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NATIONAL BOTANIC GARDENS.

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THE BANKS LECTURE FOR 1931.

It is fitting that the subject of one of the Banks Lectures should be National Botanic Gardens, as the illustrious person, whom we honour by associating his name with an annual lecture given under the auspices of the New Zealand Institute of Horticulture, was for nearly half a century associated with the chief botanical garden of the Empire. Sir Joseph Banks acted as an unpaid Director of the Kew Gardens during the time when it was developing from a moderately small royal garden into the foundations of a magnificent national scientific institution. The example of Sir Joseph Banks, who led the first scientific expedition to visit New Zealand, should at least direct our attention to the desirability of establishing a National Botanic Garden and Research Institution in the Dominion. If any stimulus is required from within the Dominion it should be provided by the knowledge that the flora of this country is not only in large part peculiar but it provides a most interesting if not unique example of a flora in the stage of adjusting itself to a varied array of conditions. All the phenomena of plant evolution are being actively carried on, and nothing could be of greater educational value than to exhibit a comprehensive collection of these plants in a position easily accessible to one of the large centres of population. But such a service would be one only of the objects of a National Botanic Garden, which may be defined as an educational and scientific institution whose function is the advancement of the knowledge of plant life in all its branches. Its usefulness extends into many economic channels where industry is based on plants or plant products.

OBJECTS.

The principal objects of National Botanic Gardens may briefly be summarised under the three headings—educational, research, and economic. Perhaps a fourth function of a botanic garden should be mentioned, namely, that of recreation. Any orderly garden performing the functions of education and research, and carrying out certain

useful economic services, must necessarily provide a place for pleasure and recreation, for nothing is more beautiful, or provides a more restful place, than a well kept garden. A garden may, indeed, be a place of recreation, without performing in any noteworthy way any of the three main functions mentioned above, and such, I am afraid, is the case of many gardens which go under the name of botanic gardens.

As regards the educational objects a botanic garden should provide information for all those who wish to learn about plants, not merely their names, which the inquirer should be able to get by an inspection of the gardens, but also the uses of plants, which the officers of the garden should be able to supply either of their own knowledge or from specimens, or from publications issued by the gardens.

The method of fulfilling the educational function of a botanic garden is therefore by maintaining a classified and named collection of living plants, and also a museum of plant products. Material should be available for the use of teachers in educational institutions, while the public are more directly reached by lectures and popular publications.

The research activities of a botanic garden should concern themselves with the exploration of the native vegetation of the country; with investigations into its economic possibilities—for instance, the properties of vegetable oils, tannins, timbers, and drugs; with numerous ecological and evolutionary problems such as the effects of changes of climate on plants; with the production of new forms by hybridization or other means; with breeding and crossing to show the taxonomic status of wild plants; and generally with the behaviour of plants under changes of soil.

Most of such work would be done in the garden's nursery section, though many of the plants on view to the public may also be under observation for some specific purpose. In connection with research work a laboratory, herbarium, and library are required. A large botanic garden should produce sufficient scientific material to justify the issue of a regular publication.

The economic value of botanic gardens will be perhaps of most interest, especially to the community among which the funds out of which the gardens are maintained are raised.

Included among the functions of a botanic garden of economic importance are the acclimatisation of useful plants, the distribution and exchange of seeds, the quarantining of imported plants, and the publication of useful information. The gardens should be used for the vocational training of horticulturists, while surplus plants should be available to public institutions.

HISTORY.

Taking the essential idea of a botanic garden as the growing of different kinds of plants in order to study them from either a scientific or economic viewpoint, then its development must be traced through the early temple gardens, and gardens where medicinal and other useful plants were grown, including especially the garden of Aristotle,

who was a student of botany. In the 16th century the herbalists began to grow plants for the purpose of study, and from these gardens sprang directly the modern botanic gardens. The first of these appear to be those founded in Italy about 1540, and the first herbarium that founded by Geraldo Cibo at the same time and now preserved in Rome. The idea of establishing public botanic gardens spread rapidly, and before the end of the 16th century there were several such in Italy, Holland, Germany, and France. One of the most important of the early gardens was that founded at Pisa in 1543. The second director of this garden was the famous botanist Andrea Caesalpini, and its influence accordingly spread far. Other early Italian botanic gardens were those of Padua, Florence, and Bologna. The earliest public botanic gardens in other European countries were Leiden (Holland) 1577, Leipzig (Germany) 1579, Montpellin (France) 1592, Copenhagen (Denmark) 1600, Upsala (Sweden) 1627, Oxford (England) 1632, and Madrid (Spain) 1763. The earliest Asiatic botanic garden is said to be that at Tokyo established in 1638. The garden at Sibpur, Calcutta, dates from 1787, Peradeniya (Ceylon) 1813, and Buitenzorg (Java) 1817.

In Australia there are some long established botanic gardens, that of Sydney dating from 1816, and that of Melbourne from 1842.

The earliest American garden is the Missouri Botanic Garden founded in 1859. The Arnold Arboretum was established in 1872, and the New York Botanical Garden in 1894.

EDUCATIONAL FUNCTIONS.

Perhaps the chief educational function of a National Botanic Garden is the maintenance of a collection of living plants. In the larger gardens this is carried out to the point of growing as many as 25,000 species, as at Kew, named and, as far as the exigencies of space and landscape effect will allow, classified according to their relationships. The Buitenzorg Gardens contain about 20,000 species, and lesser numbers are reported from the other great gardens of the World.

Complementary to a collection of living plants are the collections of dried plant-products forming botanical museums. These may exhibit not only specimens and pictures designed to illustrate the most striking plants of the World but also commercial products derived from plants, such as timber, fibres, dyes, drugs, tanning material, oils, gums, and rubber. Museums are established in all the larger gardens. At Kew there are four museums, in addition to the North Gallery containing 800 paintings of plants and vegetation by Miss Marianne North. At Buitenzorg both botanical and zoological museums are maintained in the gardens.

The gardens and museums are the chief branches of a botanical institution open to the public, and as an indication as to how they may be appreciated the tally kept at the Kew gardens may be quoted. This shows that the average annual attendance is about 3,000,000.

RESEARCH FUNCTIONS.

Of equal importance with the educational functions of a botanical garden is its research work. For this a staff of trained botanists and chemists is kept in all the larger institutions. Their work consists not only in investigations on the flora of the country in which the garden is situated, but in the case of the larger institutions the field is practically world wide. Thus the officers at Kew carried out the preparation of a number of floras of different parts of the British Empire, and for many years sent collectors out to various parts of the world, while the New York garden has a station for plant study established in the Blue Mountains in Jamaica.

