese larch; the former, being a " clone," was immune from self-pollination. The first yield was expected in the coming year.

224. A feature of a seed-yielding ash " seed garden " inspected was the visible vegetative difference between the alternate rows of " male " and " female " grafted plants; the growth of the female plants were slower than the male, this being attributed to the physiological effect of seed production. Dr. Larsen has observed that narrow annual rings coincided with ash seed years and that in older Danish stands of ash the final crop often consisted almost entirely of dioecious male trees, the majority of seed-bearing trees having been removed in thinning or suppressed on account of their slower growth.

The Danish Forest Service Tree Breeding Station at Krogerup:

225. In the company of Dr. Larsen this Station was visited, as a natural sequence to the pioneer work at Horsholm. Recognizing the practical importance of Dr. Larsen's results and their direct application to Danish State forests, the Department has recently

established this Station with the object of ensuring that both State and private forests are supplied with the best seed and tree stock available both (*a*) at the present time and (*b*) in the future.

226. The officer in charge of the Station was required (presumably in collaboration with the Seed Board) to locate and maintain an official register of the best stands in Denmark, organize the collection of seed and cones, and extract and store seed at the specially designed Station headquarters, thus fulfilling the objective (*a*).

227. With a view to the future (*b*), tree breeding research was also to continue and "seed gardens" established in close collaboration with Dr. Larsen. It was intended that the Station shall, as soon as possible, raise sufficient tree stock at Krogerup to supply all State forests and private requirements.

228. A modern Swedish seed-extraction plant was the central feature of the Station headquarters; a copy of the prospectus of the units was secured.

229. The attitude of the Danish Forestry Administration towards forest tree breeding was thus evidently one of practical definition in the realization that the origin and quality of seed was of major silvicultural significance.

230. The official Danish approach to the breeding should be closely examined by the New Zealand Forest Service; intensification of the control of seed collection and registration of stands present many practical difficulties under New Zealand conditions, but to a limited extent can be applied: the continued study of tree breeding technique (particularly grafting of conifers) is strongly advocated as an essential basis for long-term research on the intensely complex problem of improving the quality of the major introduced species.

REFERENCES IN ENGLISH

(1) "Forestry in Denmark." A. S. Sabroe. 1949.
(2) "Forest Tree Breeding and Danish Experiments." C. S. Larsen. 1946.
(3) "Forest Genetics." C. S. Larsen. Third World Forestry Congress. 1949.
(4) "Estimation of the Genotype in Forest Trees." C. S. Larsen. 1947.
(5) "Danish Experimental Forestry Service: Account of the Agency 1901–1926."

CHAPTER IX—UNITED KINGDOM

231. This report would not be complete without reference to the British system of higher forestry education, which, unlike that of most continental countries, is provided solely by independent Universities.

Degree courses in forestry are offered by the Universities of Oxford, Edinburgh, Aberdeen, and Wales.

University of Oxford

232. The Oxford Honours School of Forestry (Faculty of Agriculture and Forestry) differs from other British Schools of Forestry in that the conditions of admission require candidates to have obtained Honours either in Honour Moderations in Natural Science or in a Final Honours School, or be a graduate of an approved science faculty of another University; such basic science qualifications must include Botany, Geology, Chemistry, and Physics. The School of Forestry course, which subsequently occupies two years, is thus the equivalent of a graduate course comparable to that of Nancy (France).

The other main characteristic of the Oxford School of Forestry is that the research staff of the Imperial Forestry Institute is closely affiliated to the School.

The teaching staff thus available totals fourteen, representing the following subjects :—

(1) Tropical Forestry, Forest Policy (Professor of Forestry).
(2) Pathology, Forest Hygiene.
(3) Forest Engineering and Utilization.
(4) Forest Zoology.
(5) Forest Management and Mensuration.
(6) Mensuration.
(7) Forest Economics.
(8) Silviculture.
(9) Microbiology.
(10) Tree Physiology.
(11) Forest Ecology.
(12) Tropical Forest Botany.
(13) Soil Science (*a*).
(14) Soil Science (*b*).

For many years severely restricted in space and facilities for teaching and research, the Imperial Forestry Institute and School of Forestry expect to occupy a new well-equipped building in 1950.

University of Edinburgh

233. The Faculty of Science provides a three-year course, the first year being devoted to the basic sciences : chemistry, natural philosophy, zoology, and botany. The second and third years are confined to forestry subjects, taught by the staff of the Department of Forestry, which consists of the professor and four lecturers.

University of Aberdeen

234. The Department of Forestry provides a three-year course similar in organization to that of Edinburgh ; the staff consists of the Professor of Forestry (who delivers lectures in all the main forestry subjects) and four lecturers in special subjects.

University College of North Wales (Bangor)

235. As in the cases of Edinburgh and Aberdeen, the course is three years, the first year being the same as that for the Pure Science faculty.

The staff consists of the Professor of Forestry, Professor Emeritus and four lecturers.

Practical Training

236. All four British Schools of Forestry conduct practical forestry training in vacations, which usually include at least one tour on the Continent ; the preparation of a working plan is also compulsory in all cases. The length and scope of practical forestry training is, however, appreciably less than that insisted upon in continental Schools of Forestry.

Teaching Staff and Research

237. Oxford, alone of the four British Schools of Forestry, combines facilities for education and forestry research, by close liaison with the subsidized Imperial Forestry Institute.

None of the other Schools of Forestry is associated with research institutes and consequently the faculty staff are, with minor exceptions, fully occupied in teaching, in the case of Aberdeen the major forestry subjects, Silviculture, Management, Utilization, Zoology, and Forest Policy, are taught by the Professor of Forestry.

The consensus of opinion amongst British forestry educationists was that time and facilities to undertake research was desirable, and in spite of inevitable financial difficulties the trend was in the direction of larger teaching staff to achieve this objective.

CHAPTER X—SUMMARY OF CONCLUSIONS AND RECOMMENDATIONS

238. The following conclusions and recommendations are submitted, in the conviction that they are to a greater or lesser extent, applicable to all countries seeking the highest possible standards in forestry education and research.

For convenience of presentation, Education and Research are dealt with under separate headings; where they impinge, the liaison is discussed under Education.

EDUCATION

239. *The Principle of Academic Freedom is Recognized in European Higher Forestry Education.*—The Schools of Forestry visited may be classified as follows:—

(*a*) *Faculty of an Independent University.*—Hann-Muenden (Germany); Florence (Italy); Oxford; Edinburgh.

(*b*) *Faculty of a State University.*—Helsinki (Finland).

(*c*) *Faculty of a State Agricultural College, or Technology Institute.*—Aas (Norway); Zurich (Switzerland); Copenhagen (Denmark).

(*d*) *A State College of Forestry.*—Stockholm (Sweden); Nancy (France).

With exception of the British, German, and Italian schools, all are State institutions; this suggests the possibility of less academic independence in the latter cases, but, in fact, *there was no evidence of this*, due to both protective constitutional measures (representative Advisory Boards), and to traditional forest policies of non-interference in internal educational administration—*e.g.*, the French National School of Forestry, Nancy.

Thus, although systems of European forestry education differ in many respects, an accepted common denominator is academic freedom.

240. *The Reputation of a School of Forestry Depends Upon the Standing and Numerical Strength of its Staff.*—No apology is offered for this conclusion, which, whilst axiomatic in Europe, is inclined to be overlooked in newer countries of the English-speaking world. Two factors are involved: quality and quantity; both are equally important. As a result of the relatively few but representative contacts made with European forestry educationists, the opinion is held that the average standard of professorship is impressively high, widely experienced, and in general, inspired by long and worthy traditions.

241. Numerically the position in 1949 was as follows:—

School.	Forestry Professors and Lecturers.	Basic Science or Part-time Lecturers.	Approximate Current Annual Intake of Students.
Hann-Muenden	9	11	25
Nancy	10	*	26
Zurich	7	2+*	20
Florence	9	2+*	12
Helsinki	8	14	100
Stockholm	7	6	25
Aas (Norway)	11	5+*	30 (alternate years).
Copenhagen	5	*	10
Oxford	11	*	25
Edinburgh	5	*	30

* Denotes additional basic science lecturers of another faculty or institution.

242. By total devotion to teaching, a full forestry syllabus can be managed *after a fashion* by as few as three lecturers; it has not, however, been the experience of old-established European schools that such a minimum staff is academically or economically sound. In forestry, as much as any applied science, a breadth and freshness of outlook is required of its teachers, which can be maintained only by research, with time and scope to keep abreast of current forestry developments.

243. That is the basis upon which all the above representative Schools of Forestry have formed their respective policies; some, of course, more generously endowed and equipped for complementary research than others.

All the continental Schools of Forestry have, in their evolutionary development, depended largely upon liaison with Forest Research Institutes to complete their staff establishment; hence the consistent locational affinity one for the other, or even complete blending of both which, for instance, characterizes Hann-Muenden.

Research obviously suffers if teaching is unduly imposed upon it, and in recent decades much thought has been given in Europe to the means to achieve the fine balance between research and education, with due regard to the accepted fact that a liaison is desirable if not indispensable.

244. It is in Finland, Norway, and Sweden that the most impressive results in solving this problem are to be found. These three forest countries have reached the common conclusions, through their separate experiences, that—

(*a*) The School of Forestry and Forest Research Institute should be adjacent and in close liaison.

(*b*) Each should be self-contained as far as possible, dual capacity staff being justified only in rare and minor subjects.

(*c*) Forestry lecturers should undertake research up to 50 per cent. of their time and be provided with adequate research facilities; some control over duplication of research being exercised.

These conclusions have been put into effect in the three Scandinavian countries and are commended as long-term objectives.

245. The primary lesson which should be learnt from long European experience is, however, to avoid the temptation of establishing an inadequately staffed forestry faculty. The minimum staff which can be recommended is a lecturer for each of the following subjects: Silviculture: Utilization; Management; Protection; and Forest Policy (including valuation, economics and administration); and supplementary part-time lecturers in special subjects form the staff of a Forest Research Institute.

246. *Adequate Teaching Facilities Should Include Ready Accessibility to Forests and Forest Industries.*—It was evident in all countries visited that the standard of higher forestry education bore a direct ratio to facilities and practical training.

Recognition of the former was reflected in the modern facilities provided in the Helsinki School of Forestry, in the reconstruction of the Swedish and Norwegian School buildings, and in the decision to build a new School of Forestry at Zurich.

247. In regard to the latter, nothing impressed the writer more strongly than the importance attached to practical forestry training in continental countries, perhaps because this emphasis contrasted sharply with the relatively limited practical training which British Schools of Forestry are able to provide.

In particular, the management of a forest by a School of Forestry (Zurich; Nancy Helsinki; Stockholm) is a practice strongly to be commended.

Research

248. *Central Forest Research Institutes Provide the Basis Upon Which the Forest Management in Europe Develops.*—The centralization of forestry research in one State-endowed institution is a feature of all European countries visited. Even Germany, which has traditionally favoured decentralization of research, now recognizes (at least in the Western Zones) the merit of a strong central institution.

The extent to which Research Institutes are endowed, and consequently staffed and equipped, naturally bears a close relationship to the importance of forestry and its products in the national economy. It is significant and worthy of particular note that in Finland, Norway, Sweden, and Denmark the Forest Research Institutes receive very considerable financial support from private forestry organizations in recognition both of the practical benefits of past research and of the advantages to be gained by continuation of research.

249. *The Divorcement of Forest Research Institutes from State Departmental Control is Characteristic of the Forestry Organizations of All Scandinavian Countries.*—The Chairman of the Council of the Finnish Forest Research Institute, which consists of senior members of the Institute, is appointed by the Minister of Agriculture on a five-year term.

The Swedish State School of Forestry and Research Institute are administered collectively by a representative Board directly responsible to the Minister of Agriculture.

The Norwegian Forest Research Institute is administered by a separate Board appointed by the Minister of Agriculture, and has strong private representation.

The Danish Forest Research Institute is under administration of a Board (Chairman of which is the Director of the State Forest Service) similar to that of Norway.

It is not suggested that forestry research in New Zealand has reached, or is likely to reach for some time, the stage when such divorcement from departmental administration is either practicable or desirable. The responsibility for implementing forestry research in New Zealand must logically rest with the State as the major proprietor of the national forest resources; Scandinavian countries have, however, recognized the importance of a balanced programme of forestry research, not unduly influenced either by the demands of departmental expediency or the commercial claims of private interests. The onus is on the New Zealand Forest Service to insulate its research organization from such influences.

250. The principle of advisory representation in the direction of Scandinavian forestry research is, however, no less applicable to New Zealand. The Forests Act, 1949, provides for the setting-up of Advisory Committees, and the Forest Service already has under consideration the establishment of such a Committee composed of both private and State forestry interests to advise the Minister of Forests on the activities of the Forest Research Institute. Due regard must, however, be paid to the fact that in Scandinavian countries a much lower percentage of forests are State owned—*e. g.*, Norway, 20 per cent.; Sweden, 25 per cent.; Finland, 43 per cent.—than in New Zealand (where 71 per cent. of the total forest area is State administered), necessitating a proportionately stronger State advisory representation than in Scandinavia.

251. *The Value of International Liaison in Forestry Research is Emphasized.*—The handicaps of geographical isolation and the tendency of foresters so isolated to be satisfied to remain monolingual give special significance to the above Congress finding. The writer met many research foresters in Europe who spoke English (and other foreign languages) fluently, and was thus able to gain a slight but none the less vivid impression of the scope and nature of technical forestry literature beyond the reach (except in summary form) of most English-speaking foresters; and it was evident that the majority of Scandinavian research foresters read German and French (as well as Swedish) technical forestry literature to their professional advantage.

Believing that long-term action is needed in this connection—

252. *It is recommended*—

(*a*) That the study of a foreign language be compulsory in any course of higher forestry education which may be provided for New Zealanders in New Zealand or overseas;

(*b*) That preference be given to German, Swedish, and French in equal proportion amongst students; and

(*c*) That a bursary be granted at regular intervals to enable a suitable research student to study post-graduate forestry at a German-, French-, or Swedish-speaking school.

253. No less important than the above, and of more immediate application, is the maintenance of liaison with overseas research organizations in Europe, as well as in America and Empire countries. Such research as that undertaken—

By Burger of Zurich on erosion :
By Larsen of Denmark on tree-breeding :
By Guinier and Pourtet of Nancy on poplars :
By Naslund of Stockholm on yield and increment :
By Romell of Stockholm on forest root competition :
By Bjorkman of Stockholm on Mycorrhiza and forest pathology :
By Pavari of Florence on exotic species acclimatization :
By Ilvessalo of Helsinki on forest survey :
By Kalela of Helsinki on forest root competition and regeneration,—

are important, but isolated examples of work worthy of closer study by those who now or in the future may specialize in similar research in New Zealand.

