

# TE KURA NGAHERE

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### EDITORIALS.

This journal is produced by the Forestry Club of the Canterbury College School of Forestry, and its aim is to discuss forestry in all its aspects and to set forth the general activities of the Club. It is intended in future issues to extend the range of technical articles and to publish the researches conducted by the School. The Club is as yet small, it is true; the School has just completed its first full working year; yet it is felt that the many forestry enthusiasts in New Zealand and abroad will find topics of interest in the pages of this modest journal.

Research in all branches of knowledge is gradually becoming understood by the general public. The visit to the Dominion of the famous physicist, Sir Ernest Rutherford, has aroused great interest, and the enthusiastic reception that has greeted him demonstrates the wide appreciation of research in pure science. We hear much of research in the pure sciences, in medicine, in agriculture, but

it still has to be borne in upon the public mind that research in forestry also occupies a place of world-wide importance.

In the minds of many people forestry seems a simple business—they consider that forestry comprises merely the growing of trees and the cutting of them down. These are but two of the many branches of forestry, and “the growing of trees,” or silviculture, is an activity affording many avenues of research. While the growth and management of trees en masse may be dealt with according to certain general principles, yet the silvicultural practice for every country and every district has to be worked out according to the particular problems involved. In New Zealand, for instance, we cannot apply exactly the same silvicultural methods in detail as are followed in Europe; in New Zealand the growth of, say, pines, is much more rapid, and we had to discover the optimum conditions under which these exotic conifers grew. While some of this knowledge may be obtained by random observations over a series of years, or as the result of some lucky set of conditions or by other methods on the hit or miss principle, yet the only satisfactory method in the long run is to organise a rational system of research by the arrangement of a suitable series of experimental plots.

Forestry differs from agriculture. A farmer's work provides him with repeated experiences of the same problem. A farmer may make a mistake in a crop one year; he can rectify this error in the following year. But the forester cannot tell for many years just how his plantation is going to turn out. Even the question of tree seed selection is an important one. Heredity is just as important a factor in Forestry as in Agriculture. But whereas the agriculturist has the opportunity of putting things right in a year or two, the silviculturist may be committed to a century. Hence the need for initial accuracy; hence the need for correct knowledge which can be obtained only by painstaking investigation.

The State Forest Service has been the chief organisation in New Zealand to put forestry research on a sound basis, and for the past six years has been steadily pursuing a scheme of research projects and amassing valuable information.

Research has been proceeding on the life history and regeneration of the chief types of indigenous forests, on forest products such as

technological tests of New Zealand timbers, plywoods and veneers, crossarms poles, etc., and on wooden box construction, seasoning of timber, wood preservation, wood distillation and wood pulping. Much investigation has also been carried on in silvicultural work, e.g., eradication of weeds in nursery seed beds by various methods, establishment of plantations by direct sowing and underplanting of exotic trees in indigenous forest and afforestation of sand dunes.

In connection with the latter work the following paragraph may be quoted from Circular No. 22 of the Service entitled "Forestry in New Zealand":—"A pressing and important economic problem is the reclamation and bringing into productivity of the several hundred thousand acres of New Zealand's coastal wandering sand-dunes. The menace of these useless sand-wastes to contiguous fertile lands along the west coast of the North Island is serious and actual. During the year 1921 a sand-dune-reclamation experiment station was established at the mouth of the Rangitikei River, about nine miles north of Foxton. The chosen area contains about 2000 acres of west-coast littoral, and may be considered typical of the North Island conditions. An area of 449 acres has been planted with marram-grass, 62 acres of sand-flats have been sown with marram-seed, and experimental plantings of trees have been made, *Pinus radiata* proving most successful, and *P. pinaster* second. Spot seed-sowings of *Pinus radiata*, *P. muricata*, *P. pinaster*, *P. Banksiana*, *Alnus glutinosa*, *Cupressus Lawsoniana*, *C. macrocarpa*, and black-wattle have been made, also a careful study of the various methods of planting and espacement with relation to the effect of wind and drift. Several types of sand-arresting fences have been erected; their effectiveness is being recorded, and costs of construction have been carefully kept. As a result of this sand-dune-reclamation work, which will be continued on an experimental basis for one or two more years, the State Forest Service will be able to present a definite procedure of construction, cost, method and result for the purpose of bringing into national production at least 300,000 acres of land which to-day is not only worth nothing, but is ever encroaching on the most fertile and valuable agricultural lands in the North Island."