In Edinburgh and other gardens are laboratories open to anyone desirous of undertaking botanical research, while all gardens supply on request information on specimens for the use of specialists.

The herbaria established in the world's largest gardens have attained immense proportions, those at Kew and New York, for instance, each containing more than 2,000,000 specimens.

The results of the research carried out by the scientific staff of botanical gardens are published in various monographs and other works and serial publications. Among the larger works may be mentioned the Index Kewensis, which is an alphabetical list of every plant name (other than garden names) published, and is still being carried on by decennial supplements; and the various colonial floras issued by the Kew Gardens. The New York Botanical Garden is issuing an extensive work on the North American flora. The "Revision of the Genus Eucalyptus" published by the Sydney Botanic Gardens may also be mentioned here. The periodicals issued by botanical gardens include such important publications as the following: Kew Bulletin, Curtis's Botanical Magazine, Memoirs of the New York Botanical Garden, Mycologia, Annals of the Royal Botanic Garden at Peradeniya, and the botanical journals issued by the Buitenzorg Gardens.

ECONOMIC FUNCTIONS.

The economic work of botanical gardens naturally appeals most to the average person who desires to see some immediately useful return for the money expended in the upkeep of the garden. Such a view is, however, quite a narrow one, as it entirely overlooks the aesthetic, intellectual, and social pleasures derived from the beauty, knowledge, and personal contacts derived from well-kept botanical gardens and from botanical societies. However, as in point of fact the economic interest appeals to a more numerous class than the others, the economic functions of botanical gardens as here defined will be described a little more in detail than the educational and research functions, though these are, of course, of great economic importance, albeit this may not always immediately be seen. In relation to the economic importance of botanical gardens the following statement made by Mr. Joseph Chamberlain in the House of Commons in 1898 will bear frequent repetition:

"I do not think it too much to say that at the present time there are several of our important colonies which owe whatever prosperity they possess to the knowledge and experience of, and assistance given by, the authorities at Kew Gardens."

The leading part in the distribution of useful plants to various parts of the British Empire undoubtedly has fallen to Kew Gardens. It was after the appointment of Sir Joseph Hooker, as Director, in 1865, that the introduction of new and useful plants to the dependencies of the Empire and the fostering of new industries in connection therewith was especially made one of the chief duties of the gardens. A great many kinds of useful plants have since been distributed to new centres through the instrumentality of Kew. They include various plants producing fruits—pineapples, bananas, breadfruit; beverages—tea, coffee, cocoa; drugs—quinine, coca; fibres—sisal hemp, New Zealand flax, ramie; besides rubbers, dyes, and timbers.

Both romance and tragedy enter into the story of the first attempt to introduce the breadfruit from the South Sea Islands to the West Indies. In this venture Kew was intimately concerned. A gardener named Nelson was attached to the expedition which set out in the "Bounty" in 1787 under Captain Bligh. One of the objects of this expedition was to obtain breadfruit plants in the Society Islands. After sailing from Tahiti, where the vessel remained for about six months, a mutiny broke out on board the "Bounty" and Bligh and eighteen others were set adrift in an open boat. After a journey of 3,600 miles the Dutch settlement of Timor was reached, but here Nelson died. The breadfruit was successfully introduced to Jamaica in 1791 with the aid of a Kew gardener, Christopher Smith.

The quinine plant, Cinchona, was introduced from South America through Kew to India in 1860, the seeds being first obtained by Sir Clements Markham. At that time it was costing the Government of Bengal £40,000 a year for quinine. Now a dose of 5 grains can be bought for less than a farthing at any post office, while in England the price is one-sixteenth of what it was then. In Ceylon the Peradeniya Gardens played an important part in the establishment of the Cinchona industry in that country, millions of plants being raised and distributed to growers. It was this industry which helped the planting interests to tide over the period between the collapse of coffee and the establishment of the tea industry.

Rubber is an article of daily use, indispensible in the electrical, motor and other industries, and up to quite a recent date the world was dependent for the best of all rubbers, the para rubber, on natural supplies obtained from the tree *Hevea brasiliensis* in the forests of South America. The seeds are very short-lived, but in 1875 some obtained by Sir Henry Wickham from the forests of the Tapajos Plateau, Amazon Valley, were forwarded to Kew. From these, 1000 plants were raised and sent to Ceylon and the Malay Peninsula, thus establishing the species in those regions.

The above examples briefly summarising the transfer of breadfruit, Cinchona, and para rubber plants from one hemisphere to another should suffice to show the important part that botanical gardens have taken in the establishing of industries in different parts of the world.

It remains now to mention two other functions being carried out by botanical gardens. One is the distribuiton and exchange of both useful and ornamental plants which is carried out extensively by all national botanical gardens, and the other is the training of horticulturists. Two famous training grounds are Kew, where courses of study are laid out which fit horticulturists especially for appointments to the botanic gardens of the Empire; and Edinburgh, where the course is free, but anyone not showing satisfactory progress is removed.

Finally, it is worth mentioning that the Botanic Garden of Adelaide maintains a type-fruit orchard, including apples, pears, plums, and peaches, and from which buds and scions are available to growers.

THE PRINCIPAL NATIONAL BOTANICAL GARDENS OF THE WORLD.

BRITISH ISLES.

Kew.—The area now occupied by the Royal Botanic Gardens at Kew is made up almost entirely of two famous properties, namely, the grounds attached to Kew House, and those that belonged to Richmond Lodge, the latter a favourite residence of George II and Queen Caroline.

The thickly-wooded parts of the present time are situated in that part of the gardens which belongs to the Richmond Lodge, but the first real foundations of the Botanic Gardens were laid in the gardens of Kew House.

In 1730, Frederick, Prince of Wales, obtained a long lease of Kew House and its property, and after his death in 1751 it was managed by his widow, Princess Augusta of Saxe-Gotha, who, about 1757 began systematically the foundation of Botanic Gardens, appointing William Aiton to be in charge.

The first director was the Earl of Bute, the second was Sir Joseph Banks, who accompanied Cook in his first voyage of discovery round the world. Banks and his companion Solander were the first botanists to visit New Zealand. Banks sent out the first Kew collector, F. Masson, to the Cape of Good Hope. The last, R. Oldham, died at Amoy in 1864. Recently, with the aid of grants made by the Empire Marketing Board, several members of the scientific staff of Kew Gardens have visited different parts of the world collecting plants and studying the vegetation. They have also collected in south eastern Asia wild stocks and cultivated races of bananas for experimental purposes in Trinidad.