254. The International Union of Forest Research Organizations, which was represented at the third World Forestry Congress by Dr. Burger of Zurich, is commended for its work, and *it is recommended* that the New Zealand Forest Research Institute should seek membership of this Union.

255. *Forestry Research of a High Order Involves the Careful Selection of Young Foresters and Subsequent Intensive Training Under Eminent Scientists.*—In the initial establishment of a Research Institute the recruitment of some experienced specialists from other countries is often unavoidable. This is, however, a temporary expediency, and it has been the experience of long-established European research institutions that each country must in the main expect to select and provide adequate training for its own research foresters.

256. *It is recommended* that this conclusion be accepted in principle by the New Zealand Government and that young outstanding foresters and technicians who have already proved their research potentiality under New Zealand conditions should from time to time be seconded, preferably on scholarship exchange basis, to suitable overseas research Institutes to obtain breadth of outlook and wider research experience.

A long-term policy of training research officers in forestry and forest products under conditions which attract the most suitable men should be the basis of the development of a National Forest Research Institute.

APPENDIX (1) THE COMMERCIAL FORESTRY EXAMINATION : A SPECIALITY OF FINNISH FORESTRY EDUCATION

In Finland more than in any other country economic life is dependent on forestry. Hence it is natural that forest sciences and the highest forestry education have been devoted the most attention, and that they have—one might say of necessity—developed quite far. This applies particularly to education in silviculture, forest mensuration, and technology of logging and forest products.

Far-reaching work has been carried out in all these branches in other parts of the world too, and the results arrived at are remarkable, but in one line of forestry education Finland has come to play a pioneering role, as it were. Just because Finland is so dependent on her forests, in her international trade in particular, she has had to devote a great deal of attention, in the sphere of University education, to the commercial side of forestry. Tendencies similar in their aim have earlier been apparent in France and Germany, with the emphasis, however, on the technical side. The statute passed in Finland in 1944 on the new Forestry Examination of the Faculty of Agriculture and Forestry of Helsinki University created the first actual course of study in the world—requiring four to five years of study—the aim of which was to endow skilled personnel with a University degree to tackle the economic problems of the timber trade and forestry.

Theoretically, there had naturally been other means too of organizing the specialized economic education required in this important branch. Commercial and economic education had previously been imparted in Finland by three Universities and three commercial colleges. Nevertheless, the decision taken was no doubt the correct one, being based on the assumption that the man who will be actively concerned with the export of timber must also know a great deal of the side of forestry with which the forestry examination is concerned—on which the Faculty of Agriculture and Forestry

of Helsinki University had for tens of years past imparted knowledge. The amendment achieved by the statute was that the former forestry examination was divided into five alternative courses, the commercial line being one. In this way it was hoped to preserve a feeling of professional fellowship between foresters working in their special branches. To provide an idea of what is considered of greatest importance in these studies it may be useful to give a brief account of the course of study followed during the student's four years in the faculty.

A young student, matriculating in the University for the study of subjects connected with the timber trade, may often, after the first term or year of study, feel slightly disappointed. In the lectures and text-books he finds nothing of the timber trade—a suitable basis must first be created leading up, at a later stage of study, to the special questions of the profession. Among the basic things to learn is, *e.g.*, botany, as the strength characteristics of wood for instance, determining its commercial value, are based on the anatomic structure of tree plants. And the same applies to chemistry, as a great part of the final products of forest industries are arrived at by chemical processes. Further, it is important that in his first year the student makes himself acquainted with the general problems of national and business economy, which help him later on to understand the special problems of the timber trade. The importance of the study of foreign languages, English, and French or German, is obvious.

In his second, third, and even fourth year of study the student must make himself acquainted with a variety of subjects, many of which, at first glance, seemed to have a very slight connection with the timber trade, but which are nevertheless of the greatest importance both from professional and general aspect. Such subjects include, *e.g.*, economic jurisprudence, wood chemistry, technology of floating, roadmaking and building, rationalization, book-keeping and calculation of costs, wood protection, &c.

Not until his third year of study does the student come into contact with actual professional subjects connected with the timber trade. But apart from that, the student has to follow the same syllabus in forest technology, forest economics, and business administration of forestry as his fellows training for actual silvicultural tasks in other courses of the examination. And he must even make himself acquainted, to a fairly large extent, with silviculture and methods of forest mensuration, although it is the timber trade with its related specialties that requires his main attention.

His holidays, the timber-man-to-be, who will be awarded on graduating the same degree of Bachelor of Forestry as the others passing the forestry examination, must spend on practical training. First he will have to participate in logging and floating, proceed to sawmills and loading tasks, and finally to the study of office work in the timber business. Therefore, on finally leaving his School of Forestry behind him, he will feel he has acquired a quite comprehensive—both theoretical and practical—knowledge, and may confidently apply for employment with timber-exporting companies.

This form of forestry education, in spite of its short term of existance, has already aroused interest abroad, *e.g.*, in the United States and in Sweden. In this branch Finland can no doubt hold out a worthy example. Studies so highly specialized are naturally only possible in a country whose whole life is dependent on her forests and who must consequently devote special attention to the development of her most important branch of economy—

P. Toivonen. Extract from " Finnish Trade Review," July, 1949.

APPENDIX (2)—SWEDEN

Precis of relevant recommendations submitted by a Committee to report on the development of the Forest Research Institute, and the Royal Colleges of Forestry, Agriculture, and Veterinary Science 1947) ; and subsequent parliamentary " white paper " No. 177, dated 27th February, 1948. (Translation from Swedish by Mr. M. Grainger, New Zealand Forest Service.)

To take care of the demands of development in connection with research and higher instruction in agriculture and forestry, it is proposed that Parliament should approve a plan for the overhaul and extension of the agricultural schools to come into force on 1st July, 1949, and implying among other things a strengthening of the scientific appointments at the Agricultural, Veterinary, and Forestry Colleges, together with the Forest Research Institute. In connection therewith certain proposals are put forward concerning entrance requirements, tuition arrangements, &c., in these professional colleges.

Co-ordination of Research and Education

(1) It is proposed to set up a co-ordination Committee consisting of representatives of the colleges referred to, and also the Plant Protection Station, Veterinary Station, and the Forest Research Institute.

(2) The Committee recommends a certain co-ordination and a closer co-operation between the College and Research Institute whereby for both institutions common scientific appointments can be established. Occupiers of these appointments would be tied at the same time to both the College and the Institute. A professor at the College should thus at the same time be the chief for the corresponding section in the Institute, and the section be common to both the College and the Institute.

The Committee points out that research work at the Institute is directed towards the solution of certain outstanding problems, whereas at the College every research worker is free to select his own research sphere. In deciding the nature of research for proposed common posts occupiers, the Committee considers that certain restriction of the free research activity which in general is practised by research workers at the College may be necessary.

The particular spheres which the Committee decided could be under common professorship are, firstly, Forest Technology, and, secondly, Forest Zoology. At the same time it is proposed that the existing professorships in these subjects should be divided up thus: Forest Technology into one Professor of Job Study and one of Timber Science; and Forest Zoology into one Professor of Forest Entomology and one of Forest Zoology with Wild Life Conservation. All four Professors to be common to both College and Institute.

Education

(3) The Swedish Forest Service has been in favour eventually of reorganizing the Charcoal School into a Foremen's School, with considerably longer courses. The Board of Education and Research, for its part, agrees that it is desirable that the Charcoal School should be reorganized in this manner. The Investigation Committee has had discussions with the Forestry College and the Forest Service, and the Forest Service has put forward the following proposal: that under the Board there be set up a State preparatory forestry course of about four months' duration according to the following construction plan:—

Tuition Subjects.	Estimated Total Hours for	
	Practical Work in Forests.	Theoretical Tuition, Oral Work, Tests, &c.
(*a*) Forest Technology—		
(*a*) Felling of all kinds	130	..
(*b*) Equipment knowledge and care: (At least five different types of saw should be filed)	48	..
(*c*) Extraction	48	..
(*d*) Knowledge of horses, Harnes and extraction equipment	8	16
(*e*) Planning of cutting (logging units, &c.)	16	4
(*f*) Measuring of timber loose and solid	32	12
(*g*) Drainage and stream cleaning	24	2
(*h*) Road and main haulage roads with explosives	56	4
(*i*) Charcoal burning—		
In pits	120	10
In kilns	8	..
	— 490	— 48
(*b*) Silviculture—		
(*a*) The import of forestry in Sweden	..	4
(*b*) Release cutting	36	4
(*c*) Thinning	36	4
(*d*) Marking	16	4
(*e*) Care of cut-over areas	36	..
(*f*) Seeding and planting	72	4
(*g*) Fire protection	..	4
	— 196	— 24
(*c*) Other subjects—		
A. Employee Welfare—		
(*a*) Forest Workers Protection	..	6
(*b*) Accident Prevention	20	..
(*c*) Hygiene and Health	..	2
B. Sport: Ski driving, taking bearings, swimming	34	4
C. Camp making	16	..
	— 70	— 12
Total	756	84
i.e.	90%	10%

Students should be paid according to customary rates amounting at least to that necessary for sustenance and tuition material.

The aim in thus reorganizing the State Charcoal School is twofold. In the first place it is sought to establish a more sure basis for determining the suitability of applicants for the Forestry College; and, secondly, it is sought to open up possibilities for a more intensive tuition at the College without lengthening the study time, by carrying over to the Charcoal School certain of the practical work at present included in the Garpenberg course. This State preparatory forestry course is not proposed as the indispensable and only means of entering the Forestry College. Other equivalent instruction ought to be approved, though at present such other equivalent standard does not appear to exist.

If this proposal to reorganize the Charcoal School is approved, it is proposed that the existing preparatory course at Garpenberg be discontinued and Garpenberg become instead a function of the Forestry College for practical training and for such theoretical instruction which ought to go hand in hand with the practical exercises. In this way an extra term can be gained for theoretical studies at Stockholm ; and, further, tuition could from the outset be placed under the leadership of the respective College departments, without repetition such as occurs to some extent at present.

Tuition at the Forestry College would according to the proposal be spread over three and a half years—that is, about the same length as the existing preparatory and main courses together.

Specialist Forester's Examination :

(4) The Investigation Committee has gathered that, in the main, facilities for specializing do not exist at the Forestry College. In Finland the Forester's Examination can be obtained along not less than five different lines—*i.e.*, the General line, the Swamp Land line, the Utilization line, the Economics line, and the Timber Marketing line. The General line is intended to give a general higher forestry education, while the four others provide specialized education.

The Committee, however, considers that specialization at the Forestry College should be shaped with caution. The Committee considers that short intensive training courses of different kinds ought to be arranged under the care of the Forestry College, eventually in co-operation with other competent institutions. It considers that organization of such courses should be determined from time to time, but that in general they should not be longer than two to three months.

Forest Doctor's Degree :

(5) Need for scientific men in the sphere of forestry is very great. In order that the Forestry College may be able to train scientific men with such qualifications as are now stipulated for the higher scientific posts it is essential that the College should receive such facilities as will permit the granting of the Doctor's Degree. The Committee proposes that this should be put in hand.

APPENDIX (3)—OXFORD SCHOOL OF FORESTRY

FIRST-YEAR TIME-TABLE, 1948–49

——	Michaelmas Term.		Hilary Term.		Trinity Term.	
Monday ..	9–10 10–11 11–1	Land Utilization. Mensuration. Mensuration Practical.	9–10 10–1	Management. Forest Pathology.	9–10 10–11 11–1 2–4 5	Ecology. Systematic Botany. Systematic Botany Practical. Management (W.P.). Animal Ecology.
Tuesday ..	10–1	Surveying.	10–11 11–1 2–5	Wood Structure. Wood structure. Mensuration Practical.	9–10 10–1	Silviculture. Soil Science Practical.
Wednesday ..	10–11 11–1	Systematic Botany. Systematic Botany Practical.	9–12 12–1	Forest Zoology. Soil Science.	9–5	Excursion.
Thursday ..	9–10 10–1	Land Utilization. Surveying.	9–10 10–1 5	Silviculture. Forest Pathology. Soil Science.	9–10 10–1 2–5 5	General Protection. Surveying or special subject. Systematic Botany. Ecology.
Friday ..	10–11 11–1	Wood Structure. Wood Structure.	9–10 10–5	Mensuration. Mensuration and Silviculture Practical.	9–10 10–1 5–7	Introduction to Continental tours (7 and 8). Surveying or special subject. Systematic Botany.
Saturday ..	9–10 10–1	Silviculture. Silviculture and Mensuration. Practical.	9–10 10–12 10–1	Management. Wood Structure ; or Systematic Botany.	9–10 10–1	Forest Utilization. Forest Entomology.

SECOND-YEAR TIME-TABLE, 1948–49

——	Michaelmas Term.		Hilary Term.		Trinity Term.	
Monday ..	9–10	Utilization.	9–10	Wood Structure.	9–1	Forest Engineering.
	10–11	Wood Structure.	10–12	Wood Structure or special subject.	2	Special subject.
	11–1	Wood Structure or special subject.	12–1	Special subject.		
			2–5	Mensuration Practical.		
Tuesday ..	9–10	Silviculture Systems.	9–10	Mensuration.	All Day	Soil and Vegetation Survey.
	10–11	Management.	10–11	Utilization.		
	11–1	Special subject.	11–1	Special subject.		
	2–5	Special subject.	2.30	Tropical Soil Science.		
Wednesday ..	9–10	Forest Economics.	9–10	Forest Economics.	9–5	Excursion.
	10–12	Special subject.	10–11	Management.		
	12–1	Silviculture Systems.	11–1	Management (W.P.).		
Thursday ..	9–10	Soil Ecology.	10–11	Wood Structure.	9–10	Introduction to Continental Tours (4, 5, 6, and 7 weeks).
	10–12	Wood Structure or special subject.	11–1	Wood Structure or special subject.		
	12–1	Tropical Silviculture or British Forest Law.			10–5	Special subject.
Friday ..	9–10	Mensuration.	9–10	Colonial Forest Administration or British Forest Law.	9–10	Colonial Forest Administration or British Forest Law.
	10–1	Mensuration Practical.				
	2–5	Essay discussion or special subject.	10–11	Forest Engineering.	10–1	W.P. revision.
			11–1	Discussion.	2	Special subject.
Saturday ..	9–10	Tropical Silviculture or British Forest Law.	9–11	Special subject.	9–10	Forest Policy.
			11–12	Soil Ecology.	10–1	Special subject.
	11–1	Essay discussion or special subject.				