The Canterbury School of Forestry has also contributed its quota of research, a feature which is dealt with elsewhere in this issue. We must not neglect, however, the pioneer forest experimentalists in New Zealand—those enthusiasts in afforestation in the early days of settlement, especially in Canterbury, where plantations were established both on the plains and higher country. Plantations were formed at the homesteads, where parks and specimen trees were laid out as in English estates. These

early pioneers had nothing to guide them, and their first efforts were largely in the nature of experiments. Nevertheless, these men were enthusiasts, and the results of their persevering labours are now visible in many fine plantations and well laid-out grounds and avenues, the history of which is well known, and affords valuable data to the student of to-day.

We have indicated briefly some of the lines along which forestry research has been directed in New Zealand. But we wish to emphasise the necessity of continuing this research. Many problems still await solution. In the matter of research a School of Forestry plays a most important part. Research is an essential factor in keeping alive enthusiasm in any science, pure or applied, and especially is this so in a professional school. As forestry becomes more intensive, as more and more difficult country has to be planted up, as more economies in forest products have to be practised, so the need for well-tried and successful methods has to be emphasised, and if success has to be ensured in the future, then it must rest upon the foundations of the research of to-day.

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#### HISTORY AND DEVELOPMENT OF THE SCHOOL.

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The School of Forestry of Canterbury College has been in official existence for over a year, but research, lectures and general forestry work had been carried out in the Biology Department for over four years previously. The initiation of the work, and the arousing of public interest in the teaching of forestry at Canterbury College, is largely due to Dr. Charles Chilton, Rector and Professor of Biology in the College. Dr. Chilton has long taken a great interest in arboriculture as a member of the Christchurch Domains Board, and as Hon. Secretary of the Riccarton Bush Trustees, while his work in connection with the Christchurch Beautifying Association is well known. On May 24, 1920, he submitted to the Board of Governors a scheme for the establishment of a School of Forestry, and on his recommendation the Board applied to the Government for funds for this purpose.

For many years, too, the Board of Governors was fortunate in having as a member the late Mr. T. W. Adams, of Greendale, Canterbury, an enthusiast in arboriculture and forestry. Mr. Adams possessed many fine plantations and an arboretum at Greendale, and on his death in 1919 he bequeathed a portion of his estate and a considerable sum of money to Canterbury College for the purpose of assisting in the establishment of a School of Forestry at the College.

During the years 1920-23 public lectures in various subjects were given in the Depart-

ment of Biology by Mr. C. E. Foweraker, and the good attendance at these demonstrated the public interest in the subject.

Mr. Foweraker was appointed Lecturer in Forestry in 1921, and in 1924, when the Senate of the University of New Zealand decided that Canterbury College should be recognised a professional School of Forestry, a course of lectures in Principles of Forestry and in Silviculture was given for the first time as part of the regular College course. Three students enrolled during the year. In 1924 the New Zealand Government voted an annual grant towards the School, and this enabled a more extensive organisation to be made. The Board of Governors in December, 1924, appointed Mr. Foweraker Lecturer-in-Charge of the School, and Mr. F. E. Hutchinson, B.Sc.F. Assistant Lecturer. The following additional appointments were made later: Mr. A. L. Tonnoir, Lecturer in Forest Entomology; Mr. T. W. Rowe, Lecturer in Forest Law; Mr. E. W. Bennett, Research Assistant and Librarian. The School of Engineering arranged to give instruction in Surveying, and the Department of Economics instruction in Forest Economics.

Until recently the School has had no permanent building accommodation of its own, but its chief indoor activities were carried out in the Department of Biology, where the lectures and laboratory periods were held. Here, too, the museum, library and field equipment were housed. Early in December the Board of Governors allotted to the School a number of rooms in the adjacent Boys' High School buildings now just vacated. This will enable a permanent museum to be set up, and classrooms, etc., arranged, thus greatly facilitating future work. The excellent equipment of the laboratories of the Biology Department have proved invaluable in the work of forest botany, dendrology, forest entomology and wood technology. The Museum is being steadily built, and is dealt with elsewhere in this Journal. The library comprises a large assortment of standard text-books and general works on all branches of forestry. Half a dozen forestry journals are provided, and a large collection of bulletins and pamphlets relating to forestry is available for reference.

During the present year the equipment has been steadily increased; instruments for forest mensuration and cruising; maps and plans; wall diagrams; camp equipment; photographic outfits have been secured and made use of. One of the most useful items of equipment is a Ford car, which has proved invaluable in conveying staff and students to the field for work in mensuration, forest protection, dendrology, silviculture, etc. It has also been largely used by the staff for inspections, and visits have been made therewith to the chief plantations in Canterbury from Cheviot to the Waitaki.