After the death of Sir J. Banks in 1820, the gardens sank in efficiency and repute. In 1838 a project for abolishing Kew as a scientific institution and transforming it into a kitchen and fruit garden

for the use of the Royal family was entertained by the Government. A committee of enquiry, including Dr. John Lindley, was appointed, and reported that from a National Garden the Government would be able to obtain authentic information on points connected with the founding of new colonies.

The idea was ultimately acted on. W. T. Aiton, son of W. Aiton, was then in charge, and in 1840 Sir William Hooker was appointed Director. At this time only 15 acres were devoted to botanical collections, but a period of remarkable activity began, and the Gardens were opened to the public.

Sir William Hooker died in 1865 and was succeeded by his son Dr. (afterwards Sir) Joseph Hooker. Subsequently the gardens were in charge of Sir David Prain, and the present director, Dr. (now Sir) A. W. Hill.

The Kew Gardens cover 288 acres, all of which is under garden or arboretum. The functions of Kew are briefly set out in the "Official Guide," as (1) The Advancement of Botany or the Study of Plant Life; (2) the introduction of new and valuable plants to the Colonies; (3) a place of public resort; and (4) a school of Horticulture. Some 25,000 species are under cultivation, arranged for the most part in systematic groups. For certain exotic plants there are 19 glasshouses. The following principal divisions of the gardens give an indication of the arrangement—Fernery, Iris garden, Herb garden, Rock garden, Alpine house, Aquatic garden, Bamboo garden, Rhododendron dell, Lily pond, Aroid house, Tropical fern house, Succulent house, Pitcher plant house, Orchid houses, Economic houses, Palm house, Temperate house, Arboretum.

There is an extensive herbarium containing over 2,000,000 specimens, a complete botanical library, four museums of economic botany, a laboratory for physiological research, and a gallery containing 800 paintings of plants by Miss Marianne North.

The staff at Kew includes about 30 in the scientific and executive departments, 150 gardeners, and 40 police. The annual expenditure is about £60,000. The "Kew Bulletin" is regularly issued from the Kew Gardens.

Edinburgh.—In 1670 a small Physic Garden was established at Holyrood by A. Balfour and R. Sibbald. This was the foundation of the Royal Botanic Garden, Edinburgh. At first the garden was stocked with medicinal and other useful plants. Other physic gardens were established and all were placed under the care of James Sutherland, who received a Royal Warrant appointing him Botanist to the King in Scotland. In 1820 the gardens were transferred to Inverleith, the present site. Their present extended development as a centre of horticultural and botanical research and instruction was reached under the keepership of Sir I. B. Balfour (1888-1922).

The Royal Botanic Garden, Edinburgh, is one of the two gardens in the British Isles maintained by the State, the other being Kew. It covers an area of 57 acres, which include an arboretum, herbaceous garden, rock garden, and 17 glass houses for various classes of tropi-

cal and temperate plants. There is a herbarium, museum, library, laboratories, and lecture hall. A free course is given in horticulture and forestry, the students being taught as far as possible practically.

EUROPE.

Paris.—The Jardin des Plantes, an integral part of the National Museum of Natural History, was founded in 1635. It occupies an area of 58 acres on a level plain.

The National Museum of Natural History is organised in 21 departments, of which five are devoted to Botany. In addition there is a botanical gallery in the Museum. The five botanical departments are (1) Phanerogamic Botany and Ferns—a large herbarium with many historic collections; (2) Cryptogamic Botany and plant diseases of vegetable origin; (3) Plant morphology and Palaeobotany; (4) Culture, introduction, and distribution of useful and ornamental species. About 23,000 species of plants are under cultivation in the gardens. This department carries out research work on methods of cultivation, hybridization, and selection. It assisted the introduction of coffee to Martinique and Vanilla to Reunion. (5) Physical Botany —researches in plant physiology.

Berlin.—The Staatlichen Botanischen Garten was founded in 1679 by the Grand Duke in Schoneberg near Berlin. Between 1879 and 1907 it was transferred to its present site at Dahlem under the direction of Dr. A. E. Engler. The main objects of the garden are research in botany and teaching at the Berlin University. The garden, which covers 104 acres, is divided into five main sections—Plant geography, Morphology and ecology, Arboretum, Systematic botany, and Economic plants. There is a botanical museum and herbarium.

ASIA.

Ceylon.—The Royal Botanic Garden is situated at Peradeniya, 3½ miles from Kandy on the Colombo Road. It occupies a loop of the Mahaweliganga, which surrounds it on all sides except the south. The area is 147 acres, and the elevation averages 1,550 feet above sea level.

A plan for a botanic garden in Ceylon was first drawn up by Sir Joseph Banks in 1810. The first site was Slave Island, Colombo, and later a garden was established at Kalatara. This was transferred to the prseent site between 1822 and 1843. Notable advances were made under Dr. G. Gardner, when much collecting was done; H. Trimen, who established a museum of economic botany and began the publication of the "Flora of Ceylon"; and Dr. J. C. Willis, whose activities tended towards economic botany and agriculture and led to the development of the Department of Agriculture in 1912.

The garden comprises an arboretum systematically arranged; sections devoted to palms, conifers, herbaceous plants, water plants, and ferns; an orchid house; and economic and ornamental nurseries. There is a herbarium and a museum.

There are branch gardens at Hakgala, altitude 5,600 feet, originally selected by Thwaites for carrying out experiments with Cinchona, and at Heneratgoda, at sea level, established for the reception of Para rubber plants.

The "Journal of the Royal Botanic Gardens, Peradeniya," is regularly published by the garden.

Java.—The 's Lands Plantentuim or Government Botanic Gardens was founded at Buitenzorg by the Dutch Government in 1817, the work being entrusted to Professor C. G. E. Reinwardt. The present efficient state of the gardens is mainly due to the work of Dr. M. Treub, Director from 1880 to 1909. Not only were the existing institutions, such as the botanic garden proper, herbarium, photographic studio, library, and others enlarged, but, partly with pecuniary assistance from private individuals, a number of new laboratories, experimental stations, and museums were built. Teaching institutions were also added, and a special laboratory reserved for foreign naturalists. Thus the garden became a scientific centre, which, in 1905, was made a division of the Department of Agriculture.