PART III—AN INVESTIGATION OF METHODS OF MILLING AND EXPORT MARKETING IN SCANDINAVIA

By. K. C. A. Carter, Dominion Federated Sawmillers' Association.

CHAPTER I—INTRODUCTION

When I was offered the opportunity of representing the industry at the Conference, I was influenced to accept not so much that I expected to gain so much of value to the industry from the Conference itself, but it afforded also the opportunity of studying the milling and yarding methods adopted in Scandinavia in the conversion of small-diameter timber, similar to the exotic plantations in New Zealand, and the treatment of the timber for export marketing.

In this connection I would like to place on record the fact that I was given an entirely free hand by the New Zealand Forest Service to pursue my investigations in any field I considered advisable and in any part of Scandinavia.

Independently of the Conference and the investigations in Scandinavia, I decided to proceed via Canada, and to spend some additional time in investigating the industry in the region of Vancouver, and such information of value gained in this portion of the trip is also contained in the report.

Whilst the time spent in any one country was entirely inadequate to cover more than but a small portion of the industry, nevertheless I believe that in each country the methods employed fall into specific well-defined groups, which enable sound conclusions to be reached and which are indicative of the types of plant and methods employed generally in each country.

Third World Forestry Congress

Each delegate to the Congress concentrated on one or two of the sections in which he was primarily interested ; for my part I concentrated on—

Section IV : Forest Utilization ;
Section V : Forest Industries,—

and spent some time at—

Section III : Forest Economics, including Forest Policy.

The following points are deserving of special mention :—

(*a*) The increasing realization of the importance of forestry, and forest utilization in the economy of the various countries, and its importance in the interests of better living standards.

(*b*) The recognition of the interdependence of forestry and industry, and the necessity for complete co-operation in the attainment of the respective objectives of each.

(*c*) The necessity for the improvement of working methods and the specialized training of forest labour.

(*d*) The trend towards integration of the various wood-working industries, with a view to maximum utilization of the forest.

(*e*) The importance of the continued prosecution of scientific and industrial research in the utilization of wood waste, in assistance to industry in the solution of its problems, and the fullest exchange of information between such research institutions in various countries.

Although (*a*) above has more application to countries facing a diminishing supply or change in usage of wood or in which forestry operations are largely seasonal, it is nevertheless of interest to New Zealand, by virtue of the potential major expansion of the industry in the utilization of exotic timbers, capable of regeneration in perpetuity, and its pre-eminent position as a world's fastest grower of softwood timber.

In respect to (*b*) above, it is my opinion that much more can be achieved by way of co-operation between forestry and industry in New Zealand, particularly between the New Zealand Forest Service and the organized industry. In my opinion, a permanent Council of interested Government Departments—New Zealand Forest Service, Treasury, Works, Labour and Employment—woodworking industries, labour, and private forest owners should be set up under State forest legislation to ensure the co-ordination of the various interests in the formulation of forest policy and utilization.

In respect to (*c*), it is imperative that each employer undertake the training of unskilled labour within his own operations, rather than seek to obtain experienced labour by competitive bidding.

The trend towards integration of various wood-using industries deserves careful consideration in the establishment of milling units on a permanent basis, so that, where possible, the waste products of one industry may constitute the raw material for a subsidiary industry.

It is regrettable in respect to (*e*) that greater progress has not been made in New Zealand in the establishment of a centralized scientific and industrial research in wood technology on the lines of the Forest Products Division of C.S.I.R. in Australia, and Forest Products Laboratories in Canada and the United States of America.

Whilst the problems confronting New Zealand in the utilization and maintenance of its exotic forests differ very materially from those confronting the European and Scandinavian countries, it is apparent that a great deal can be learned from the long experience of these countries in the utilization of their softwood timber to best advantages, and the maintenance of sustained yield from the forests.

It is apparent also that in the formulation of forest policy, both for State and private enterprise, and for the formulation of plans for maximum utilization, due regard to the trends operating in the major timber-producing countries must be given due and serious consideration. To this end, attendance at such conferences by representatives of forestry and industry, both State and private, is more than justified.

Indications at the Congress would suggest that most countries in the world are facing a diminution in timber-supplies due to overcutting, and that economic world supplies are likely to fall short of demand, particularly in the higher grades.

These circumstances, combined with the difficulties of supply from Canada and the United States of America due to shortage of dollars, offer to New Zealand a unique opportunity of consolidating and expanding its timber exports to Australia, if the present difficulties of shipping, labour, plant, and equipment can be overcome.

CHAPTER II—TIMBER INDUSTRY IN CANADA AND THE UNITED STATES OF AMERICA.

With the exception of a one-day trip to the operations of the Hammond Lumber Co., Ltd., in the redwood forests at Eureka, the fortnight was spent in the vicinity of Vancouver.

To view the Canadian industry in its proper perspective it is necessary to remember that the shipments of the *coast sawmills of British Columbia alone* totalled 2,130,000,000 ft. in 1947 and 2,163,000,000 ft. in 1948, distributed as under :—

		Per Cent.		Per Cent.
Total Canada	818,000,000	39	930,000,000	43
Total United States of America	203,000,000	9	495,000,000	23
British Empire	963,000,000	45	664,000,000	31
Other export	146,000,000	7	74,000,000	3
	2,130,000,000		2,163,000,000	

Of this quantity, Australia received 71,313,000 ft. in 1947 and 54,376,000 ft. in 1948, while New Zealand received 15,362,000 ft. in 1947 and 6,768,000 ft. in 1948.

In addition to the foregoing timber-production, a total of 87,406,000 ft. of logs was exported in 1947 and 163,000,000 ft. in 1948.

At the time I was in Vancouver, details of the contract with Great Britain had just come to hand, and the industry was considerably concerned at the smallness of the allocations, and prices had receded $17 per 1,000 b.m.

It appeared evident that were it not for the dollar shortage and the restriction of imports into Australia, New Zealand would find it impossible to market *Pinus radiata* in Australia at current rates, and that the potential of the Canadian industry in the Australian market must be carefully watched. This was subsequently confirmed in Australia on my return, hemlock being quoted in Australia at 62s. 10d. for merchantable and 60s. 10d. for case grade, as against New Zealand *Pinus* 73s. and 74s. free of pith grade.

It is my opinion that if and when the present dollar shortage is overcome, New Zealand will face a substantial decline in present prices and severe competition from Canada and the Baltic countries, particularly in low-grade material.

Every endeavour should be made to reduce production and handling costs, internal transport charges, shipping freights, &c., to enable New Zealand *Pinus* to compete on the Australian market.

Sawmilling Methods in British Columbia

The plants visited in the vicinity of Vancouver generally conformed to the fast Pacific headrig principle, followed by multiple saw edgers, gang saws, or resaws, and varied in capacity from 30,000 ft. per day to 300,000 ft. per day.

There is increasing interest in the use of log gang frames for small-diameter timber, and a number of these have been installed in recent years.

Typical of the plants visited would be—

Canadian White Pine Co.

This consists of three mills situated on the one site.

A. Mill.—Consists of a double-unit mill, logs 17 in. and under going through a log gang, and logs over 17 in. through a band mill, each line being supplied separately from the water, and at opposite ends of the mill. The band-saw line consists of a Pacific headrig with steam log-turners, and a band-saw, cutting both ways, feeding timber direct and also to a multiple-saw edger.

Heavy timbers produced on the band-saw proceed direct through the mill on driven rollers, and provision is made for cross-cutting defective baulks and diverting to the edger or resaw. At the end of this line the timber passes a heavy trim saw where it is finally trimmed to length and side traversed to the yard.

Side timbers and flitches produced on the band-saw are trimmed and side traversed to a multiple-saw edger.

The log gang unit operates on the through and through principle, mainly 2 in., and feeds its production to a separate multiple-saw edger.

Timber from both edgers passes over a multiple-saw trimming-table operated by one man overhead, and on to a green sorting-table where it is sorted for straddle trucks.

Provision is made on the lower floor for the resawing of defective baulks, edgings, &c., from the sorting chain, by the installation of a band resaw, and small edger feeding back on to the sorting chain.

This plant has a capacity of 90,000 ft. b.m. per day per eight-hour shift.

B. Mill.—The B Mill consists of Pacific headrig with electric set works, and electrically-operated dogs, with a 10 ft. band-saw unit feeding to a five-saw 48 × 12 edger and to a 48 in. open-gate gang saw.

Provision is also made for the band-saw to produce timber direct. Defective baulks and edgings are directed to a band-saw resaw and heavy slabs to a circular resaw followed by a small edger and on to a trimming-table and finally to the green sorting chain. Production from edger and gang saw is passed over a multiple-saw trimming-table operated by one man overhead, and on to the green sorting chain.

Baulk timber produced on the band-saw proceeds direct through the mill on driven rollers, past a heavy trim saw, and on to either the order chain or on to skids for stock, from whence it is removed by crane.

The mill employs fifty-five men, and has a capacity of between 160,000 ft. and 175,000 ft. per eight-hour shift.

C Mill.—The C Mill is a comparatively new plant, and consists of two 36 in. Soderhamn log frames feeding cants to a Wicks double-gate cant frame.

These are followed by two edgers, each taking the side timber from one log frame and wane edged timber from one side of the cant frame. All timber drops on to a traverse chain and over the multiple-saw trimmers, operated by one man overhead, and on to the green sorting chain.

This plant is cutting logs up to 17 in. in diameter, and is claimed to have a capacity of 80,000 ft. per eight-hour shift, with a complement of thirty-four men, including two in the log pond.

Additional to the original log frame has been fitted a flattening head for the purpose of giving a small flat face on the under-side of the log on the bottom feed rolls.

The superintendent of this plant is of the opinion that he can considerably increase the capacity of this plant by replacing one log gang with a gun-shot pony Pacific cutting cants and timber, and feeding with logs 10 in. and over. He claims also that it would increase the versatility of the mill in producing special orders. He claimed to be able to handle 150 logs per hour on a fast pony Pacific. This plant is operating on barked logs, and edgings and slabs are conveyed to a chipper; the chips are then conveyed by belt to a barge for transportation to a wallboard-mill.

At this plant, also, a trial was being made of a hydraulic log-barker operating at 1,400 lb. pressure. I was informed that it required an 800 h.p. motor to drive it.

M.B. King

As an addition to its main mill, this company has installed a single-gang mill on the ground floor to deal with logs 8 in. to 16 in. top diameter. Logs are accumulated during the day and this operation runs as a night shift.

Logs are fed unassorted as to size through a single Ideal 24 in. log gang, fitted with a flattening head preceding the bottom feed rolls, and hydraulic lift on the top rolls, and powered with a 75 h.p. motor. It operates on the through-and-through principle.

This is followed by a four-saw edger powered with a 40 h.p. motor, two saw overhead trim table, and green sorting chain powered by a $7\frac{1}{2}$ h.p. motor.

This unit is producing between 24,000 ft. and 25,000 ft. per day on average 10 in. to 12 in. logs.

The following man-power was employed at the time of my visit :—

Foreman	1
Log boom and feeding log chain	2
Log frame—	
Head	1
Tail	1
Transfer and turning down to edger	1
Edger : head	1
Trim saw table	1
Green chain—	
Grading, marking	1
Tally and inspection	1
Branding	1
Pulling Off	2
Straddle truck	1
	14

The mill appeared to be underpowered.

Glaspie Lumber Co.

This unit comprised one 36 in. Wicks log gang with flattening bottom head, followed by a 42 × 6 Heaps four-saw edger, two-saw trim table, and green sorting chain.

It was cutting logs unassorted as to size from 8 in. to 24 in. in diameter at the top. It was claimed to be cutting 50,000 per day on an average of 12 in. logs, but I saw no figures to support this, but the additional men, compared with other units, and the large logs, would tend to support it.

Labour comprised—

Logs feeding chain and crosscutting	2
Log gang—	
Head	1
Tail	1
Edger—	
Head	3
Tail	2
Trim saws	4
Sorting chain—	
Grader	1
Tallyman (P.I.B. Inspector)	1
Pulling off	4
Branding	2
Mill foreman	1
	22

The timber was taken away by straddle truck and stacked by mobile cranes.

The total labour complement for the unit, including the yard, was said to be forty men.

I understand that this is the only Wicks log gang in operation, and that this company no longer builds a log gang.

Canadian Forest Products, Ltd.

Eburn Mill No. 1.—This comprised two units, one a Pacific mill, and the other a new log frame mill.

The Pacific mill claimed to cut 250,000 in eight hours, and to have one of the fastest log carriages in Canada.

The mill comprised one Monarch, one man Pacific headrig carriage with air-controlled dogs, and electric set works, and gun-shot feed. This carriage itself was equipped with log-turning device, but this was not being used, a Simondson log-turner being in operation. This feeds a 10 ft. band mill. From the band mill flitches were fed to a 42 × 12 four-saw edger, and a Wicks double-gate gang saw 48 × 14, with steam-lift top rolls.

Subsidiary resawing equipment was also installed for dealing with defective baulks, edgings, &c.

Eburn Mill No. 2.—This is a new plant comprising a single log gang cutting unassorted logs from 8 in. to 20 in. and an average of 14 in. and has a capacity of 40,000 in eight hours.

It comprises one Heaps 30 in. log gang with flattening head, and hydraulic lift on top feed rolls, and powered by a 200 h.p. motor. One 42 × 8 four-saw edger powered with a 50 h.p. motor. One two-saw trimming-table, and green sorting-table.

All slabs and edgings are hogged for fuel in a Sumner hog powered with an 100 h.p. motor.

Labour engaged :—

Log pond and crosscutting	2
Log gang—	
Head	1
Tail	1
Edger	2
Trim saws	2
Cleaning up and spare	1
Sorting chain—	
Grader	1
Tallying	1
Pulling off	4
Foreman	1
	16

All slabs and edgings and mill refuse go underneath on to a 24 in. belt conveyer to the hog.

The building is of ferro-concrete construction.

This unit was, in my opinion, the most compact and the most efficient of its type seen in British Columbia. Due to its design, it contained a minimum of equipment, but was nevertheless fully mechanized in a compact space.

Lin Forest Mills

Of the smaller-type mills visited, this is a typical operation cutting timber to small dimension sizes. Equipment comprised Pacific headrig with twin circular saws, followed by a four-saw 7 × 36 edger, followed by circular resaw, traverse and trim-saw table, and green sorting-table.