The School is indeed fortunate in the large number of plantations of exotics in various parts of Canterbury which are available for practical field work. The large plantations and nurseries of the State Forest Service at Hanmer, the plantations of the Selwyn Plantation Board in the neighbourhood of Darfield, the Christchurch City Council's plantations at Bottle Lake, and the very numerous privately-owned plantations throughout Canterbury, and especially in the neighbourhood of Christchurch, have all been extensively used during the year. Further, the vast Taxad Rain-Forest of Westland is always within less than six hours' train journey, and here all the larger-scale operations have been conducted.

The interest of the Canterbury public in the School is steadily increasing, and owners of plantations and specimen trees throughout the province have been most generous in making available for the use of the School, not only their plantations, but all the information they had concerning them.

On the whole, the conditions under which the School is working are satisfactory, and with the ideal conditions for field work that exist, it is evident that the School is possessed of unlimited scope for future activities.

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#### THE SCHOOL OF FORESTRY MUSEUM.

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The museum of the School of Forestry has undergone a great process of expansion during the past year, and although still rather scattered, due to lack of a permanent home, now presents quite an imposing array of material, which is at present housed mainly in the Botany Museum of the College, but will be moved next year to permanent quarters in the old Christchurch Boys' High School building.

The most important part of the Museum is the collection of woods, used as laboratory material in connection with technological work, dealing with the structure and identification of woods, and their mechanical properties.

This collection contains several hundred pieces of native, imported, and home-grown exotic timbers, and is still far from complete, as a wide assortment of different specimens is needed to illustrate such characteristic variations in colour, weight, rate of growth, etc., which occur within the same species of any wood. A start was given the collection last year, when Mr. J. Young, Curator of the Christchurch Botanical Gardens, donated to the School blocks and log sections of some fifty exotics, mainly conifers, growing in the Gardens.

Mr. James Deans also presented an extensive set of log sections of various conifers

grown on his estate at Homebush, North Canterbury.

Pieces of commercial, native and imported timbers were obtained from local saw-mills through the courtesy of the proprietors, while a number of the rarer cabinet woods were donated by Mr. Barrett, of the Training College.

Mr. Calvert, Lecturer in Engineering at Canterbury College, kindly presented the School with his collection of North Auckland woods, while the assistance of several Rangers of the State Forest Service has been given in the gathering of collections of woods characteristic of their respective regions, so that, with this broad foundation to work on, the matter of classifying the various commercial woods into an accurate but simple code of identification can be carried on with confidence.

In addition to this technological collection, which serves as a reservoir for material for microscopic sectioning, and for a certain amount of testing, display sets of the various woods, carefully prepared to illustrate figure and other characteristic features, are being prepared as exhibit material. This will include sets of polished wood sections, prepared log sections, and planks for display in the Museum, and for exchange with other institutions. A set of Fijian timber pieces has been donated by Mr. B. Parham, a former resident of the Islands, while the Philippine Government Forestry Bureau has presented the School, on an exchange basis, with a prepared set of thirty of the common woods of that country, and it is hoped in time to obtain other collections from various parts of the world.

A fairly complete collection of cones of the exotic conifers growing in New Zealand has been made from various sources, and the making of an herbarium has been commenced. A full collection of the plants of the Westland Rain Forest has already been made, as well as an extensive collection of material of the New Zealand Taxads, both dried and in spirit.

A forest products section of the Museum is also in preparation. Exhibits of commercial products of various woods leading to closer utilisation of New Zealand timbers, successful uses of New Zealand native or exotic timbers in place of imported woods, etc., are displayed to advantage, so that visitors to the School may become acquainted with recent developments in forest industries. In connection with this activity, the School keeps in touch with the various manufacturers whose products are presented, and is able to supply prices and information as to suitability for various uses to interested enquirers.

Mr. A. L. Tonnoir, Assistant Curator of the Canterbury Museum, and Lecturer in

Forest Entomology, has been busy throughout the year in the making of a collection of specimens and preparations dealing with forest entomology. Already a good collection of forest insects in various stages, and of wood, bark, leaves, etc., showing the ravages of insect pests, has been set up.

### The Nursery.

Recognising that Forestry in its widest and best sense is essentially a practical science, it is the policy of the School to carry out as much work actually in the field as is possible. All students are taking Silviculture at least to the elementary stage, and the value to them of actually doing the work of establishing and carrying on a nursery themselves, in addition to receiving lectures upon the subject, is not difficult of realisation. Accordingly, during the year, the formation of a small demonstration and experimental nursery for the growing of forest trees was decided upon. Canterbury College, fortunately, has the administration of numerous areas of land, in the form of reserves, both in and around Christchurch, and the Board of Governors being approached in the matter a ready assent was forthcoming to the proposal to use part of one of these areas for a nursery site.