The Government Botanic Gardens directed from Buitenzorg now form an immense establishment comprising three gardens, Buitenzorg, Mt. Gedeh, and Sibolangit on the east coast of Sumatra. The total area includes 350 acres of garden and 3330 of nature reserve; the staff includes about 20 professional officers and 200 native gardeners; the annual expenditure is about £50,000.

At Buitenzorg the gardens cover 205 acres situated 850 feet above sea level, and include about 20,000 species of plants under cultivation. The institutions include the following—herbarium, library, physiological laboratory, laboratory for visiting botanists, museum for systematic botany, phyto-chemical laboratory, zoological museum and laboratory, marine zoological laboratory and aquarium at Batavia. The publications include five periodicals.

The Tjibodas gardens, situated at an altitude of 4,500 feet on Mt. Gedeh, comprise 74 acres of garden, and 2,960 acres of nature reserve reaching to the summit of Mt. Gedeh, 11,000 feet.

The Sibolangit gardens, on the east coast of Sumatra, comprise 50 acres of garden and 370 acres of nature reserve.

India.—The Royal Botanic Gardens are situated at Sibpur near Calcutta, and cover an area of 370 acres all under cultivation. About 1,200 species are cultivated; the staff includes 10 professional officers and 200 native workmen; the annual expenditure is about £7,000.

The Sibpur Garden was established in 1787 under the directorship of Lt.-Col. R. Kyd. In 1864 a cyclone accompanied by a storm wave from the Hooghly practically wrecked the garden and carried two ships into it. Three years later another cyclone completed the ruin. After this the garden was reformed by Sir George King, who treated it for landscape effect. Lakes were excavated and plant houses and a herbarium erected. King's successor, Sir David Prain, sketched out a geographical arrangement which is being carried out as opportunity

offers. The scheme was to treat the garden as a map of the world on Mercator's projection.

The introduction, experimental cultivation, and distribution of economic plants forms a large part of the work of the garden, which has greatly aided the introduction or improvement of tea, cinchona, cotton, jute, hemp, coffee, cocoa, rubber, and indigo.

AUSTRALIA.

Sydney.—The Sydney Botanic Gardens, which are situated on the South side of the harbour, cover an area of 62 acres all under cultivation.

When Port Phillip was settled in 1788 a farm was started at Farm Cove for the use of the Governor and officials, and seeds and plants from England, Rio Janeiro, and the Cape of Good Hope were planted. From this time plants and seeds were received from various parts of the world and planted in the garden, but it was not until 1816 that it was officially declared a public botanic garden and a Superintendent appointed. The explorer and botanist, Allan Cunningham, who collected in New Zealand and wrote a flora as the result of his expedition, was the fourth Director of the Sydney Botanic Gardens.

Within the garden is a herbarium where research work is carried on, a botanical Museum exhibiting timbers and other specimens, especially teratological and ecological, and a library. The plants in the Lower Garden are arranged systematically; in the Upper Garden are orchid houses, green houses, hot houses, bush houses, and a palm house.

The staff includes about 20 professional officers and 60 gardeners; the annual expenditure is about £20,000. Several important works, including the "Forest Flora of New South Wales" and a "Revision of the Genus Eucalyptus," have been issued from the Sydney Gardens.

Melbourne.—The Botanic Gardens at Melbourne were founded in 1846 as the result of a petition signed by over 300 citizens. A systematic arrangement of the plants was undertaken by Baron F. v. Mueller, who also established the National Herbarium. The garden covers an area of 103 acres on the left bank of the Yarra.

Adelaide.—The Adelaide Botanic Garden covers an area of 104 acres and includes about 3000 species of plants. It includes a library and museum of economic botany. A type-fruit orchard is established at Mylor, where there is a wide range of varieties of apples, pears, plums, and peaches under cultivation.

SOUTH AFRICA.

The National Botanic Gardens of South Africa was founded in 1913 for the preservation, cultivation, and study of the South African flora. The Botanical Society of South Africa was founded at the same time, and exists mainly to support the Gardens. The garden is situated at Kirstenbosch on the eastern side of Table Mountain and

extends to the summit of the mountain. The area is 1060 acres and the altitude 300 to 3,500 feet. The lower portion is in course of development as a garden, the upper is a nature reserve and includes evergreen forest, silvertree woodland, and scrub of great interest and beauty.

A herbarium is established on the site of the gardens, and research work is carried out on essential oils. The members of the Botanical Society participate in the distribution of surplus plants and seeds. The annual expenditure on the gardens is about £5,000, of which sum the Botanical Society contributes over £400. Grants are also made by the Government and by the City of Cape Town.

UNITED STATES.

St. Louis.—This is the oldest botanical garden in the United States. It was founded in 1859 by Henry Shaw, and now covers an area of 75 acres garden and 1,500 acres for trees adjacent to the city. Scientific and educational work is carried out in co-operation with the Botany School of St. Louis University.

Boston.—The Arnold Arboretum owes its origin to Mr. James Arnold, who in 1868 left 100,000 dollars for the promotion of agricultural or horticultural improvements. The interest which two of the trustees had in trees determined the use to be made of the fund, and in 1872 part of a farm presented to the Harvard University by B. Bussey was devoted to the purpose and C. S. Sargent appointed Director.

The Arnold Arboretum is a station for the study of trees in their scientific, economic, and cultural requirements. Only woody plants which can be grown out of doors are cultivated. The gardens cover 260 acres, in which over 6,500 species are grown. There are 15 professional and administrative officers and 20 gardeners on the staff, and the annual expenditure is about £21,000.

The economic work of the Arnold Arboretum includes the selective breeding and hybridization of trees; importation, exchange, and distribution of plants and seeds. Many useful plants now extensively grown in the United States were first introduced by the Arnold Arboretum. There is a herbarium, and a library containing 37,000 volumes and 14,000 photographs.

New York.—The New York Botanical Garden was founded in 1891 through the instrumentality of the Torrey Botanical Club. In that year 250 acres in Bronx Park was authorised to be set aside after a fund of not less than 250,000 dollars was raised by public subscription. The area has since been increased to 400 acres, in which over 15,000 species of plants are now grown. The staff numbers about 130, including 20 botanists. The annual expenditure is about £80,000, of which 63 per cent. is provided by the City of New York and the balance is derived from endowments and membership fees.