Production at the unit was mainly for 10 × 5 sleepers, with offcuts being cut to 5 × 1½. In timber not suitable for sleepers, and in flitches not large enough, a predominance of scantling sizes was being produced. 10 × 5 produced on the edger passed straight through to docking-saws, and the balance was traversed to the resaw.

Timber from resaw went on to a traverse, dimensional sizes were permitted to pass to trim-saw table, but flitches were pulled off on to a belt and went back to the resaw on a round-and-round principle. The resaw was therefore fed on one side from the edger, and on the other from returns from the traverse.

The resaw was equipped with circular saw, vertical feed rolls, air-operated dial, dimensional setting on one side opening to 10 in., and air-controlled press rolls on the other side opening to 17 in.

Standard rates of feed from 100 ft. to 160 ft. per minute.

The round-and-round principle, using a dial setting, horizontally fed resaw, is deserving of serious consideration as an improvement on the New Zealand breast bench for softwood cutting. It should give greater speed, more accuracy, and less exertion and skill is required of the operator.

A number of other mills were visited, but as they were similar in principle to the three types described it is considered that there is no point in detailing them in this report.

The mills visited therefore fall into three main categories :—

(1) Big-capacity units based on fast headrig Pacific benches, followed by large multiple-saw edgers, and/or gang frames. These units were invariably higher powered and were run at maximum speed.
(2) Smaller-capacity units on the same principle, but with less mechanization and less power.
(3) Log frame units, mainly single frames, cutting through and through, and followed by multiple-saw edgers.

There are many practical operators who will argue that the single-man, electrically-controlled Pacific carriage with log-turning device is faster and involves less man-power in small timber than does the log frame. They claim also to have greater versatility in cutting customer requirements.

After seeing some of the gun-shot feed carriages with air or electric set works and dogging, log-turners, &c., in operation, I can agree that some operators will live up to their claims in good-quality, free-cutting timber. Nevertheless, I am personally convinced that it would be wrong to accept production figures based on Canadian output, as I do not believe such are possible in the quality of logs available from the exotic forests in New Zealand, nor do I think it possible to secure operators in New Zealand to work these machines at such a high rate of speed.

I believe also that it must be admitted that the dimensional cutting produced under these circumstances is far from satisfactory and variations of $\frac{1}{4}$ in. are quite common. Confirmation of this is the fact that most mills supplying domestic requirements or special dimensional stock are equipped with high-speed planers, through which the timber is passed to ensure uniformity of size, and this is part and parcel of the normal mill process.

Also I doubt if anything is to be gained on the score of installation cost as the price and installation of headrig equipment and band mill will exceed that of log frames.

I can say with conviction that, with the exception of the superintendent of Canadian White Pine Co., the operators of the single-gang units are well satisfied.

Logging Equipment in British Columbia

Time permitted the inspection of two logging camps only, and to do this it was necessary to hire a "Seabee" pusher amphibian plane, but I spent some further time in discussion with operators and machinery manufacturers particularly in respect to Diesel haulers.

One of the problems facing sawmillers in New Zealand, in the conversion of steam log-haulers to Diesel, or in the building of Diesel haulers, has been the procurement of suitable gear-boxes, the heavy-truck type generally not being strong enough and giving trouble with the clutch, due to the uneven and shock loading.

In British Columbia I found three types of gear-boxes giving satisfaction :—

(1) *The Wilson transmission*, built by Self Change Gear Co., Ltd., Lythals' Lane, Coventry, England. Agents in New Zealand are Richardson and McCabe, Wellington. These transmissions are built to withstand loadings from 100 ft./lb. torque to 1,550 ft./lb. torque, according to model, and are available in eight sizes. The three smaller units, up to 400 ft./lb., are pre-selective, and the larger models are air operated. There is no clutch, and gears can be changed from high to low instantaneously, simply with a hand control. Gears can also be changed under load without stopping.

(2) *The Gearmatic air-actuated quick-change transmission*, manufactured by Gearmatic Co., Ltd., 636w 6th Avenue, Vancouver. These are designed in various models, and model 16 and 20 are designed for engines from 135 to 400 h.p.

(3) *Hydraulic torque converters*, manufactured by Twin Disc Clutch Co., Hydraulic Division, Rockford, Illinois.

I did not see any of the torque convertors in operation, but was assured by the logging superintendent of Canadian Forest Products that they had a number giving excellent service. They are normally fitted to the Diesel haulers built by Tyee Machinery Co., Ltd.

Various operators argued that with the torque convertor there was a heavy loss in engine efficiency in the lower ratios and in increase in fuel consumption.

I am indebted to W. A. Crouse, Westminster Iron Works, 1135 Queens Avenue, New Westminster, and to J. S. Wilson, Tyee Machinery Co., Ltd., Granville Island, Vancouver, B.C., for their assistance in this matter.

Both of these companies built yarders and haulers of various sizes, and should any operator be interested I will be pleased to forward pamphlets and quotations handed to me by these people. The Westminster Iron Works normally fit the Wilson or Gearmatic transmission, according to the customer's choice, and Tyee Machinery Co. normally fit the torque converter.

On the heavier-type machines fitted with Wilson or Gearmatic transmissions it is usual to fit flexible couplings on either side of the transmission and a fluid coupling on the input shaft.

At the operations of the Fleetwood Logging Co. I saw one of the Diesel haulers in operation. It was a high lead operation, downhill pulling 12 chains to 15 chains, and they claimed to be pulling 1,800,000 ft. log measure per month with twelve men.

The crew comprised—

One leading hand (hauler-driver).
One engineer.
One rigging slinger.
Three choker men (hooking on).
One whistle punk (whistle boy).
One chaser (unhooking).
Three loading lorries (loaders).
One loading engineer (hauler-driver).

All timber is felled ahead of the hauling operations.

The lead tree had been erected and was 146 ft. long with a 24 in. top.

Timber was taken away by lorry and was pre-loaded with a McKone pre-loader. This is simply a frame to carry the bolsters, the load then being loaded on to the bolsters on the pre-loader. Upon the arrival of the truck the bolsters are removed, truck and trailer backed underneath, bolsters connected, and moved off.

The average load being carried at this operation was 11,000 ft. b.m., mainly down grade, on heavy-duty dual-axle trucks and trailers.

I was left with the impression that there was a very considerable volume of good usable timber left on the ground, but was informed that it was uneconomic to touch it under to-day's circumstances.

CHAPTER III—SAWMILLING OPERATIONS IN FINLAND AND SWEDEN

The supreme importance of forestry to both Finland and Sweden is evident from the fact that of the total area of Finland 71·0 per cent. is in forest land, 16·5 per cent, is in waste land, and 12·5 per cent is in cultivated or farm land. Of Sweden, 60 per cent. is in forest land, 28 per cent. is in waste land, and 12 per cent. is in cultivated or farm land.

In Finland 57·4 per cent. is owned by farmers, 34·1 per cent. by the State, 6·8 per cent. by companies, 1·1 per cent. by communes, and 0·6 per cent. by parishes. In Sweden 76 per cent is privately owned, of which approximately 50 per cent. is in small farms and 50 per cent. in the hands of companies ; 24 per cent. is owned by the State.

The significance of farm forestry in the economic life of Finland and Sweden is therefore fundamental

In 1946 Finland had—

531 sawmills and planing plants (independent of small farmers' sawmills).
30 prefabricated-house factories.
20 plywood-mills.
8 reel and bobbin factories.
432 joinery-factories.
5 match-factories.
28 groundwood-mills.
17 board, millboard and fibreboard mills.
9 sulphate cellulose mills.
9 sulphite cellulose mills.
23 paper-mills.
5 rayon and artificial-wool mills.

In Sweden some 3,000 sawmills are recognized and 430 pulp, paper, and board mills.

The administration of forests is under the general authority of the Ministry of Agriculture, with the State Forest Service acting as a separate Department representing the general forest policy of the State.

Sawmilling Operations

According to my observations, the methods employed in Finland and Sweden were practically identical, and I propose therefore to deal with these two under one heading.

Finland

According to information given me by Finnish Sawmill Owners Association, the membership of that association comprises 105 members, producing approximately 85 per cent. of the total production and 94 per cent. of the total export. Qualifications for membership requires a minimum production of 2,000,000 ft. b.m. per year.

In addition, 250 associate members, comprising small units, would produce 7 per cent. of production and 5 per cent. of export, the balance being produced by a multiple of small farmers, single-saw units solely for local use.

The total production is between 1,600,000,000 and 1,700,000,000 ft. b.m. annually·

Of the 105 members producing 85 per cent. of the production, I am given to understand that these are all based on the log frame principle.

Mills visited in Finland include—

Paimio River, Ltd.

This mill was built in 1944 at a cost of 8,000,000 Finnish marks, and the shares are held by 78 forest owners and 5 forest owners associations.

The plant consists of a two-story wooden building containing—

One Karhula log frame cutting through and through.
One two-saw edger.
One circular resaw recutting slabs and edgings.

This unit operates only five months of the year, and produces approximately 2,000,000 ft. b.m. on a forty-eight-hour week.

An efficient two-line mill visited in Finland was—

Zoh Askolin Isnas, Finland

This was a new and modern mill of two stories, brick construction, cutting logs down to 5 in., average 17 ft. long, and 4–5 cubic feet per log. It was a two-line mill, tandem principle, Bolinder equipment, sorted to ½ in. diameter classes, and produced 64,000 per day with the following man-power :—

Top floor—			
Foreman	1		
Log pond feeding mill chains	2		
	–	3	
Log frames : Head	2		
Cleaning up and slabs	1		
Cant Gangs : Head	2		
Edgers : Head	2		
	–	7	
Top docking chain (travelling two ways)	2		
Man marking for docking and grading	1		
Bottom docking chain	2		
	–	5	
Green sorting chain—			
One side	5		
Other side for kilns	2		
	–	7	
		–	22
Bottom floor (dealing with slabs and cleaning up)—			
One radial arm resaw	2		
One five-saw edger	2		
One three-saw crosscut	1		
One resaw	2		
One hog	1		
Cleaning up and stacking	2		
	–		32

This mill had a return belt to edgers from green sorting chain and from docking chain. Progressive-type kilns. Steam generator, 1,000 h.p. Mill requires 700 h.p.

The total man-power employed comprised 110 men and 40 women.

This operation was the most modern and appeared to be the most efficient visited in Finland.

With the exception of two other plants in Sweden comprising single-frame units, all other plants visited in Finland and Sweden were working on the tandem principle—that is, one log frame producing cants for a cant gang, followed by an edger, and these varied from single-line to six-line mills. All were working on logs sorted to 1 in. or ½ in. diameter classes.

As, in general, their mills were of a similar type, varying mainly in the number of lines operated, I believe it sufficient to detail only one or two of the most efficient of these units. Also as I am of the opinion that the smaller-type unit is of more application to New Zealand, I concentrated mainly on single- and two-line mills.

One of the most efficient mills was that of—

Marma Langors AB.

This is an integrated unit comprising sawmill, sulphate, and sulphite pulp mills.

The sawmill was a two-story ferro-concrete building, and all interior runways, steps, &c., were in steel, no wood being used in construction.

All logs were barked before entering the mill, this being done mainly in the forest.

It comprised a two-line mill on the tandem principle and consisted of—

Two log frames (1 Soderhamn 30 in. with a 26 in. sash and fitted with air lift on top rolls).
Two cant frames.
Two edgers.
Trimming-table.

It was fully mechanized, compressed-air-operated infeed trucks, reversible screw rolls for lining cants to shadow line, automatic rolls to take slabs and wane edge boards as soon as freed from the frame, automatic transfer of cants to cant frame, automatic separator for square-edge timber from cant gang, wane edge boards dropping off on to chain conveyer to edger, and square edger timber direct to trimming-table on belt conveyer. The trimming chain comprised two units, one above the other, the top one receiving square-edge timber from cant gangs, and the bottom one receiving timber from the edgers, each equipped with two saws. The bottom chain had a cross transfer to enable short pieces to be sent from one trim saw to the other, after docking one end.

There was also provision for the return of wane edge timber from trim saws to edger by way of belt.

From the trimming chain timber was discharged on to two separate belt conveyers to loading-point.

Slabs from each pair of frames were discharged on to two wide belt conveyers, each of which picked up the edging from their respective edgers and fed same to chippers.

Sawdust and rubbish were conveyed by cross conveyers to a separate line.

This mill was entirely electric, and had no steam plant, compressed air being used for all purposes normally done by steam.

It was driven by two 150 h.p. motors for each pair of frames, with a countershaft between, and other subsidiary motors.

The timber from this mill was loaded on to railway trucks by overhead belt, and transferred to a separate yard.

Man-power in mill—

Foreman	1	
	–	1
Two log gangs	2	
Two cant gangs	2	
Cleaning up and watching slabs from log gangs	1	
Two edgers	4	
Trim saws—		
Top	2	
Bottom	2	
	–	13
Saw-doctor	1	
Oiler and general	1	
	–	2
Loading railway trucks	2	2
Spare	2	2
		—
		20

This mill was cutting logs minimum 6 in., top maximum 18 in., with an average of 9 in.

Production was claimed to be 80,000 per eight hours.

Yard handling for this unit will be dealt with under a separate heading.

Another plant visited of particular interest to the New Zealanders, was that of—

Hissmafors AB., Krokom

This plant receives the bulk of its logs by rail, and logs are sorted into thirteen diameter classes on land without the use of the sorting pond.

Logs are crosscut to length and rolled on to a heavy link chain. This chain is tressled up some 12 ft. above the ground-level.

Logs are marked on end for diameter classes and pass an operator who controls thirteen levers. As the logs pass, he pulls the appropriate lever, which drops a guide at the respective unloading point, and logs are guided off the chain, and drop into their respective diameter classes. Storage space is approximately 50 ft. wide.

Slightly below ground-level and parallel to the unloading point, on the opposite side of the storage space, is another chain on to which the logs are loaded from their respective diameter classes for feeding to log frames.

Photographs of this are available to any one interested.

The mill itself is a single-line mill, two frames in tandem.

Logs generally are of poorer quality than other mills visited, and showed pronounced taper, large butt flanges, were inclined to be crooked, and contained more knots.

Average diameter said to be $7\frac{1}{2}$ in., and the mill was cutting 750 logs per day, average 16 ft. length, producing 32,000 ft. per day.

This mill had a simple automatic device behind the log frame to automatically turn wane edge boards produced on either side of the cant, narrow face up, to save the edger man having to turn the boards. This mill also did not have the conventional trim chains and green sorting chains, timber being docked as it proceeded on the out-feed belt, and was handled direct on to six trucks, being sorted into six sizes.