A small reserve at Opawa, within easy cycling distance of the College, was chosen, and a quarter of an acre of it, facing approximately due north, was marked out and fenced in. There being no hares or rabbits in the vicinity wire netting was not needed. A large draught horse of homely appearance, but evil reputation, which is grazed on the remainder of the reserve, is the only animal enemy, and a sufficiently severe penalty for the first student who leaves the nursery gate open will have to be decided upon by the Forestry Club.

A fair start was made by the students upon the initial work of trenching the ground; unusually wet weather, however, and the gradual approach of examinations, reduced the time which could be spared for this work, so help was secured to finish the operation. In due course about two-thirds of the area was thoroughly trenched, and some timely frosts further assisted in the breaking up of the ground.

The soil is quite suitable, being a good loam of some 9 to 12 inches overlying a slightly sandy subsoil, shingle being reached at a depth of about 3ft. 6in.

It having been decided to use one quarter of the nursery for seed beds, when weather and time permitted this was well forked over, and repeated rakings reduced the soil to a fine tilth.

Pegs were put in and the beds laid out, ample paths between being left for weeding,

wrenching, and so on. All was now in readiness for the sowing of the seed. This was obtained from the State Forest Service nursery at Tapanui, and early in November the beds were sown down in *P. radiata*, *P. ponderosa*, *P. Laricio*, *Pseudotsuga taxifolia*, *Sequoia sempervirens*, *Thuya plicata*, *Cupressus macrocarpa*, and a small selection of Eucalypts. During the long vacation all the students are engaged in various forestry occupations away from Christchurch, so little help is available, and in these circumstances it was considered wise to sow down only such a number of the beds as could be properly tended during the interval before the new year starts. These beds are provided with light, easily portable seed frames for protective purposes. Half of the remainder of the prepared ground will be used for experimental purposes, mainly in the direction of investigating the various methods of drill sowing, a practice which is becoming increasingly popular with many nurserymen. Potatoes were planted in the other half, the object being not so much to secure the crop as to ensure the thorough working over of the ground which follows through the moulding up and digging of the potatoes. This ground will then be in good condition for the transplanting of the seedlings from the seed beds. The unprepared portion of the nursery is being left in grass, and will be utilised next year. At afternoon tea time on a hot day, the presence of the Canterbury College Ranger's house, which adjoins the nursery, is much appreciated, and adds greatly to the pleasure of the work.

It is probable that the young trees produced in the nursery will be used in planting up such areas of the College estates as the Board of Governors decides upon. Students taking advanced Silviculture will use these areas for the formulating of practice planting schemes. In the main, however, the object of the nursery at present is to give students a clear demonstration of nursery practice in all its aspects, and to provide them with the opportunity of actually doing the work themselves, and so acquiring that amount of experience which is essential if they are later to successfully help in the management of a forest nursery.

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### COURSES OF STUDY IN FORESTRY.

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The scholastic qualifications, the ultimate aim and the time at the disposal of students entering the School of Forestry, are so varied that it was found necessary from the start for the School to offer at least three different types of Courses, viz., the Degree, the Associate and the Ranger Courses.

The Degree Course is designed for students intending to qualify for the Degree of

Bachelor of Science in Forestry in the University of New Zealand. Matriculation is a pre-requisite. This course requires as a minimum one year's preliminary and three years' professional work. The work of the preliminary year embodies the study of pure science and mathematics, and the three years' professional work is devoted to the study of the theory and practice of technical professional forestry subjects. It is unnecessary here to enumerate and define the subjects in detail, as this is done fully in the prospectus of the School. In addition to passing the professional examinations, a student must spend at least 12 months in the actual practice of forestry operations in the field. The Degree Course is designed for students desirous of becoming professional foresters with a high degree of technical knowledge.

The Associate Course is modelled on the Degree Course, but is a shorter one of less difficulty, and covers the work required by students intending to qualify for the Certificate of Associateship of the School of Forestry of Canterbury College. This course requires a minimum of three years' work. Matriculation is a pre-requisite, but the preliminary year's work in pure science is not demanded. The Associate Course is intended for students who cannot see their way to take the more extensive Degree Course. It is primarily framed for men who have allowed some years to elapse since matriculating, and who have been engaged in forestry work of a strictly practical nature. The course supplies the needful theoretical background to their past forestry experience, and would suit those who would feel a difficulty in working up to the standard of the intermediate examination in pure science and mathematics required by the Degree Course. The standard of the course is slightly lower than that of the Degree, but it must be clearly understood that the Certificate of Associateship is granted by Canterbury College alone, and does not give the student a University status such as belongs to the Degree.