The work of the garden includes botanical exploration in North America and the West Indies. There is a herbarium comprising over

2,000,000 specimens, a museum, library, and laboratories. Several important publications, including periodicals and the "North American Flora," are issued by the institution.

Brooklyn.—The Brooklyn Botanic Garden was established in 1910. Scientific and educational work in botany is carried out, the research work being mainly experimental genetics, ecology, physiology, and pathology. Popular courses are given for the public, and there is a children's garden and greenhouse. The institution is financed by the City of New York and from private funds. There is a library, open to the public, and a large herbarium. Several publications are issued.

Los Angelos.—What promises to be one of the most important botanical institutions in the United States is the California Botanic Garden established in 1927. Of the 3,200 acres originally donated and purchased in the Santa Monica Mountains, 800 are dedicated to garden and the balance is to be held as an endowment. The garden area extends from 400 to 2,000 feet above sea level.

The garden is planned to cover all fields of plant science, including plant introduction and experimental stations, systematic and regional collections, herbarium to cover the world's floras, research laboratories for the study of botany and genetics, and the publication of popular and technical periodicals.

BOTANIC GARDENS IN NEW ZEALAND.

It now remains to say something about Botanic Gardens in New Zealand, firstly, those already established, and secondly, what course it is advisable to pursue in the future. Many excellent gardens, entirely or mainly controlled by municipal authority, exist in New Zealand. In all cases horticultural considerations are given first place. In two large gardens, however, attempts are being made to exhibit collections of native plants. One is the Dunedin Botanical Gardens, where there is a good display of alpine and other indigenous plants, the other is the Otari Open-Air Native Plant Museum in Wellington, where, under the guidance of Dr. L. Cockayne and Mr. J. G. Mackenzie, native plants are being grouped according to the associations in which they are found in nature.

The earliest garden to be established in New Zealand by Act of Parliament was the Botanic Gardens in Wellington, an area of about thirteen acres on the Karori road being set apart in 1869 for a Botanic Garden, which was placed in charge of the Board of Governors of the New Zealand Institute. Through lack of funds, however, the garden could not be adaquately developed or even kept in order. Since 1891 it has been vested in the corporation of the City of Wellington and is now one of the finest sights of the city and of great horticultural interest. A few years ago on the suggestion of Mr. J. G. Mackenzie, Director of Parks and Reserves, Wellington, the forest reserve at Wilton's Bush was set aside as a garden for the establishment of native plant associations and renamed the Otari Open-Air Native Plant Museum. Considerable progress has been made since

Botanic Gardens, Dunedin. *Ranunculus Lyalii in flower.* [Photo. by kind permission of the Director.

then, and provided the original scheme is adhered to and sufficient funds are available a really valuable display of great scientific interest should result.

The only botanical garden in New Zealand at present partly under Government control is the Christchurch Botanical Garden. Hagley Park was made a Public Domain in 1872, and in 1904 provision was made for a controlling Board of thirteen persons, of which four are appointed by the Governor-General. There is a fine horticultural display in the Christchurch gardens and a section devoted to native plants, but in this collection only a small proportion of the indigenous species are represented.

In the Dunedin Botanical Gardens, which are entirely under Municipal control, there is, besides a general exhibit, an excellent collection, systematically arranged, of indigenous plants. This is the most successful attempt yet made in a public garden in New Zealand to gather together a named collection of native plants. In 1878 the Dunedin Botanical Gardens were brought under the Public Domains Act of 1860 and placed under the control of a board of seven members. This system was abolished in 1884, when the gardens were vested in the Dunedin City Council.

The question as to what should in the future be aimed at as regards a National Botanic Garden in New Zealand may now be considered. Quite aside from the work of plant breeding and research carried on by the Department of Agriculture, and the upkeep of gardens maintained by the various municipal authorities, there is the question of maintaining a properly representative, named, and classified collection of plants, both exotic and indigenous. That is to say, just as a Museum is considered worth maintaining for its educational value so should also a collection of living plants be considered a necessary part of the educational institutions of the Dominion. Here alone is sufficient reason for the establishment of a National Botanic Garden quite independent of any municipal gardens. But in addition to the display of a collection of living plants a botanical garden would perform other useful functions, for instance, the exploration of the native flora, the introduction to horticultural use of both native and exotic plants, and generally investigations into all phases of plant life, including genetics, ecology, taxonomy, propagation, and useful properties. Another useful service that a botanical garden should perform is the distribution and exchange of surplus plants and seeds. I do not mean that the gardens should come into competition with nurserymen, on the contrary it should assist them as has been the case with the transference of useful plants performed by Kew, and the importations of the Nelson Rock Garden Society.

The site for a National Botanic Garden must of course be considered, and there may be differences of opinion. Accordingly I give only my own personal opinion that it should be within easy reach of Wellington. Only one site appeals to me as being suitable, and that is the area west of Tinakori Hill on either side of the road between Wadestown and Karori and including Wilton's Bush. Here is a piece

of native forest close to the city, and one which is, as the Otari Open-Air Native Plant Museum, in process of being developed as an exhibition of indigenous plants, while on the opposite side of the road is an area suitable for a collection of exotic plants. To find another piece of native bush one would have to go so far from the city that a Botanic Garden would lose much of its value on account of the time taken to reach it.

Finally must be considered the maintainance of a National Botanic Garden, for the solution of this ensures the success of the whole project. Though the Government should contribute perhaps the main share it should not be expected to stand the whole cost. From two other sources help should come, namely from the city and the people.

Most important I consider for the establishment of a National Botanic Garden in New Zealand will be the interest shown by the people themselves. There are two practical forms which this might take. The first is in donations, and as a precedent for this I might mention the case of the New York Botanic Gardens. Before the city granted a section of Bronx Park it stipulated that the public should raise not less than 250,000 dollars. This, of course, was done and the gardens started. The other method by which the public might help is by the formation of a Botanical Society which might make annual contributions, as does the South African Botanical Society, besides forming a permanent council to maintain an interest in the gardens and no doubt supply members to the controlling board. I believe the time has arrived when an active botanical society could be formed in New Zealand, one which besides research into the flora could interest itself in the maintainance of a National Botanic Garden. Besides the ordinary privileges of kindred societies, namely, regular meetings, use of library, and publication of a journal, members would have the extra advantage of receiving surplus plants and seeds for their own use. Founded with these objects in view a botanical society should have a large number of members in New Zealand. In fact a society with only one of the objects just mentioned, namely, the importation and distribution of plants and seeds was formed in New Zealand and proved a phenomenal success. I refer to the Nelson Rock Garden Society, whose enthusiastic secretary, Mr. A. Wilkinson, was responsible for the importation into New Zealand of a great many ornamental plants now found in our gardens.