Labour employed—

Saw-doctor	1	
Foreman	1	
		2
Feeding log-sorting chain	1	
Levers	1	
Straightening and assisting	1	
		3

These men were employed part time only on this work and did other yard duties.

Feeding mill chain to pond	1	
Loading mill chain from pond	1	
		2
Log frame	1	
Cant frame	1	
Cleaning up and assisting	1	
Edger	2	
		5
Loading slip trucks from timber outfeed belt	2	
		2
		13

Although provision was made for docking, none was being done at the time of my visit, and timber was taken to yard as produced from the mill.

Across the back of the mill was a traverse on to which the loaded trucks were taken and diverted to the yard. Here a mobile crane handled the timber for stacking.

Labour employed as on previous page	13	
Transfers and stacking	5	
		18

When dry, all timber was resorted, docked, and remanufactured, or tallied for sale, but this is dealt with under a separate heading.

Another small unit with application to New Zealand conditions would be—

Boxholmes AB.

This is a two-line mill, on the tandem principle, followed by edgers and using Bolinder equipment.

Only one line was operating at the time of my visit and labour employed was as under :—

Log pond feeding mill chain	1
Log gang—	
Head	1
Tail	1
Cant frame	1
Edger	2
	6

For two sides the tail man on the log gang would look after both frames, making a total of eleven men required for the two lines, on mill floor.

The one line produced on an average of 2·1 standards per eight-hour day = 4,200 ft. b.m. = 33,600 per day.

Timber passed on to trim chains where it was docked one end only, and then on to belt conveyer to green sorting chain some distance away : 1 man.

En route it passed through a vapour sap-stain treatment, which is dealt with separately in this report.

Off sorting chain, timber was pulled off on the other side to slip trucks and filleted; provision was made for 35 trucks:—

For one-line production .. .. 5 men.
For two-line production .. .. 8 men.

This sorting-table differed from the conventional type in that it was operated on eccentric and lifted approximately $\frac{3}{4}$ in. at each forward movement of 15 in. and then lowered and paused.

At each point of pause, light rollers 15 in. long were let into the frame of the sorting-table on which the timber was pulled whilst the table was at pause in the lowered position, thus leaving the rollers above the level of the sorting-table.

Behind the men pulling off were similar rollers, adjustable for height, over which the timber was passed to the trucks below.

The sorting chain was built up some 6 ft. and timber was passed down to the trucks until they were practically loaded.

This plant was sorting to $\frac{1}{2}$ in.-diameter classes, and had the following throughput of logs per hour, average 15 ft.:—

To 6 in. logs	122	$9\frac{1}{2}$ in. logs	87
6 in. to 7 in. logs	117	10 in. logs	64
6 in. to $7\frac{1}{2}$ in. logs	107	$10\frac{1}{2}$ in. logs	60
8 in. logs	98	$11\frac{1}{2}$ in. logs	50
$8\frac{1}{2}$ in. logs	92	$12\frac{1}{2}$ in. logs	42
9 in. logs	92		

It was powered by electric motors having 120 h.p. for each pair of frames, 40 h.p. each edger, 50 h.p. on fuel hog, and 30 h.p. on conveyers.

This company also operated kilns, planing plant, manufacturing department for doors, garden furniture in packets, standardized furniture, and interior fittings in prefabricated form, wooden pipes, and joinery.

Plants visited and not detailed in this report comprise:—

Sweden

Iggesunde Bruk AB.	Iggesunde
Bervik och Ala Nya AB.	Soderhamn
Korsnas AB.	Gavle
Uddeholm AB.	Uddeholm
Erickson	
Jadarberg and Co.	
Florsjon	Hesigme

Finland

Aug Eklof AB.	Bonga
Mr. Palio	Ruhimaki

and a few others of which no record was kept.

CHAPTER IV—SAWMILLING METHODS IN NORWAY

Norway was deserving of more time than I was able to give it, as, in my opinion, conditions in Norway are more similar to New Zealand than Sweden and Finland. Due to limited time, I did not visit log frame mills in Norway, but concentrated on other types of equipment and manufacture.

No detailed accurate figures could be obtained as to the proportion of production produced by log frames, circular log edgers with following equipment, and small-type circular mills.

Contact was made with *Norges trelastforbund*, which is the Sawmill Owners' Association. This association has 167 members, representing 55 per cent. to 60 per cent. of production.

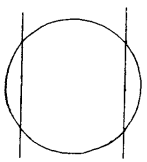
Total production was given as between 600,000,000 and 660,000,000, and it was estimated that between 25 per cent. and 30 per cent. was frame sawn, and the balance by circular methods.

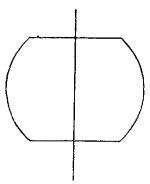
Ten mills of the larger type are using circular log edgers, and a considerable number of smaller-type mills are using table top bench with fence, followed by resaw. As in Sweden and Finland, there are literally thousands of very small farmers' mills which have no practical application to New Zealand.

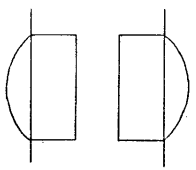
Among the mills visited are—

Nosted Bruk C/S Drammen

This plant was operating on logs of an average top diameter of 7 in. and average length 15 ft., cutting out the square of the small end as under :—

1. 
One circular log edger, D 110—
78 h.p. motor .. .. 2 men.

2. 
One circular splitter, D 14—
40 h.p. motor .. .. 2 men.

3. 
One circular resaw, G 130 .. .. 2 men.
40 h.p. motor .. .. 1 man.

All timber produced was square edged, free of wane, all wings or slabs were chipped for the wallboard mill.

75 h.p. motor.

This mill is producing 500,000 ft. b.m. per month (48-hour-week basis).

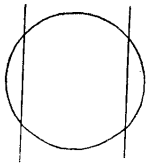
In connection with this plant was a planing department and wallboard-factory.

Berger Langmoen, Brumunddal

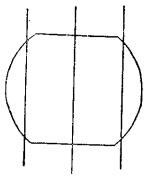
This mill comprised two breaking-down units and one subsidiary line. Logs were delivered to the mill deck in sling lots, very rough, crooked, or large logs being delivered to No. 2 line, unassorted as to size.

Foreman .. .. 1 man.
Log deck .. .. 2 men.

No. 1 Line :—

1. 

Circular log edger, D 110—
Head .. .. 2 men.
Tail .. .. 1 man.

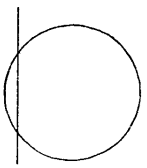
2. 

Circular three-saw edger, D 115—
Head .. .. 1 man.

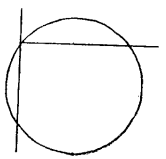
Wings or slabs dropped underneath on to belt, from which they were discharged to a transfer chain.

No. 2 Line :—

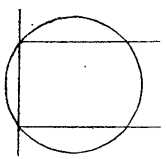
Small circular flat top. Roller type with roller fence .. 2 men.



Small logs, one cut.

1. 

Medium logs, two cuts.



Large logs, three cuts or four cuts.

Slabs and flitches from this line were transferred to—

2. 

One circular resaw, G 130, hydraulic dial setting and side-feed rollers and outfeed attachment by way of transfer chain.

These were put through one after another, dimensional timber being dropped off on to belt on one side. Heavy slabs or flitches for further recutting were dropped on to a screw roller, on the other side on to belt, returned to feed inside, and off on to screw rollers, and returned to feeder. Completed slabs were dropped under on to slab belt from No. 1 line.

Thus this machine was fed from both sides.

Heavy slabs and flitches from No. 2 line on one side, and recut slabs and flitches already put through and returned on the other side.

All slabs were delivered by belt to transfer chain, and straightened and roughly square edged.

Provision was made for returning large slabs to resaw at this point.

On transfer chain they passed through a set of six fixed goose saws at approximately 3 ft. centres, and were discharged on to 36 in. belt.

Slabs were sorted on this belt, and large slabs pulled off for resawing, small slabs and edgings pulled off for chipping. Rubbish, sawdust, &c., straight into hopper: 4 boys.

Larger slabs were put through small resaw bench, followed by small four-saw edger. Slabs and edgings being returned to belt.

This department was producing box-shooks, which required square ending when dry.

Resaw	2 boys.
Edger	1 boy.
Stacking	2 boys.
	5 boys.

All timber delivered to green sorting chain by belt.

Pulling off and filleting on trucks below: 4 men.

This mill was cutting 1,200 logs per eight-hour day, with an average length of 16 ft. and average top diameter of 7 in., and claimed to average 40,000 ft. b.m. per eight hours. The mill has been in operation for twelve years.

Saws in use were as under:—

Log Edger: Tapered saws, centre 10G, rim 13G.
Triple Edger: Centre saw level, 13G.
Side Saws: Tapered, centre 10G, rim 13G.
Resaw: Tapered saw, centre 12G, rim 14G.

In connection with this unit was a box-factory, planing plant, and wallboard plant.

Skidsmo Og Egsberg Bruk, Lillestrom

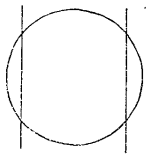
This plant was sorting logs in water, to four-diameter classes.

5 –6½ }
6½–8 }
8 –9 } to saw edger.
9 –11 }
Over 11 to flat top.

Logs were cut up to 22 ft. 6 in. long, with an average length of 15 ft. Maximum diameter, 18 in., minimum, 5 in.; with an average of 8 in. The flat top was seldom used and was idle at the time of my visit.

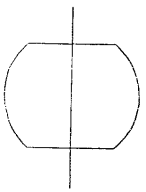
They claimed to handle 700 logs per eight hours on the single line, and to produce between 30,000 ft. b.m. and 34,000 ft. b.m. per eight hours, in wane edge timber 2 in., 2½ in., 3 in., and 3½ in. thickness, and cutting the slabs out to 3 x ½.

Logs were fed from log pond: 1 man.

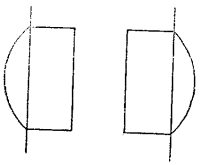
1. 

Circular log edger, D 115—
Head .. .. 2 men.
Tail .. .. 1 man.
3 men.

Slabs dropped underneath on to steel deck, inclined to make them slide to one point. Straightening: 1 man.

2. 

Circular log-splitter, D 14—
Head .. .. 1 man.



3.

No. 1 circular resaw, G 130—
Head .. .. 1 man.
Tail .. .. 1 man.
2 men.

This operated on the round-and-round principle previously explained.

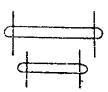
Timber was taken away by the belt and slabs dropped underneath on the transfer chains.

One man straightening and pulling off on the belt, 1 man return, any recuttable slabs. These are returned to the steel deck to which slabs from log edger were delivered.

4. 

No. 2 circular resaw—
Head .. .. 1 man.
Tail .. .. 1 man.

This dealt with slabs from log-edger and slabs returned from slab transfer from No. 1 resaw.

5. 

Edger two-saw head .. .. .. 1 man.

Timber from edger, on to belt and to green sorting chain.

Final slabs passed through set of six fixed goose saws and on to the belt, where they were loaded into trucks and sold for manufacture of chips.

Rubbish and sawdust was loaded separately on to trucks: 4 men.

Green sorting chain: Pulling off and block stacking: 3 men.

In addition to the foregoing, this mill had a flat-top roller-type bench with roller fence, but this was seldom used. If used, the slabs produced were dropped over the steel deck to be dealt with by No. 2 resaw, and separate belt line was provided for timber produced.

Saws used :—

Log-edger : Tapered saws, centre 6G, rim 13G.
Log-splitter, tapered saw, centre 6G, rim 13G.
Recutter : tapered saw, centre 10G, rim 13G.

No water was used on the saws and all sawdust was removed by fan and blower system.

In conjunction with this mill was a planing department and box-factory, progressive-type kilns.

Slabs (free of bark) were sold at 35 kroner = 35 × 1s. 4d. = 46s. 8d. per fathom = 2·4 cubic metres.

Other plants visited in Norway were of a very small type consisting of either

One small flat-top bench with fence ; or
Two small flat-top benches on a common base, and about 2 ft. apart, working to a double-ended saw spindle, one saw to each bench.

Other plants consisted of small flat-top with fence, followed by a 13G circular resaw working on the round-and-round principle, and producing 10,000 ft. to 12,000 ft. per day with eight to ten men.

It will be noted that of the three mills detailed in Norway :—

(*a*) *Nosted Bruk* was cutting out the square of the small end with no wane, and chipping the balance.

(*b*) *Berger Langmoen* was cutting out to wane edge on the principal machines, and was recovering from slabs in a separate box-shook department, effecting complete utilization and at the same time using any balance for chips.

(*c*) *Skidsmo Og Egsberg Bruk* was cutting out to wane edge on the principal machines, and resawing slabs on the two resaws, to effect maximum utilization down to 3 × ½, and then selling balance for chips.

Each of these mills had efficient resawing and planing units, and by far the greater part of sale were made in the form of dressed timber and box-shooks.

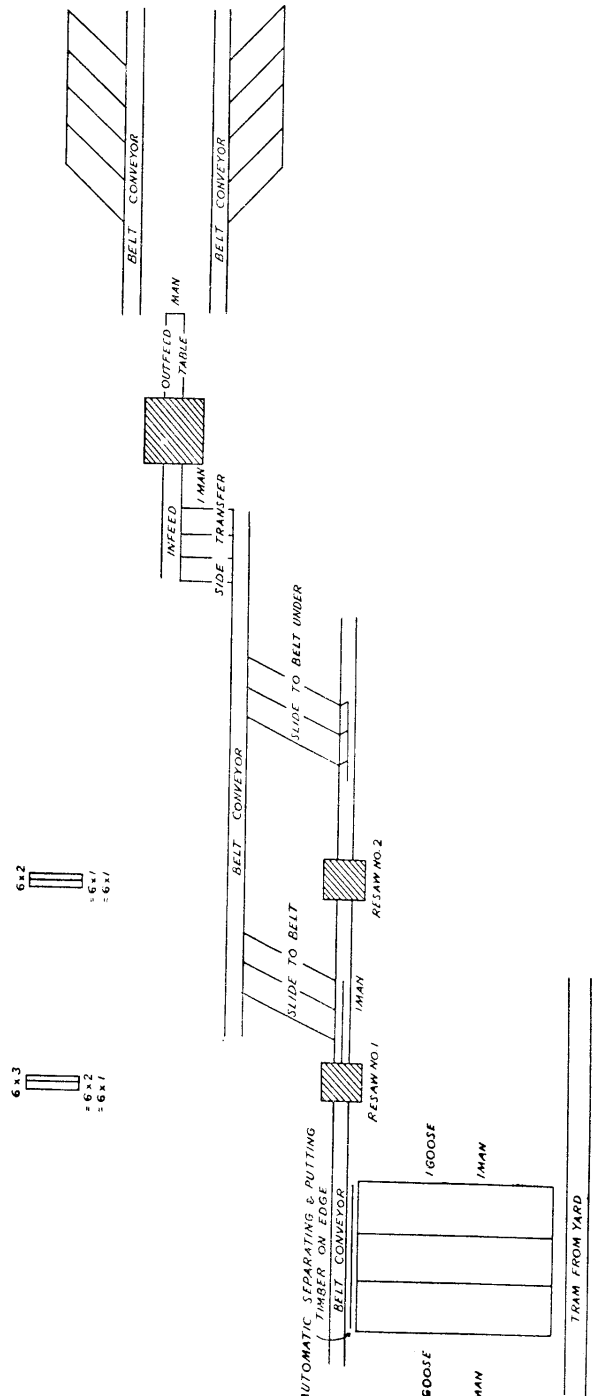
At the first two mills production was air-seasoned, and at the third mill it was kiln-dried in progressive-type kilns.