The two-year ranger course is designed for the needs of men, not of matriculation standard, who desire to enter the State Forest Service or other forestry organisation as rangers or field executives. It is the aim of the course to turn out men fully qualified to do plane and topographical surveying as needed for forestry work; to estimate timber; to make reconnaissance and other forest field surveys; to handle nursery and plantation projects in an executive capacity—in other words, men capable of taking hold of field routine, taking charge of field crews and assuming responsibility for project work. The men for whom the course is primarily suited are those who are rather older than the average University student, and who have already had some ex-

perience in some line of forestry work either as forest guards, plantation and nursery workers, bushmen or field men on survey parties, and who, for lack of secondary education or for financial reasons, are prevented from taking the Degree or Associate courses.

In scope the course is intensely practical, stress being laid upon the field application of the work. The subjects taken in the two years are:—Mensuration, surveying, forest protection, wood technology, forest utilisation, forest botany, dendrology, silviculture, forest law and administration, and elementary courses in logging engineering and forest management. As much of the work as is possible is done in the field under actual field conditions,—at the School's forest nursery; in the large plantation areas adjacent to Christchurch which have been placed at the disposal of the School for practice work; at the saw-mills and forest utilisation plants of the city; and in the virgin forest of Westland, where the annual three-weeks' Spring Camp of the School is held. It is hoped that in the future, when the staff of the School becomes large enough to handle the work, the field period for the ranger course students may be extended to cover a whole term each year in practical applied forestry carried on by the students under supervision of the staff.

#### **FORESTRY RESEARCH AT THE SCHOOL.**

##### **(i) The Taxad Rain Forest of Westland.**

The State Forest Service, desirous of obtaining detailed information concerning the vast areas of Taxad Rain Forest in Westland, inaugurated some four years ago an investigation scheme which was placed in the hands of Mr. C. E. Foweraker. This work was rather extensive, and as Mr. Foweraker could devote only the summer vacation to field work, the investigations had to be spread over a series of years. The general topographic features and climatic conditions of Westland were studied, and a careful ecological survey made of representative types of the forest. The Rimu, Kahikatea, Totara and Silver Pine areas were investigated, and the composition and life history of the various stands thereon were worked up. Special attention was paid throughout to the important question of regeneration under varying conditions, as the phenomenon of regeneration was the main item upon which the State Forest Service desired information. The work has gone steadily forward, progress reports have been furnished each year, and the whole investigation is now being finalised. A general account of the Rain Forest appears elsewhere in this issue.

In connection with the study of the Taxads, the State Forest Service desired information concerning the nature of the growth

rings in the wood, and concerning the germination of the Taxad seeds and the establishment and development of the seedlings. Investigations on these subjects were carried out during the years 1922 and 1924, under the supervision of Mr. Foweraker, in the Department of Biology, Canterbury College. Miss F. B. Murray, M.A., and Mr. E. W. Bennett, M.Sc., carried out the research on Seedlings and growth rings respectively during 1922. The work was continued and elaborated in 1924 by Miss J. B. Cunningham, M.A., and Miss M. S. Fitzgerald, M.Sc. Full reports of the work carried out were furnished to the State Forest Service.

##### **(ii) Investigations into Growth and Yield of Exotic Plantations in Canterbury.**

In view of the great planting schemes being formulated by private companies, local bodies, and Governmental agencies throughout New Zealand, and in view of the complete lack of data as to rate of growth, yield, and other data essential to forest management, steps were taken by the School early in the year to secure the necessary information in regard to the chief species being planted on a commercial scale in Canterbury. By courtesy of the Selwyn Plantation Board, through the Superintendent, Mr. R. G. Robinson, permission was given the School to establish sample plots throughout the plantation areas controlled by that body. During the current year eight sample plots have been established, all in the more recent plantations, of which complete and accurate record is available. The plots cover the three species of *P. ponderosa*, *P. radiata*, and Douglas Fir, and include a variety of sites and methods of handling, including two underplantings of *P. radiata* under diseased eucalypt, and under wattle-scrub, the result of afforestation experiments of the early days which proved a failure. Measurements will be taken annually on these plots, and a careful record kept of all thinning and other work carried out on the areas, so that at the end of the rotation, about thirty years hence, a complete set of actually measured data on growth and yield will be available as a check on the present empirical estimates.

Arrangements have been made with the Mackenzie County Council to establish similar plots in their high country plantations of larch and pines at Burke's Pass this summer, while it is planned to extend the work in the Selwyn plantations to some extent next year.