FARM FORESTRY.

By Norman Hall.

(*Concluded*).

FINANCIAL AND ECONOMIC CONSIDERATIONS.

The scope of this article excludes a detailed account of all the financial and economic questions involved in growing timber, but a few of the more outstanding facts may be indicated. First of all we can accept the fact that the world is consuming timber at an appreciably faster rate than it is growing timber; hence the timber resources of the world are being depleted, while the civilized population of the world is increasing, and consequently the demand for timber. This applies especially to coniferous timber, which is the main class used. At present Canada and the United States of America are two of the chief locations of extensive coniferous supplies, but even there the rate of cutting and other causes of forest depletion are estimated to exceed the increment; and there is no surer fact than that there will be a shortage of mature milling timber in those countries, between the time when the present mature stands are cut out and the time when regrowth and plantations become ripe for cutting. Even European countries which have practised scientific forestry for long periods are unable to cope with their demands.

Here, then, is New Zealand's opportunity, for we appear to have conditions eminently suited to growing timber in a shorter time than is required in the Northern Hemisphere. Much has been said of the phenomenal rate of growth of trees in New Zealand; but the statements have not always been based on sound methods of comparison. For instance it is not sound to compare the rate of growth of *P. radiata* in New Zealand with that of Fir in Germany. A study of the latest British Yield Tables will indicate that Douglas Fir does not grow appreciably faster here than it does in the British Isles; indeed the rate of diameter growth in the latter place is considered by some as being rather faster than is conducive to the production of high grade lumber. In general the rotation for conifers in New Zealand may be placed as one-half to three-quarters of the period of time for the species used in the Northern Hemisphere, but this excludes *P. radiata* and many of the Eucalypts.

Within certain limits an increase in the rate of diameter growth in hardwoods does not appreciably affect the strength of the wood, whereas with conifers when the diameter growth exceeds a certain rate the strength of the wood falls rapidly. One advanatge of proper tending in plantations is the ability to regulate, within certain limits, the rate of diameter increment.

People who do not know any better frequently put forward the argument that due to scientific development, substitutes will be found for wood, so that the demand for wood will fall considerably. This

argument, while taken seriously by many people, can be disproved by actual statistics. While the use of reinforced concrete for buildings has lessened the demand for timber in one class, it has actually created a huge market for the cheaper grades. For the Princes Wharf, Auckland, no less than 1,500,000 super feet of *P. radiata* were used for casing. The consumption of pulpwood has grown to immense dimensions and the indications are that the demand is likely to exceed the supply in many cases. The planting of fast-growing species on a short rotation for pulpwood is undoubtedly a sound financial proposition. People who have been farming for a number of years know, without figures being quoted, the increasing price of good-grade fencing-posts, especially Totara.

THE ECONOMIC POSITION OF SMALL PLANTATION AND WOODLOT OWNERS.

Timber is essentially a bulky product, and transportation is a very heavy item in the cost of production. This is one of the main advantages that small, centrally situated plantations have over large areas remote from profitable local markets. Thus small plantations may be as profitable, comparatively speaking, as some of the huge areas of a hundred thousand acres or so which are situated on the central volcanic plateau of the North Island. When a small plantation is situated close to centres of population the owner has the advantage of cheap marketing and hence one of the most important factors in the profitable utilisation of his forest products. He can thin his area at the right time for the remaining trees, and even show a profit on the transaction. In England the growing of European larch on good sites may be so profitable when there are good local markets for thinnings that the returns from these may pay for the cost of the plantation, and so leave the final crop free of charges of production. In Germany it has been shown that the small communal forest may be as profitable or even more so than the large areas which appear to have outstanding economies in administration and protection costs. However, some of these economies of large scale production may be counterbalanced by various drawbacks in regard to thinning and the profitable utilisation of small material. Certainly establishment operations in small areas may be more costly than is the case with large areas, but on the other hand we must remember that the farmer often plants a small area during the winter when other farm operations are more or less slack, and by spreading the establishment over a convenient number of years he can make his plantation at what is really a nominal cost. Again, in the matter of protection the large concern must have special fire rangers, lookouts, and so on, but the farmer with a small plantation surrounded by farm land may not incur any extra costs other than perhaps ploughing a narrow strip around the edge.

It has been pointed out that probably the biggest single factor in the successful creation of a plantation is the correct choice of species and method of establishment. Here the big concern has a definite

advantage over anyone else, since it can afford to engage the services of a professional forester; but the small owner can usually secure advice as to starting his plantation. This particular topic has been dealt with more fully in the first article.

Some of the economic advantages a farmer has in establishing his own woodlot have been dealt with. The species for such woodlot will be selected in accordance with the probable demand for timber on the farm or in the local markets. Firewood, fencing-posts, strainers, droppers, and stays will be needed in nearly all cases, but there will also be other demands. All practical farmers will be aware of the costs of buying fencing material, and no elaboration of the financial advantage of growing one's own supplies is needed here. Many farmers are unaware of the advantage of subjecting wood not naturally durable to some form of preservative treatment before use. In this way even species such as *P. radiata* can be made sufficiently durable for use as posts. The process is simple and relatively inexpensive compared with the advantages which are secured. Farmers desirous of details of treatment should write to the State Forest Service, Wellington. They issue the following two free publications: Circular No. 19, " Preservative Treatment of Fencing Posts "; Leaflet No. 5, " Preservative Treatment of Fencing Posts."

Moderate-sized plantations belonging to farmers and local bodies situated within easy haulage distance of centres of population are in a strong position for marketing at a profit if the correct choice of species is made and the probable demands studied. No hard and fast rules can be laid down for any particular case, but a local study must be made for each case on its own merits. As specific examples, species suited for making fruit-cases may be grown in a fruit-growing district, and mine-props in another area, while good firewood close to suburban areas yearly becomes more valuable.

COSTS OF GROWING TIMBER.

Before establishing plantations of any size the farmer or local body concerned usually desires some idea of what the cost will be. There are two points of view when considering this problem; the first is the case of quite small plantations and woodlots established to profitably use up otherwise waste land already owned by the farmer, and the second is the case when we consider it purely as an investment to be compared with investments in other lines of business. In the first case it is quite legitimate to ignore compound-interest charges; but in the second case, since forestry is being considered as an investment like any other business, compound-interest charges must be considered because of the long time-interval involved between outlay and the final income. Otherwise we would not have an equitable basis upon which to compare the relative returns on investments.