When seasoned, the timber was brought in and passed over resawing units, of which the following would be typical :—

Timber handled, say, 6 × 3.
This would be unloaded on to trim chains, and square ended and docked. Two saws : 2 men.
From this it was elevated to a belt, automatically put on edge and proceeded to first resaw.
A divider behind the resaw dropped the 1 in. piece off on to a further belt running parallel, and the 6 × 2 proceeded to the second saw.
The two pieces dropped off on either side and were traversed to the outfeed belt.
From this they were side traversed to planer.
Behind the planer were two outfeed belts on to which the dressed timber was graded. An attempt to sketch this is contained on the following page.

It was claimed by the operators of these mills that they recovered a greater percentage of the logs than did the frame mills sawing to 1 in. stock, and that they did it cheaper and with less capital outlay.

They claimed that the handling costs and drying costs on the 2 in., 2½ in., and 3 in. timber was cheaper than 1 in. stock with less waste and shrinkage. They claimed also that with fine-gauge resaws a 3 in. flitch could be reduced to three 1 in. boards for planing and still finish the required thickness from the planer, thus effecting a saving in over-all recovery.


6 x 3
= 6 x 2
= 6 x 1
6 x 2
= 6 x 1
= 6 x 1
BELT CONVEYOR
BELT CONVEYOR
OUTFEED TABLE
1 MAN
INFEED
1 MAN
SIDE TRANSFER
BELT CONVEYOR
SLIDE TO BELT UNDER
SLIDE TO BELT
1 MAN
RESAW NO. 2
RESAW NO. 1
AUTOMATIC SEPARATING & PUTTING TIMBER ON EDGE
BELT CONVEYOR
1 GOOSE
1 MAN
1 GOOSE
1 MAN
TRAM FROM YARD

CHAPTER V—YARD HANDLING AND PREPARATION OF TIMBER FOR EXPORT

Yard Handling

The use of two saw trimming chains, and green sorting chains for production 20,000 and above, is universal in both Canada and Scandinavia. Operators in Scandinavia in particular have devised various means of easing the work of pulling off by provision of rollers adjacent to the chain and between chain and the truck.

In Canada the use of straddle trucks is universal for small operations either in conjunction with end-lift trucks or mobile or fixed swinging cranes. For some large operations, straddle trucks are displaced by double-ended overhead bridge cranes, but these involve considerable capital outlay.

In Scandinavia very few straddle trucks are used ; green sorting chains are generally built up so that the operators are pulling down on to the trucks below. These are assembled side by side on lines, with a traverse the full length of the sorting chain, on to which full trucks are run, and thence to yard, and replaced by empty trucks. This involves very little capital equipment and is reasonably efficient.

In some operations sorting chains are overhead, with the trucks underneath, and the sorting is automatic, the timber being dropped on to the respective trucks.

An example of this is the yard of *Marma Langrors AB* at Soderhamn.

This yard is several miles from the mill, and situated on the coast, so that timber can be loaded direct to barges for shipment.

Timber arrives in railway trucks and is unloaded on to belt and screw rolls to sorting chain.

Two lines in from truck : two men feeding.

The initial portion of the sorting chain is used for grading and re-docking.

Grading and marking	1 man.
Straightening and goosing	1 man.
Levers	1 man.

This man is overhead and controls seventy-two finger levers, which he sets in accordance with grade marking and size.

Timber is then carried under the sorting chain and drops off on to trucks below, in accordance with the setting of the levers.

Straightening on trucks	3 men.

This table handles 60,000 per day without difficulty, and has a capacity of 90,000 to 100,000. Parallel to the sorting chain is a traverse on to which the loaded trucks are run, and thence to the yard, where they are filleted by hand from an electric stacker.

Grading for Export

As far as my observations are concerned, grading, branding, and tallying of sawn timber in Canada is often done green sawn at the sorting chain. One man grading and length marking. One man recording and check grading (generally a P.L.I.B. Inspector.) One man stamp marking on the end, and timber is pulled off to those markings.

In Scandinavia little or no timber is shipped green and timber is graded for stock or kilns, and finally graded, tallied, and marked either for holding in storage sheds or direct to ship or rail.

Various methods are used with varying degrees of mechanization and instanced as under :—

Marma Langrors

All timber is filleted and air seasoned, stacks are parallel to the running-out line, square ended, and of a universal size, length 24 ft., width 18 ft., height 20 ft.

Between two lines of stacks and at the back of each is a permanent set of live rolls driven by light chains. Stacks are pulled down on to the live rolls, and proceed to a portable grading and tallying table. These tables consisting of a length of controlled rollers on to which the timber is directed from the live rolls. At the end of these is a goose saw generally working from underneath pulled up with the right hand. The rollers are controlled by pressure of the left hip against spring-loaded friction. Timber is square ended and docked both ends if necessary, grade and length marked, from a tally rod extending from the goose saw. Timber is then conveyed direct to barge, where it is stacked and end branded in accordance with grade marking.

Pulling down	1 man.
Goosing	1 man.
Grade, marking and tallying	1 man.
Stacking in barge	1 man.
Branding	1 boy.

It is claimed that four men and one boy handle—

16,000	per eight hours in	$4 \times \frac{3}{4}$.
24,000	,,	6×1.
30,000	,,	9×1.
40,000	,,	9×3.

In the same yard nine men are filleting 80,000 per day average, with the use of an electric straight-lift stacker, and taking delivery from sorting chain.

Delivery from the sorting chain with tractor	1 man	1	1
Two electric stackers, each loading straight from the truck	2 men	$2 \times 2 = 4$	
Unloading from stacker and filleting	2 men	$2 \times 2 = 4$	
		$+ 2$	
		9	9

An attempt has been made to sketch this layout on the following page.

At other operations mechanical methods are used such as—

Boxholms AB.

Complete load from kilns is lifted by overhead electrically operated purchase block to above the grading and tallying table.

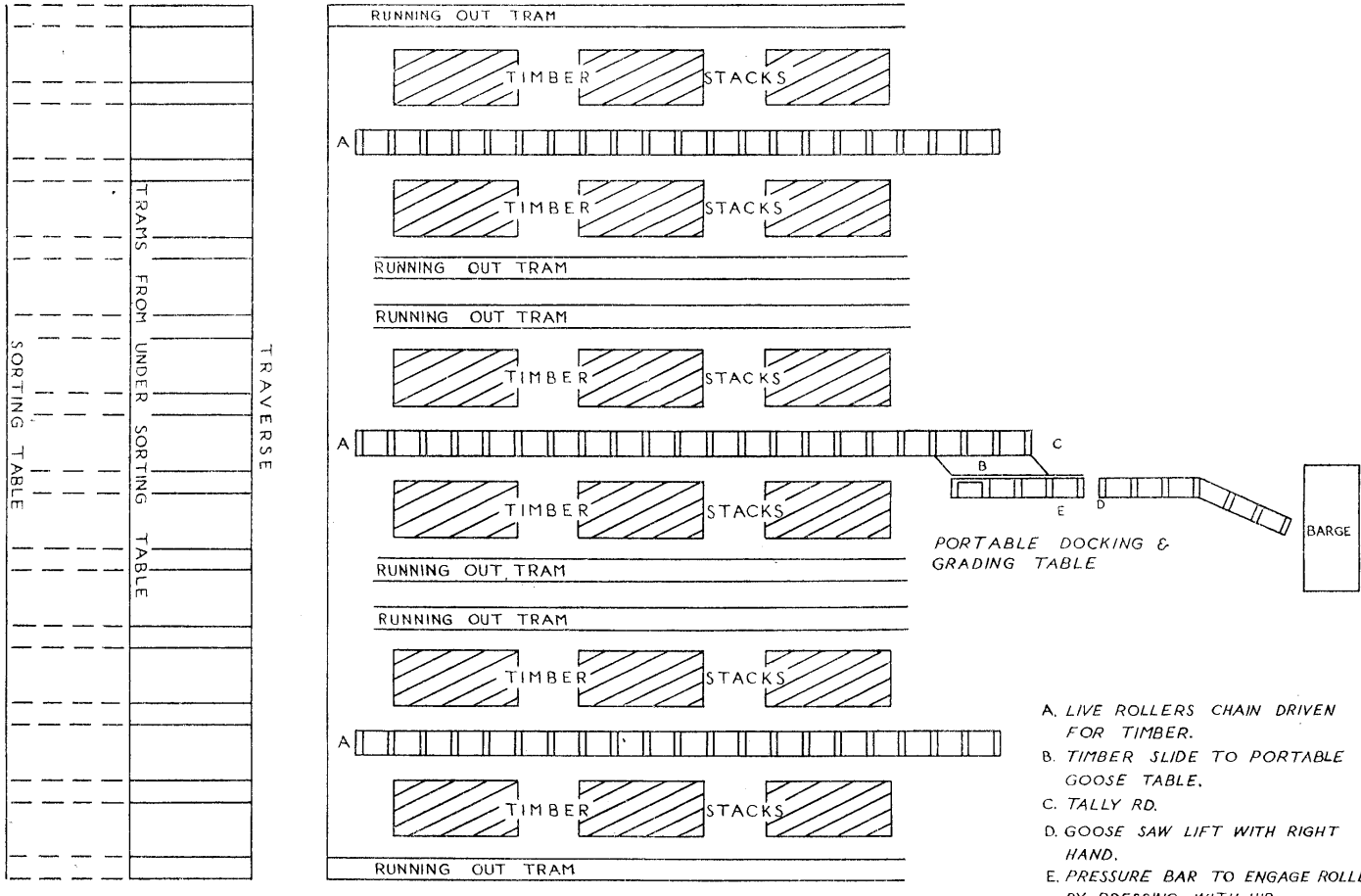
Unstacked by hand and load lifts as stack reduces. Placed for trimming one end	1 man.
Automatic transfer across. Placed for trimming other end. Graded and tallied	1 man.
The grader sets one finger lever for grade, one for length, and timber is automatically stamped both ends with paint mark. Miller's brand. And both ends hammer branded with length, and tally is recorded.	
Reject timber is pulled off on to belt transfer by grader. Stacking to truck	1 man.

These men claim to handle 40,000 ft. b.m. of 6×2 per day.

Korsnas

Kiln loads on kiln trucks are run over an hydraulic lift similar to garage greasing-hoist. Timber is automatically unstacked layer by layer, and fillets dropped on to the belt, the hoist lifting as each tier is discharged on to grading-table.

Two men trimming, grading, and tallying, as previously described.



A. *LIVE ROLLERS CHAIN DRIVEN FOR TIMBER.*

B. *TIMBER SLIDE TO PORTABLE GOOSE TABLE.*

C. *TALLY RD.*

D. *GOOSE SAW LIFT WITH RIGHT HAND.*

E. *PRESSURE BAR TO ENGAGE ROLLERS BY PRESSING WITH HIP.*

Timber proceeds beyond grading-table, and is automatically dropped, in any of four grades or orders as set by the operator, on to one of four trucks below.

Straightening on trucks below .. .. 1 man.

In Canada, responsibility for grade and tally appears to rest with P.L.I.B. officers at each mill and is done green sawn.

In Scandinavia, each mill is extremely zealous of its name for grade and sells under its own mark.

In either case, each piece is subject to individual inspection and check, and tallies and grade can be relied upon, and each piece clearly marked with seller's mark, grade, and length. To compete on the Australian or other export markets, New Zealand has an extremely long way to go to compare with competitive countries, and some positive action to improve the situation is essential and overdue.

Timber Treatment

Sap-stain treatment is not universal in Scandinavia, but is practised by a considerable number of operators. These methods are used :—

(1) Spraying on running-out trucks with watering-can.
(2) Immersion treatment between trimming and green sorting chain.
(3) Vapour or fog treatment on outfeed timber lines to trim table or sorting chain.

Details of vapour or fog treatment are available and, if suitable to New Zealand conditions, is to be strongly recommended as being simple and inexpensive as to installation and requiring little room.

Seasoning

All timber for export is either air seasoned or kiln seasoned as part and parcel of the milling process.

Progressive-type kilns appear to be in increasing favour, and many kilns were of this type.

I believe one reason is that the progressive type works in best with the running-out system, many operators filleting off the sorting chain on to the trucks, and the timber remains on these trucks through the kilns and until finally disposed of into holding shed of sale.

Considerable literature on kiln seasoning was brought back by the writer.

Enormous stacks are held at most operations, both in dry-timber sheds and in covered filleted stacks as instanced below :—

Korsnas

This mill produces 72,000,000 per year and has indoor storage for kiln-dried timber for 20,000,000 in parcel lots of 6,000 ft. each.

One shed is 960 ft. long by 180 ft. wide, and is serviced by overhead crane system.

Iggesunde Bruk

Three-line mill. Capacity, 100,000 ft. per day.
All filleted stack. No kilns.
All timber immersion dip treated.
Holding-capacity under bridge crane system, 34,000,000.

This bridge crane handles green sawn timber from slip truck to stacks, dry timber from stack to truck for shipping for an output of 100,000 ft. per day, with two men.

The bridge crane covers 325 ft. in width, covering eight parallel stacks, four on either side, and has a very considerable lengthwise travel.

Bergvick Och Ala Nya AB

One shed 240 ft. long by 114 ft. wide.

Timber fed in by three belts at various levels and fed out by two belts at ground-level.

CHAPTER VI—GENERAL

State Participation in Milling and Industry

In both Finland and Sweden the State is operating a few sawmills and pulp and paper mills in State-owned forests alongside private enterprise.