##### **(iii) The Wood Identification Project.**

With the purpose of securing an authentic guide to the identification of the common woods of New Zealand, a start was made in the classification, on the basis of structure, of the everyday woods of New Zealand. This work

had been begun in a small way by a student of the Yale (U.S.A.) School of Forestry, for the New Zealand Government, but only a few species had been dealt with, and from lack of a sufficient quantity of each species to show characteristic variation, and from lack of familiarity with the woods handled, the descriptions given were not always definite enough for positive identification. Apart from this no work whatever on the subject was available for use. Accordingly some fifty species of the common timbers encountered frequently in everyday use in New Zealand, including indigenous, home grown exotic, and imported timbers were assembled and classified. A preliminary key (published in this issue) for field use by non-technical men, based on macroscopic features of structure, has already been prepared, and has been distributed to various wood-users for testing as to accuracy and simplicity in everyday use. This preliminary work is now being followed up by more detailed work into the more intricate problems of identification confronting the wood-user—the specific identification of the various eucalypts entering New Zealand, under various trade names—the specific identification of the New Zealand beeches and other matters of considerable importance to buyers of timber for special uses. Research into the microscopic characters of the various woods is proceeding, attention being concentrated on the New Zealand hardwoods—a field hitherto untouched in a practical way, and it is hoped that two or three years will see some finalised results on this study.

The School has already arrived at the stage when it will undertake to identify, with reasonable certitude, wood samples that may be sent in by forest users.

#### (iv) Canterbury Economic Survey.

By arrangement with the State Forest Service, the School has undertaken the project of an economic survey of Canterbury with regard to forest products and their use in the province, covering the consumption of forest products in Canterbury, sources of supply, probable length of time before exhaustion of the present supplies, the present resources of the province itself, and the possibilities in forestry to meet the future needs of the province. The importance of this study in a province which now imports almost the entire stock of timber consumed, yet which contains a vast area of potential forest land, now lying idle or only semi-productive, needs no stressing.

The preliminary work for this project is already well under way, and it is planned to spend the greater part of the coming vacation in field work connected with this survey.

## THE RAIN FOREST OF WESTLAND.

The average New Zealander speaks of his native forests as “bush,” but, from a scientific standpoint, this bush comprises different types of forest—chiefly rain-forest. The bush in Westland is a true rain forest—correctly termed a “taxad rain forest,” because the dominant timber trees are taxads, belonging to that family of the Gymnosperms known as the Taxaceae. The most familiar type of this family is the English yew, *Taxus baccata*, from which the family takes its name. The term rain forest is applied to that type of forest which depends for its physiognomy on a copious rainfall well distributed throughout the year. There are many types of rain forest—tropical, subtropical, and temperate, that of Westland belonging to the latter class, and demanding a rainfall of at least 100 inches per annum.

There are various taxads in the Westland forest, e.g., Rimu (*Dacrydium cupressinum*), Miro (*Podocarpus ferrugineus*), Kahikatea (*Podocarpus dacrydioides*), Totara (*P. totara*), Matai (*P. spicatus*), and others of smaller size. These trees are usually referred to as “pines,” e.g., red pine (Rimu), black pine (Matai). A well-known species of the smaller taxads is the Silver Pine (*Dacrydium Colensoi*). The characteristic feature of the taxads is the fructification, which, like that of the yew, has usually some portion or other of a fleshy nature, often reddish. This fructification is, botanically, a reduced cone, and serves to distinguish the taxads from the true pines of the family Pinaceae, whose cones are large, dry and woody when ripe. Two other features of the taxads are their small leaves, often reduced to mere scales, and the fact that they are dioecious, i.e., the trees are distinctly male and female.

The forest is composed of several types depending on soil and elevation. The limits of space do not permit of a full treatment of all the types of this forest, so only one and the chief ones will be treated, viz., the lowland taxad rain forest.

Westland presents a wide range of physiological features. It comprises a comparatively narrow strip on the west of the South Island having an area of approximately 3,045,700 acres (4442 square miles), of which mountain ranges and forest occupy 2,843,150 acres, rivers and lakes 29,750 acres, and open country 172,800 acres. The dominant features are the chain of the Southern Alps forming the eastern boundary, and merging into foothills and an elevated pene-plain to the west, and finally the narrow western coastal plain. This coastal plain is broken here and there by morainic bluffs, reaching to the coast, and by large river valleys. On this plain is found the lowland forest just referred to.

The rainfall is abundant, days and weeks of steady rain alternating with periods of fine weather and bright sunshine. High winds are infrequent, and the winter is not severe. Altogether the climate is well suited for the growth of a luxuriant forest.

The lowland forest, then, is found on this narrow coastal strip, which was, in primitive times, nearly all occupied by forest. Even the irregular tongues of morainic debris, reaching to the sea coast in many places, were densely wooded. At intervals a river valley running approximately east and west, occurs, on the more recent terraces of which are found certain distinct types of forest.