For the farm woodlot or small plantation the cost of establishment is the chief outlay; indeed, it may be the only one, since protection and administration may be nil, and the cost of land can be ignored if the trees are put in areas otherwise showing no return. It is not

possible to go into details of costs, but the following remarks taken in conjunction with the tables will give some indication of the likely cost for a case conforming to a general type. The costs of nursery plants are based on standard rates per 1000 plants as quoted by large private nurseries for 1930. When dealing with large numbers, especially if the farmer grows his own stock, the rates will be substantially lower.

To determine the cost of establishing an acre of plantation take from Table I the cost of the trees according to spacing and species, from Table II the cost of planting, and from Table III the cost of clearing the land preparatory to planting. The resultant figure will not indicate the cost of clearing around the young plants after planting, if this be necessary, and which will probably vary from practically nothing to 20/- or more per acre. For complete establishment the cost of blanking the plantation in the second year must be included. This latter factor is so variable that no range of cost is given, but under careful planting conditions the cost should not be great, if it is incurred.

Let us take three typical examples of cases likely to occur on a farm.

CASE I.—*P. radiata* seedlings, to be planted 8′ by 8′, on almost cleared ground.

	£	s.	d.
Table I, Nursery stock	0	18	$7\frac{3}{4}$
,, II, Cost of preparing land	0	5	0
,, III, Cost of planting	0	10	0
Total cost per acre.....	£1	13	$7\frac{3}{4}$

CASE II.—*C. macrocarpa* "trayed" seedlings (or some Eucalypt), to be planted 6′ by 6′, on land requiring some clearing before planting.

	£	s.	d.
Table I, Nursery stock	3	0	6
,, II, Cost of preparing land	1	0	0
,, III, Cost of planting	1	15	6
Total cost per acre.....	£5	16	0

CASE III.—*C. Lawsoniana,* to be spaced 6′, for a shelter belt on land requiring ploughing previous to planting, allowing for a strip ploughed 4′ wide.

	£	s.	d.
Table I, Nursery stock (3-year-old transplants to be used; smaller plants would be much cheaper)	3	19	4
,, II, Cost of preparing land	0	15	0
,, III, Cost of planting	1	5	4
Total cost per mile.....	£5	19	8

Table I.

Costs of Plants.

	Type of stock.	4′ by 4′ or 2720 p. acre.	6′ by 6′ or 1210 p. acre.	8′ by 8′ or 680 p. acre.	Per mile spaced 4′.	Per mile spaced 6′.	Per mile spaced 8′.	Cost per 100 plants.	Cost per 1000 plants.
P. radiata	.... S		33/3	18/7½		24/1¼	18/1	4/6	27/6
	2T		90/9	51/-		66/-	49/6	9/-	75/-
P. ponderosa	.... 2T		121/-			88/-		10/-	85/-
C. macrocarpa	.... S	136/-	60/6	34/-		44/-	33/-	6/-	50/-
	tray	217/6	97/-			70/-	53/-	9/-	80/-
	2T	238/6	116/-			84/-	63/-	11/6	95/-
C. Lawsoniana	.... 2T				119/-	79/4	59/6	10/-	90/-
	3T				138/6	92/4	69/3	14/-	120/-
P. Douglasii	.... S	136/-	60/6	34/-	66/-	44/-	33/-	6/-	50/-
	2T	231/-	121/-	57/10	132/-	88/-	66/-	10/-	85/-
S. sempervirens	.... S		48/6	27/-	52/-	35/-	26/-	5/-	40/-
	2T		121/-	57/-		88/-	66/-	10/-	85/-
Poplars	rooted cuttings						158/-	24/-	
	bare cuttings						69/-	12/-	
Eucalypts	Open-rooted		48/6	27/-	52/-	35/-	26/-	5/6	40/-
	Trayed		85/-	47/6	92/-	61/6	46/-	8/-	70/-

S—One-year-old seedlings.
2T—Two-year-old transplants.
3T—Three-year-old transplants.
Costs based on quoted rates per 1000.

The various spacings for which costs have been filled in are those most likely to be used for the respective species. A spacing 4′ by 4′ will only be used in special cases, while a spacing 8′ by 8′ will be most common, especially with rapid-growing species. If a farmer is thinking of planting poplar extensively it is cheaper for him to plant say 100 cuttings and grow them until he can propagate his requirements from them.

Table II.

Cost of Clearing Land per Acre.

I. Land covered by short vegetation needing but little clearing, or which can be burnt clean .... up to 5/-
II. Land covered by fern or light teatree which needs some lines cut in it and cleaning up .... up to 20/-
III. Land covered by fairly heavy teatree, scrub, or gorse which needs cutting before burning, if it is to be burnt .... up to 40/-

These values will vary greatly with the distance apart of planting lines and nature of the topography. In the case of shelter-belts in grass paddocks the cost of ploughing will be considered, plus the cost of fencing-off from animals.

Table III.

Cost of Planting.

Spacing.	Nos. per acre.	Rate per acre. Minimum.	Maximum.
4′ by 4′	2720	40/-	80/-
6′ by 6′	1210	17/9	35/6
8′ by 8′	680	10/-	20/-
	Nos. per mile.	Rate per acre.	
4′	1320	19/-	38/-
6′	880	12/8	25/4
8′	660	9/6	19/-

The minimum price per acre or mile will be for small, easily handled plants such as seedling *P. radiata,* while the maximum will be for "trayed" plants or large plants such as 3-yr.-old *C. Lawsoniana.* Plants such as 2-yr. Redwood or Douglas Fir may be reckoned as a quarter to a third more expensive than seedling *P. radiata.* Wages are reckoned at the rate of 2/- per hour or 16/- per day.

The preceding account has dealt more especially with woodlots and shelter belts etc. With the cost of plantations we have more factors to consider, and we must also allow compound interest on the capital charges involved. For the sake of simplicity a rate of 5% will be used.