These operations, however, operate as public companies or corporations, are distinct from the State Forest Service, who are responsible for the forest, are members of trade associations, &c., pay normal taxation, levies to association. &c., and play their full part in community business life.

It is my opinion that action on similar lines in State activities would be to the advantage of New Zealand.

Machinery

Opportunity was taken to call on the various manufacturers of machinery.

Delivery from Scandinavia on all types of equipment appears to be very slow, it being estimated on a two- to three-year basis.

De'ivery from Canada appeared to be a little better, but landing prices from this source does not appear to be competitive with Scandinavia.

Labour

Both Mr. Freeman and myself had formed the opinion that, due to the displacement of some 500,000 Karaelians, that there was available in Finland a considerable number of rural workers suitable for the sawmill industry in New Zealand.

Accordingly, an interview was sought with Mr. Onni Peltonen, Minister of Public Works in the Finnish Government, to ascertain the Government attitude towards the emigration of these workers.

The Minister gave us an assurance that no obstacle would be placed in the way of Finnish forestry workers desirous of proceeding to New Zealand, and that such actions would be facilitated by his Government.

The labour position in both Sweden and Norway appeared to be fairly acute, and many plants were complaining of a shortage of skilled labour.

It seemed strange that a greater number of Finnish workers had not migrated to Sweden and Norway.

CHAPTER VII—CONCLUSIONS REGARDING *PINUS* MILLING

The writer is rather suffering from having seen too much too quickly, and of conflicting values, but an attempt is made to arrive at some concrete conclusions which would be applicable to New Zealand.

In considering the application of the various methods used in other countries it is necessary to examine certain basic factors and to compare them with New Zealand conditions. These comprise—

(1) Quantity of raw materials available.
(2) Quality of raw materials.
(3) Cost of raw materials.
(4) Cost and efficiency of labour.
(5) Type of market to be catered for.
(6) Competition from other sources.
(7) Capital outlay, taxation, and return on investment.

As a general statement, I believe it would be correct to say that New Zealand has ample resources of raw material in its exotic forests to permit of large-scale expansion, and which, if not harvested, will result in tremendous economic loss.

Quality is poor, and below that of competitive countries.

Cost of raw material is relatively low, and cost of labour relatively high.

In any expanding industry it can be assumed that efficiency of labour will be lowered by the introduction of a greater percentage of unskilled labour.

The expansion of production beyond domestic requirements is dependent upon being able to market in Australia in competition with other countries, and such competition will necessitate the lowest possible selling-prices for bulk sales.

Under to-day's conditions, cost of equipment, installation and building is unreasonably high, involving considerable outlay.

Taxation absorbs up to 11s. 5·6d. in £1, requiring a margin of—

1s. 11·4d. on a production of 6,000,000 to return 5 per cent. on shareholders' capital of £50,000.

3s. 10·8d. on a production of 6,000,000 to return 5 per cent. on shareholders' capital of £100,000.

If the foregoing assumpions are correct, then I believe that, within reasonable limits, expanded production at minimum cost is more important than maximum utilization; that maximum mechanization is required with a minimum of skilled labour; and that capital outlay is required to be kept as low as possible.

My observations convince me—

(1) That where a sufficiency of milling life is available, the use of log gang saws in small-diameter timber is, without question, the most economic, from the point of view of utilization and labour cost.

(2) When operated in conjunction with chipping for pulp, resawing and planing factories, box-factories, and remanufacturing plants generally, the use of circular log-edgers, with following resaws, is fully justified at considerably less capital expenditure if a market in Australia can be developed for flitches 4×2, $5 \times 2\frac{1}{2}$, 6×3, $7 \times 3\frac{1}{2}$, 8×4, 9×3, 10×3, 12×4. This type of installation is well worthy of consideration.

(3) In small operations the use of circular log-edgers of approved design, flat-top bench with fence, or light Pacific bench, followed by circular resaw with dial setting, and vertical feed rolls worked on the round-and-round principle, and the use of light-gauge tapered saws, is a fully efficient and economic operation.

(4) In conjunction with any log gang installation, I am of the opinion that it is advisable to provide a small circular unit to deal with rough and ill-shapen logs. These remarks equally apply to circular log-edger units.

In my opinion, the fast headrig type of operation, gunshot feed and double cutting band, is not suitable to New Zealand conditions in small-diameter logs.

Based on these conclusions, it is necessary to examine the merits and demerits of the Canadian system of through-and-through sawing with a single gang, followed by multiple-saw edgers, and logs unassorted as to size, as against the Scandinavian system of cant sawing on the log gang, followed by a cant frame and logs closely sorted to 1 in. and $\frac{1}{2}$ in.-diameter log classes.

CANT SAWING

It is claimed in Scandinavia that cant sawing—

(*a*) Increases the recovery from the log by between 6 per cent. and 8 per cent.
(*b*) Increases the percentage of higher grades.
(*c*) Enables a faster throughput of logs.

It is claimed by Canadian operators—

(*a*) That any increased recovery (which they do not admit is the case) is offset by the additional cost of the dual operation.
(*b*) That any increase in grade production is confined to the "wings" on either side of the cant and as such is infinitesimal.
(*c*) That in small logs it is possible to obtain some wider boards by single sawing than cant sawing, and that in big logs the planks have to be reduced to smaller dimensions in any case.
(*d*) That it is easier to produce a run of small-dimension scantling from medium and large logs by single sawing followed by multiple-saw edgers than cant sawing.
(*e*) By the use of additional power, and modifications to the Swedish gangs, they claim there is little difference in the speed of sawing.
(*f*) It eliminates the necessity of log sorting, with consequent saving in operational costs.

If cant sawing is adopted, then log sorting is an absolute essential.

It is my opinion—

(1) That even with single through-and-through sawing, restricted log sorting into three or four diameter classes is advisable and, indeed, necessary for best results.

(2) That cant sawing will produce timber more accurately sawn than will multiple-saw edgers.

(3) That there is undoubtedly a greater recovery from the log by cant sawing, very little difference in grade returns, and very little difference in sawing speed by adopting Canadian modifications.

The advantages therefore in single through-and-through sawing are—

(*a*) Reduced capital expenditure, requiring a lesser margin in selling-prices to cover return on capital and provision for taxation;
(*b*) Greater versatility in the production of small dimensional sizes,—

at the expense of—

(*a*) Some loss in recovery from the log.
(*b*) Less accuracy in width cutting.

(4) That, as an alternative to the log frame, the use of circular resaws with power-driven vertical feed rolls, and worked on the round-and-round principle, should be considered as an alternative to the breast bench both from the point of view of accuracy in cutting and in the use of less highly skilled labour.

(5) That, in the planning of any long-term sawmill, due regard should be given to the possibility in the future of the use of chips from slabs and edgings, and provision left accordingly.

(6) That any projected pulp operations should consider the economic possibility of using waste materials in the form of chips from sawmills.

(7) That, in view of the extremely high cost of equipment, consideration should be given to some form of special depreciation on imported sawmilling equipment, and the remission of any duty paid on such equipment.

(8) That, with timber for export, a rigid system of check grading and tallying should be applied by the industry, and the Government approached for any necessary assistance in transport charges, &c., to make same practicable.

Under the heading of " Machinery " mention was made of the long delay in obtaining equipment from overseas sources, particularly Scandanavia, and it does appear that, both in regard to log frames and circular log edgers, delays of two or three years will be encountered.

For this reason I am of the opinion that the greatest possible temporary use should be made of equipment available in New Zealand, combined with circular resaws, which are readily available from Canadian sources.

In concluding this report I would like to express my appreciation to the authorities for the opportunity afforded me to attend the Congress and for the opportunity of inspection of the industry overseas.

I would like to acknowledge the very great help given me by the various sawmillers' associations overseas, the manufacturers of machinery, who provided advice, transport, and literature and management of the various plants visited, for their unfailing courtesy and assistance. In particular I would like to thank Mr. Dalman, of Soderhamns, Verkstader A.B. of Soderhamn, for placing at my disposal a car and driver for a complete week in Sweden, and to Mr. Holtsmark, of Jensen Og Dahl, who provided a similar service in Norway.

PART IV—AN INVESTIGATION OF INDUSTRIAL RELATIONS IN SCANDINAVIA

By J. FREEMAN, New Zealand Timber Workers' Union

Before the Congress, in company with the other members of the New Zealand delegation, I took part in an excursion organized by the Congress Committee which travelled through a large area of forest in south-west Finland. Following the Congress, after consultation with Mr. Birch and Mr. Carter, the other members of the delegation, I accepted the invitation of the Nordic Forest Union to take part in excursions through forest areas in the Scandinavian countries. It is upon matters which came under my observation during those tours which I wish to comment particularly. However, I should like first to refer to some parts of the official reports of the Congress which I consider to be of special importance.

I was particularly interested, as a representative of the workers' organization in the New Zealand timber industry, in the emphasis placed on the necessity for measures to maintain an efficient force of workers in forest enterprises. It was recognized in the preamble to one of the resolutions adopted by the final plenary session of the Congress that in many countries there was a necessity for improving working and living conditions in forest work and forest industries ; and that the benefits to be derived by the workers are tied up with the financial returns to the industries concerned (para. 68 of the general report).

Section 4 of the Congress dealt with matters pertaining to forest utilization ; and its report, which was adopted by the Congress, dealt with the economic and social conditions of forest workers and the effect of these on the application of silvicultural methods.

Arising from discussions on reports submitted to Section 3 of the Congress, which dealt chiefly with forest economics, the resolution adopted by the Congress directed attention to the necessity for continuous production as an essential for the stability and security of forest workers and technicians. The resolution went on to state that this called for better conditions of work, housing, food, and social security. Vocational training, it was pointed out, is also indispensable in order to secure the maximum of production, which in turn leads to an improvement of economic conditions.

During the tours in Finland preceding the Congress, and in the Scandinavian countries following it, evidence was avilable of the recognition by employers and Government agencies of the importance of this factor in production.

The sections of the report which deal particularly with technical problems of silviculture, while naturally of great interest to all connected with the timber industry, are more especially the concern of foresters. I shall not comment upon those sections. Some sections dealing with general forest policy are, however, subject for comment.

In these sections, stress is laid upon the increasing importance of the role of forests in modern society (*e.g.*, page 12, para. 29). In all the countries visited in the course of my tour I was greatly impressed by the insistence of forest technician and economists on the necessity for making policy decisions for each country on the proportional distribution of forest area and cultivated land. In every country visited, this had resulted in legislation by the respective Governments to establish and preserve the proper balance. For example, see the accompanying article on Finnish law relating to private forestry.

Paragraphs 60 and 61 on page 15 of the report are also worthy of special note. They point out the possibility of the introduction in New Zealand of a policy of encouraging reafforestation by private land-owners on steep, eroded, and otherwise unproductive and unprofitable areas.

I am not sufficiently conversant with the policy of the New Zealand Forest Service to speak with complete assurance on this matter; but although there may be nothing new in the lessons which I have derived from the Congress discussions and from the studies and demonstrations in the course of the tours, I think it worth while to set out some of my ideas.

I will venture to suggest that, if it has not already been done in New Zealand, the system of accounting used by the Danish Forest Service could be profitably applied to the regeneration of forests in this country. For their hardwood supplies the Danes rely largely on their managed forests of oak and beech. The rate of growth of these timbers may be compared to some of our valuable native types. The rotation period for beech is 110–120 years, and for oak 120–130 years and upwards. The aim of the forester is an annual increment of timber approximating in value 4 per cent. on capital invested in the plantation, including the cost of the land itself, which in Denmark is high. This aim is rather easily attained by the growing of conifers, but generally speaking hardly ever by the growing of hardwoods, because of the great costs of artificial regeneration. In addition to the 4 per cent. annual increment, the forest must earn its maintenance costs.

Approximately 68 per cent. of the forest area in Denmark is privately owned and managed. Numbers of the large forest-owners employ their own superintendents and forest rangers. Smaller forest-owners combine in associations, similarly employing superintendents and advisers.

Denmark is one of the most poorly wooded countries in Europe, having 870,000 acres of forest, roughly 8 per cent. of the total land area. Yet it is able, on the basis of scientific methods of forest management, to supply nearly all the hardwood requirements of a population of 4,050,000 and about one-quarter of the softwood requirements. Denmark's annual requirements of wood amount to 144,771,000 cubic feet, including firewood. The return from the State forests show a net average return per acre over the past ten years of approximately 40 kroners.

Throughout the Congress and in the course of the tours before and after it, I was greatly impressed by the confidence of all the delegates and the leaders of the tours in the various countries that we were entering on an age of wood—an age when wood and wood products will assume ever-increasing importance as the metal resources of the world approach exhaustion. New Zealand, because of its dependence on outside sources of supply of metals, could well emulate Finland, where the variety of uses to which wood is put is remarkable.

I have placed the above conclusions and observations at the head of my report because they bulk more largely in my mind than the technical reports and demonstrations which I heard and witnessed.

During the tour I was able to take advantage of opportunities of meeting and talking to people with special interests bearing on the timber industry. One of these was Mr. Kantola, secretary of the Forestry Section of the Finnish Work Efficiency Association. At his offices he demonstrated to me some of the scope and methods of his association, and I was able to obtain some of the pamphlets, brochures, and journals on this work, which is significantly in line with recommendations of the Congress.

Exploring the field of labour relations in Finland, I met the secretary of the Finnish Timber Workers' Union, Mr. Antillo. He explained to me, through an interpreter, the difficulty which the industry was facing because of ideological warfare within the ranks of his organization. At the same time he detailed to me the improvement which had been effected in the working and living conditions of his members during recent years.

I later met Mr. Antikainen, secretary of the Finnish Agricultural and Forestry Workers' Union. His members are engaged in logging, afforestation, and floating operations. From him also I got an interesting picture of what was being done to improve industrial relations in the forest workings.

I accompanied Mr. Alwyn Carter on a visit to Mr. Peltonen, Minister for Works and Communications in the Finnish Government. The purpose of our visit was to inquire into the possibility of recruiting for the New Zealand timber industry from among Finnish forest workers. This inquiry was in line with the policies of our respective organizations. Mr. Peltonen's reply was that he thought his Government would be sympathetic to any approach made by New Zealand immigration authorities, as there was a surplus of labour in the forest areas of Finland.

The New Zealand delegation, comprising Mr. T. T. C. Birch, Mr. A. Carter, and myself, arrived in Helsinki on Tuesday, 5th July. On the evening of the following day we joined a party of excursionists going to Turku, a large town in south-west Finland. This was the real starting-point for a tour of study and inspection covering three days in time and much territory.