The bulk of the lowland forest is composed of what may be termed the Rimu-Miro forest, or more briefly, the Rimu forest. The river valleys and other lower-lying areas contain what may be termed the flood-plain forests of Kahikatea and Totara. Silver pine areas occur in Rimu country, but are of comparatively recent origin.

By far the greatest portion of the lowland forest is composed of the Rimu-Miro type. In this, Rimu is the dominant tree, dominant as regards timber value, not dominant numerically; but another taxad, the Miro, is constantly associated with it. The Rimu is a tall tree, 60-80ft., with a trunk 2-5ft. diameter.

Its bark is brownish, and flakes off irregularly, leaving exposed areas of younger bark marked by numerous raised wrinkles like ripple-marks on a beach. In virgin forest, however, the bark is rarely visible, because the trunk is densely covered with mosses, filmy ferns, leaves and epiphytes generally. The crown is roundish, and the pendulous twigs and branches give the graceful, drooping appearance so characteristic of this tree. The leaves are minute, more or less awl-shaped, and the seed is small, about  $\frac{1}{2}$  in. long, seated on a small cup-shaped scale much like a tiny acorn. Occasionally the region at the base of the fruit becomes fleshy and succulent.

The Miro is constantly associated with the Rimu, and is a fairly tall tree, 50-80ft. high, with a trunk 1-3feet. in diameter. The bark is blackish, and the old bark flakes off in such a way as to leave more or less rounded pits or depressions, giving the trunk its characteristically "hammered" appearance. The leaves are dark green,  $\frac{1}{2}$ - $\frac{3}{4}$  in. long, narrow and somewhat sickle-shaped. They are arranged in two opposite rows down the twigs in a feather-like manner. The female trees bear the well-known Miro "berry"—a reddish purple plum-like fruit up to  $\frac{3}{4}$  in. long, with a fleshy and succulent outer coat enclosing a hard "stone." The Miro does not occur in pure stands. A grove of many adult trees in one spot is rather rare, and the tree is usually scattered unevenly throughout the forest.

The Rimu forest shows a well-marked arrangement into four tiers—the taxads, broad-leaved trees, shrubs and the forest floor. Lianes and epiphytes abound. The general impression is one of luxuriant growth—a result of the copious rainfall. The floor is constantly wet, but not generally swampy. The wealth of floor herbage is noticeable, mosses and ferns in particular being abundant.

When the edge of this forest is viewed from a little distance, say, at the edge of a clearing, the most prominent feature is the giant trees, with their tall, straight boles, and crown of foliage overtopping the general mass of shorter trees. In all cases the large trees are Rimu and Miro. The next tier of trees is composed of the broad-leaved dicotyledons, which, when mature, vary in height according to species and growth conditions. Their approximate height is 70 feet. In any case their crowns are well below those of the taxads. Two broad-leaved trees constantly occurring in the forest are the Kamahi (*Weinmannia racemosa*) and *Quintinia acutifolia*. These two appear to be the numerically dominant trees of this tier. Others frequently occurring are the Horoeka or Lancewood (*Pseudopanax crassifolium*), Houhou (*Nothopanax Colensoi*), Kapuka or Broadleaf (*Grisehina littoralis*), Mahoe (*Melicactus ramiflorus*), Pate (*Schefflera digitata*), Toro (*Suttonia salicina*), Porokaiwhiri (*Hedycarya arborea*), *Ascarina lucida*, Hinau (*Elaeocarpus dentatus*), Pokaka (*E. Hookerianus*), Putaputaweta (*Carpodetus serratus*), and several others less abundant. The southern Rata (*Metrosideros lucida*) is, in many areas, a common component of the Rimu forest.

The shrubs include the smaller tree forms, chiefly species of *Coprosma*, which grow up to a height of about 20ft. These bear approximately the same ecological relation to the larger broad-leaved trees as the latter do to the taxads. Common shrubs are the Hupiro or stink wood (*Coprosma foetidissima*), Kanono (*C. grandifolia*), Karamu (*C. lucida*), Mingimingi (*C. propinqua*), Horopito (*Drimys colorata*), *Suttonia divaricata*, Rohutu (*Myrtus pedunculata*), and several others.

The forest floor and substratum may be considered as being composed generally of four layers. On the surface is a carpet of mosses, filmy ferns, and creeping, prostrate and minute herbs. Below this comes a layer of coarse particle humoid matter composed of decaying and decayed leaves, twigs, bark, etc. Next is the third layer, also of humoid material but much finer, and interspersed with rootlets from the forest trees, the rootlets of the taxads being easily distinguished by the modules thereon. Lastly comes the primitive substratum itself, which may be stony, clayey or sandy, according to its geological formation. The above is a generalised description of

the floor. In certain localities it varies from this type. Where the floor is still in process of being formed, as, for example, in areas denuded by landslips, the depth of humus is not great—rocks and boulders project here and there, and the humus layer is very thin. In other swampy or boggy areas the floor is mainly covered with dense masses of Sphagnum moss, with pools of water in depressions. Again, there may have been much breakage and falling among the adult trees, and this strews the floor with branches and logs which may take years to decay to humus.

A noticeable floor feature is the great profusion of seedling trees and shrubs. The majority of such seedlings are those of the broad-leaved trees and shrubs, but taxads, too, are constantly found, though their relative numbers and distribution vary. The chief importance of the floor lies not so much in its chemical or even its biological constitution, but in its physical condition, where porosity, retention of moisture and looseness of particles are its chief properties. The floor bears an intimate relationship to the other tiers of the forest. The tree and shrub tiers are dependent on the floor, and the floor on the upper tiers. Any disturbance of this balance of ecological relationship, such as by clear felling, fire or stock, is fatal to the continued well-being of the forest.

Lianes abound; these are the creepers, climbers or scramblers, and they form a characteristic plant type in the forest. It is difficult to find any area of rain forest in which lianes do not occur. They sometimes scramble over the forest floor, cover shrubs, logs and tree tops, or climb lofty taxads, and so gain the light, to which they expose their chief leaf masses. As a distinct group in the forest the lianes are important and interesting, and from the point of view of forest ecology they appear to be important in two directions. Firstly, certain lianes, e.g., one of the Ratas, *Metrosideros florida*, may actually strangle its host tree. Secondly, after logging operations, many scramble about the forest floor, and, forming dense matted tangles, inhibit the growth of seedlings and saplings. The chief lianes are the various Ratas (*Metrosideros* spp.), the Supplejack (*Rhipogonum scandens*), various Bush Lawyers (*Rubus* spp.), and the Pohuehue (*Muehlenbeckia australis*).

The epiphytes or "perching plants" are of many types, and include ferns, lycopods, orchids, and other seed plants. A profusion of epiphytes is one of the chief characteristics of this rain forest. They are a corollary to heavy rainfall, great humidity and a mild climate.

In the flood plains of the great rivers two distinct types of forest occur, the Kahikatea Swamp Forest and the Totara Forest. The Kahikatea (*Podocarpus dacrydioides*), is a

tall taxad with buttressed trunk, which normally inhabits the lower-lying and more or less swampy areas of river valleys, and lagoon and lake edges. The Totara (*Podocarpus totara*) occurs also in river valleys, but on higher land than that occupied by Kahikatea chiefly on well-drained shingly terraces. It is the driest type of rain forest—the floor is not always soaking wet.

Silver Pine (*Dacrydium Colensoi*) does not form pure stands of large extent, but is usually scattered sporadically throughout the moister Rimu forests of long standing. Other taxads occur in Westland, but these inhabit higher ground than the lowland forest as a whole.

The foregoing is but a brief account of a few types of the vast rain forest of Westland. No attempt has been made to touch upon forestry problems. These are many, and often perplexing. Problems relating to life history, rate of growth, regeneration, effects of logging, fire and stock, management, succession, etc., etc., are ever present, and may form topics of discussion in a future issue.

—C. E. F.

## FORESTRY AS A PROFESSION.

Forestry in some of its many varied aspects has provided a livelihood for men since the very beginning of civilisation, for civilisation is dependent upon wood, and since wood is obtained from forests, this entailed forestry of some sort, since forestry has been defined as "any and all activity whose object is woodland." In primitive times, forestry consisted entirely in the harvesting of needed wood from the abundant forest wealth supplied by Nature, so that the first forester was that sturdy and independent being, the bushman, who has wrought mightily here in New Zealand to supply us with timber for our buildings, fertile clearings for our crops, and also, perhaps, to some extent, with barren acres of blackened stumps and bare clay soil—the result of an excess of misdirected energy. Aside from this last point, for which he can hardly be blamed, his work is most necessary and valuable, and he fills an important place in the life of the nation. But he is not altogether a forester, for his work is only a small part of forestry, albeit an indispensable one.

As civilisation developed, probably the next form of forester was the game warden, who, from his knowledge of the wild things inhabiting the forest, regulated the comings and goings of people therein to the one end of providing good hunting for his employers, the great lords and nobles of the realm. In his day this gamekeeper forester was a great man indeed, looked up to by his neighbours, and respected even by the great lords his mas-