In the course of the tour we visited many forest stands of different types, tree breeding stations, and plant nurseries. Also we visited several industrial concerns, including one small sawmill, one large mill and joinery-factory, and a large wooden-ship-building yard. I was impressed by the obvious efficiency of the plants, large or small. Another very striking thing was the high proportion of women and girls employed at tasks which in New Zealand are exclusively for men. It was explained that much of this was due to the heavy loss of men in the recent war. Upon inquiring whether the women were paid the same as men for the jobs they were doing, I was told that there was a lower wage scale for women, but that recent wage agreements had narrowed the gap. At the small sawmill visited, a noteworthy feature was the very fine dining-room included in the administration building. The houses occupied by the workers on this mill appeared to be of a high standard. At the O.T.K. mill and joinery-works near Hameenlinna, the manager took justifiable pride in showing us the dining-room, change-room, and washing facilities provided for the workers. This was a very large plant by New Zealand standards, but not by Finnish standards.

The Congress opened in Helsinki on 11th July and continued until the 19th July. The New Zealand delegation endeavoured to cover as much ground as possible by dividing the time of members between various sections dealing with the various groups of reports. The proceedings of the Congress were varied by social functions and receptions of various kinds which were of a nature to demonstrate the abounding hospitality of the Finnish people.

At the conclusion of the Congress, after consultation with my co-delegates, I accepted an invitation to participate in excursions in the forest areas of the Scandinavian countries which were being arranged by the Nordic Forest Union.

Prior to leaving for Stockholm to join up with the excursion departing from there, I joined a party of delegates in a visit of inspection to a large prefabricated-house factory situated about forty-five miles from Helsinki. Here we saw a very large and efficient mill on which the enterprise was based. The organization of a dry-log-sorting yard was a feature of this plant. Here again we saw a very high proportion of women employed both in the mill and in the large factory adjoining. The sawmill here had an output of 64,000 board feet per day. Its whole output went to supply the prefabricated-house factory.

I left Helsinki on 21st July by plane to Stockholm, arriving the same day. There I boarded a train for Kristenhamm, arriving there the following morning. Our party, numbering about thirty-six people, including wives of some of the delegates, was taken by cars to Brattfors Forest, on the estate of Uddeholm's, one of the largest Swedish industrial enterprises, with interests in both wood and metal.

Throughout the day we travelled through various types of forest stands, with frequent halts at selected demonstration sites. Here the Swedish foresters explained their methods and invited comment and discussion. We were shown something of what was being done to improve the housing and living conditions of the forest worker and to compensate him to some extent for the isolation of his life. I took advantage of the opportunities to ask questions about the general living and working conditions of the workers in Swedish forest industries; and I gathered from the answers that, although Sweden is a prosperous country with employment for all, the living standards of the workers were not as good as in New Zealand. Sweden, however, is proud of its progress in the field of social reform; and I found the Swedes very eager to learn as much as possible about what we are doing in New Zealand.

We spent the night at Karlstad, where we had an opportunity of observing river transport of pulpwood.

The following day was spent in studies of nurseries and forest stands, with a detour to the home of the late Selma Lagerlof, one of the greatest figures in Swedish literature. Our Swedish guides were eager to make us acquainted with this other product of Swedish genius; and for our part we appreciated the diversion. Proceeding on our way we came, after sundry halts and inspections, to Arnicka, where we had dinner.

Here we were taken over by the guides for the Norwegian section of the tour. We said good-bye to our Swedish hosts and entered a bus for the night journey over the frontier to Konsvinger, arriving late at night.

Early the following morning, which was Sunday, we were taken by bus to a forest estate on fairly high country. Here we were given a demonstration of Norwegian methods of forest culture. At the same time we were given the best exposition of forest economics which we had so far listened to.

In the afternoon we travelled to an experimental area under the control of the Norwegian Forest Service where we were given most painstaking expositions of their methods. Some very interesting discussions were heard here. Our party included Americans, Canadians, Austrians, Swiss, Japanese, English, and Argentine delegates as well as the Director of the Forestry Division of the FAO.

That night we reached Oslo. The proposal of the organizers of the tour was that the excursionists should at the completion of the Norwegian itinerary cross over to Copenhagen for a two-day excursion under the auspices of the Danish Forest Service. The fee asked for the Norwegian excursion was 222 kroner, and this included transport to Copenhagen. The programme for the Danish excursion suggested that the whole tour would be well rounded off; so I made the arrangements and obtained my ticket.

The last day in Norway was occupied mainly with visits to museums where the uses of wood through the history of Norway were demonstrated. At night we caught the train to Halsingborg, in Sweden, and the following morning we were met at Halsingor by Professor Howard Gron and officials of the Danish Forest Service. After breakfast we were taken to the forest area of Nodebo, about forty kilometres north-west of Copenhagen. The forest studies under Professor Gron's leadership were the most interesting and profitable of the tour to date. From Nodebo we went to the Jaegersburg Forest district. Here we were shown beeches about three hundred years old and oaks up to eight hundred years old. In the Dyrehaven or King's Deer Park, which is under the control of the Forest Service, we were regaled with an exposition of plans for a three-hundred-year rotation of forest. We had dinner at the beach resort of Klampenborg on the outskirts of Copenhagen and were then driven to our hotels.

The following day we were taken to privately-owned forest areas on the Stevns Peninsula, south of Copenhagen. Here the method of management was explained to us; also we saw the measures taken by the State to promote sound management.

On 29th July I returned to Sweden. I spent the week-end at Halsingborg, and then travelled to Malmo to meet some trade-union officials to whom I had introductions.

I was unable to make my way back to the main timber-producing areas of Sweden. The itinerary arranged for the delegates by the Scandinavian Forest Union had taken me too far away from the districts which I would particularly have liked to visit. However, I made the most of my opportunities in meetings and discussions with representative workers to discuss the state of industrial relations in the countries visited.

My outstanding impression of Finland, Sweden, and Norway was that the problem of improving industrial relations and maintaining harmony in industry was being faced by responsible sections of workers and employers. Government legislation for better working-conditions, industrial conciliation and arbitration, social security, and similar provisions followed along much the same lines as in New Zealand. In Finland, considerable strides had been made in recent years.

I found workers and employers who were convinced that social and economic change, however desirable and necessary, were not the whole answer to the problem. These measures were not entirely effective in combating the ideology of class warfare, which was the root cause of much industrial unrest and upheaval. The strikes in the timber industry which broke out shortly after our departure from Finland demonstrated that fact.

In all of the Scandinavian countries I found evidence of the good work being done by Moral Re-armament in promoting unity between management and labour. It presents an ideology of change in human relation as an alternative to class hatred, racial and national enmity.

A few months before the World Forestry Congress an M.R.A. force had visited the main industrial centres of Finland presenting their message of unity on the basis of absolute moral standards through the medium of a stage play called "The Forgotten Factor." Mr. Antikainen, secretary of the Agricultural Workers' Union, which organizes the forest workers in Finland, spoke very enthusiastically on the effect of the play and of the general work of the M.R.A. teams. While I was in Helsinki, preparations were being made to send a delegation of workers, employers, farmers, students, teachers, and professional men to Switzerland, where the World Assembly for Moral Re-armament was being held. Professor Saari, who presided over the Forestry Congress, was to accompany the delegation, as was also Mr. Antikainen.

In Sweden and Norway also I found that M.R.A. was becoming a powerful factor in overcoming division and strife in industry and throughout the life of the countries. In Britain the ideology of Moral Re-armament was gaining ground ; and its influence in the coalfields was of great value to the nation.

In the field of industrial relations this positive force for combating strife and division was the most significant thing I discovered in the course of my tour.

APPENDIX I—THE PROMOTION OF FARM FORESTRY IN FINLAND

By Dr. N. A. OSARA, Helsinki

Because many of the members of the World Forestry Congress have inquired about the way in which the promoting of farm forestry in Finland has been organized and because there is no up-to-date publication reporting this matter in English, I'll try to give you a little survey on the subject.

The actual Law for Private Forestry is not the first one ; it was preceded by the Forestry Laws of the years 1917 and 1886. The organization we have now was developed gradually from these laws. And even behind these old laws there was a long course of development. It can be mentioned that the first law concerning forests was enacted in the year 1647. The democratic spirit of the Finnish people has established through centuries a certain knowledge that forests belong to the whole nation and that a single person cannot be allowed to harm them.

I will not repeat all the paragraphs of the Private Forestry Law, but I want to point out some of them. In the first and the second paragraph there are stipulations about what it is forbidden and what it is allowed to do with forests. In paragraph 3 are set out the penalties for acts contrary to the stipulations.

The Finnish Law for Private Forestry is so far a prohibitory law, in which there is not enough advice for positive forest management. We are aware of the fact, and a committee appointed by the government is working up a new law concerning private forests. It seems apparent that in the near future the existing Private Forestry Law will be replaced with a new one, a Forest Management Law, involving considerably more positive features and stipulations on effective forest management.

Many paragraphs in the Private Forest Law deal with the consequences of false management of forests and with the so-called closing of the forest. Further there are stipulations about the liability to pay the costs of reforestation work in case of devastation. The land-owner and the owner of the felling right are both responsible. In Finland much timber is sold on the stump, and in that case the buyer often, especially in earlier days, decided which trees were to be cut.

Now I shall describe the organization which has been created by the Law for Promoting Private Forestry. Beginning from below there are the Communal Forestry Boards, consisting of three members in every commune. This Board receives notice of tree-felling given by the forest owner, and its members are present when inspections of devastated forests are made.

The proper hull of the field organization is built up by the District Forest Conservation Boards, eighteen in number. As a rule, the Board consists of at least three, but often of five, regular members and as many deputies. The law provides the Boards with the power of authority and the application of the first and second paragraph in the Private Forestry Law decisively depends on the Boards' consideration.

As the central organizations for the District Forest Conservation Boards there are two Central Forestry Associations, one for the Finnish-speaking area (" Tapio ") with sixteen Boards subordinated, and another one for the Swedish-speaking area with two subordinate Boards. In addition to the District Forest Boards, the Central Forestry Association has other members, as a remainder of earlier practice before the year 1928, but, in fact, only the District Forest Conservation Boards have any significance. The Central Forestry Association is led by the Administrative Board and by the Board of Directors, which consist of the most prominent and leading persons among forest owners.

The Central Forestry Association has the form of a free organization, in spite of its authoritative role, and the State exerts no other control on the Central Forestry Association, or on the District Forest Conservation Boards, than to see that the Private Forestry Law is complied with and that the grant is used for the purposes dictated.

Thus we come to the highest organ, to the Forest Service. There is a special department for private forestry questions, although it consists of only one single person, and its main task is to see that private forestry work is granted sufficient money in the State Budget. Of course, above the Forest Service there are the Government and the Diet.

An annual grant provides the organization with money. Beyond that the District Forest Conservation Boards acquire means by charging for forest operations executed. The charge doesn't cover the costs, but it is preferred to collect this charge for two reasons. First, as a matter of principle it is not considered right that the State should pay for all the silvicultural work carried out in private forests, and second, the forest owners value the aid more if they have to pay for it.

Additional income the organization acquires by supplying seed and plants, and by publishing books and a forest newspaper.

According to the sixth paragraph in the Private Forestry Law the Forest Conservation Boards, besides the supervision of the stipulations concerning tree-felling, are expected to promote private forestry by means of spreading knowledge of rational forestry, guiding and assisting forest work, encouraging and supporting collaboration in forestry, and adopting other measures for developing forestry. During the recent years this aspect has become very prominent. Instead the cases of forest closing are becoming more and more rare.

It would take too much time to describe all the measures taken by the Forest Conservation Boards for fulfilling the obligations set out in paragraph 6. The most important form is the marking of trees for cutting, and the personal guidance given to the forest owners in that connection. Assistance is given in other forest management work, too, in planting and seeding, and in preparation of regeneration areas. Among young people instructive and propaganda work is carried out.

In the sixth paragraph it is provided that the Forest Conservation Boards also promote collaboration between forest owners. This order was included because over the period of fifty years special Forest Owners' Associations have been established and they have become very significant. As a rule, they cover a commune area each, and they employ one middle school educated forester at the disposal of members. The costs are divided among members in proportion to the forest area. The private forest owners adopted this way voluntarily and with great success. At present there are 330 Forest Owners' Associations and they employ about 360 middle school educated foresters. The weight of the instructive field work is going over to the side of these associations, and it is intended to establish their activity firmly by new legislation. Nowadays these associations get state assistance up to 20 per cent. of their income. In the new law it is proposed that every forest owner should be obliged to pay a so-called forest management fee, which would fall to the local association.

Now it is time to take the Law on Forest Improvement in Finland into discussion. This law provides that during a five-year period certain sums will be put at disposal for draining swamp lands, for forest growing, planting, and putting devastated areas into productive state as well as for building forest roads. This law entered into force in 1929, and up to 1939, when the war interrupted the work, nice results had been won. During ten years 279,000 hectares land was drained and different kinds of seeding, planting, and other silvicultural work was carried out on 198,000 hectares. Altogether 477,000 hectares were thus treated.

The interruption caused by the war was a great loss to the work that was proceeding so well. It has meant effective progress in silvicultural work. The forest owners were most interested in the draining work, but other improvement work also gained more and more significance.

The State support based on the Forest Improvement Law is given either as assistance or as loans at a low rate of interest. The amount of support depends on the financial standing of the forest owner in question. A small farm owner can get a quite considerable support, while a big farm gets less. In all improvement work assistance is given in the form of planning, foremen, tools, and seeds and plants—free of charge. It has proved that particularly the drainage work requires a specially trained staff to be successfully carried out. The winter, when it is impossible to perform field work, is well used for the pretentious planning work, for estimating costs, and for settling the accounts.

In short, we can say that the organization for promoting private forestry work in Finland has proved very successful in our circumstances. Perhaps its most essential feature is that the responsibility is left to forest owners themselves. There are strict stipulations in the Private Forestry Law, but when the application of the law is entrusted to men who know forest work and feel it their own, matters can be run more smoothly. The Finnish farmer values his freedom high, he has never submitted to strange command, and the way of his own responsibility is doubtless the only possible. Had there been no war, probably there would already be a new and more complete law of forest management in force.

The Finnish farm forests have not reached a very high level yet. After all, twenty years are not a long time in forest management, especially not in the far north, where forests grow slowly. But we trust that we are on the right road and we try to go forward along it.

Approximate Cost of Paper.—Preparation, not given; printing (1,178 copies), £280.

By Authority: R. E. Owen, Government Printer, Wellington.—1950.

Price 2s.