Land.—Land on which moderately large plantations are established must not be unduly expensive, but where the area is particularly favourably situated in regard to markets the use of more expensive land is justified. Hiley of the Imperial Forest Institute at Oxford has shown that good land at £20 per acre may give a better financial return than poor land free of cost. When a farmer owns 2000 acres of land of an average value of £15 per acre, but of which 200 acres are unsuited to farming, then it is not reasonable to charge the forest enterprise with the capital charge of £15 per acre; in this case a charge to forestry of £5 per acre might be reasonable, if the land is considered to be one-third, or less, as productive per acre as the more fertile land. Only in special cases is it wise to use land for forestry of which the cost is over £5 to £10 per acre. Eucalypts can be most profitably grown on fairly good land, even if the cost of the land is much in excess of the cost of poorer land. Some species are much more sensitive to the quality of the land than others.

Preparing planting area.—This has been dealt with and has been indicated as probably varying from practically nothing up to £1 per acre or more.

Cost of Plants.—When the trees are spaced 6′ by 6′ or 8′ by 8′ and the forester grows his own trees, the cost of stock should not exceed £1 per acre. With trayed Eucalypts the cost would be appreciably greater.

Cost of Planting.—This has also been dealt with, but it may be indicated that with large areas, and having the same men planting over an extended period, the cost tends to drop slightly.

Cost of Blanking and Cleaning Young Plantations.—This has been referred to as an extremely variable factor. It is sound forestry to spend a little more time and money on the first planting, if by doing so more time and money on blanking can be saved.

Annual Cost of Protection.—This includes maintenance of fire-breaks, possibly fire patrols in summer, and so on. It is an extremely variable factor in small scale operations, and much depends on the relation of the plantation to adjacent areas. The cost may vary from practically nothing up to 2/- or more per acre.

Cost of Administration.—For the farmer this cost will probably not be considered, but must be taken into account in local-body and corporation forests. In any case the cost should not exceed about 1/- per acre.

Table IV.

To show the cost of afforestation, including compound interest at the rate of 5% on the sums expended.

Year.	A. Showing amount to which a capital of £1 accumulates at compound interest. £ s. d.	B. Showing amount to which an annual outlay of 5/- will accumulate. £ s. d.
1	1 1 0	0 5 0
2	1 2 0½	0 10 3
3	1 3 1¾	0 15 9
4	1 4 3¾	1 1 6½
5	1 5 6¼	1 7 8
6	1 6 9¾	1 14 0
7	1 8 1¾	2 0 8½
8	1 9 6½	2 7 9
9	1 11 0½	2 15 1½
10	1 12 6½	3 2 10½
15	2 1 6½	5 7 10½
20	2 13 3¾	8 5 3¾
30	4 6 5¼	16 12 2½
40	7 0 0½	30 4 0

With rapidly growing species such as *P. radiata* or well selected Eucalypts favourably situated with regard to the markets, returns should commence by the fifteenth year, so that the cost of maintenance will be covered and possibly the total cost of the plantation wiped out. Much depends on the value of the thinnings.

RETURNS FROM GROWING TIMBER.

Concerning the immediate costs of growing trees it is possible to give reasonably close approximations, since we are dealing with outlays of the present more particularly, though the future may be involved when we consider maintenance costs. When we come to returns from timber in the future it is quite impossible to be dogmatic, since we are dealing with values it is impossible to prognosticate. But we are able to say with some certainty that prices are likely to

be higher in the future than they have been in the past, because of the world-wide situation in regard to future supplies generally. A study of timber prices over a long period of time shows that, ignoring transient factors, timber prices have tended to rise by as much as 1% per annum.

Concerning actual returns from *P. radiata* the reader is referred to Circular No. 3 of the New Zealand State Forest Service entitled "The Insignis Pine," i.e., *P. radiata.* On page 8 we have the reference, "The stumpage paid per acre of plantation felled amounts to £155/14/10 at 1/6 per 100 super feet." This is a very low royalty, but it is offset to a certain extent by a very high volume per acre, being 28,842 cubic feet under bark for all wood over 9" diameter. The age was 46 years. Concerning this particular area the yield per acre is given as:

Age.	Av. ht. in ft.	Volume inside bark to 9" D.O.B., cu. ft.	Board-feet volume inside bark to 9" D.O.B.
10	52.5	1,000	7,200
15	82	5,150	37,080
20	110	9,250	66,600
25	128	14,200	103,240
30	137.5	19,500	140,400
35	142	23,700	170,640

In converting to board-feet measurement one cubic foot is taken to produce 7.2 board feet.

The volumes for other species will be much less, though some of the Eucalypts under careful management may show somewhat comparable returns for short rotations. With these species the value per unit of wood should be greater. As yet it is not possible to give specific returns for most of the exotic conifers in N.Z. Provisional returns for Douglas Fir in England are as follows:

Douglas Fir. Best-quality Class.

Age.	Mean ht. in ft.	Vol. under bark in cu. ft. per acre.
10	24	—
20	53	2840
30	78	5100
40	95	6630
50	110	8000

GYMNOSPERMS OR "SOFTWOODS." FAMILY PINACEAE.

P. canariensis.—The wood of this pine is both strong and durable, and few other members of the genus produce an equally valuable timber. The wood is especially valuable for construction.

It has been planted in South Australia and South Africa, but only specimen trees occur in N.Z., mainly in the Northern districts. It grows to a large size, and has a tall, erect habit. Unfortunately it is one of the most difficult pines to transplant, since the seedlings do not readily develop fibrous roots, and the greatest care is needed in transplanting. Because of the loss resultant in using bare-rooted stock

in transplanting, establishment is usually carried out by planting in bamboo tubes or small paper pots, and attempts have been made at "spot seeding," i.e., sowing the seed *in situ*. This species withstands both drought and heat, but is not considered suitable for the coldest parts of N.Z. It will grow on a wide range of soils, provided that they are well drained.

Because of the valuable wood of *P. canariensis*, especially when compared with some of the more common species of Pinus, it is likely to yield good returns when properly grown. The tree grows at a moderate rate, but naturally does not mature as rapidly as *P. radiata*.

P. radiata (D. Don).—There is still a certain amount of confusion regarding the nomenclature of this pine. The name *P. insignis* is a synonym, but does not take priority over *P. radiata* in botanical nomenclature. The vernacular names include "Monterey Pine," "Remarkable Pine," and also "Insignis Pine." This tree will grow 4-5′ in height annually, and ultimately attain a height of 100 to 150′. Early diameter growth is also very fast, and in open growth trees will grow 1-1½″ annually for many years. Well grown timber is strong, and useful for crating, fruit boxes, and concrete boxing, and it is gradually being recognized as eminently suited for housing, and even utility furniture. When exposed to the weather it should be painted. In the past, due to the milling of coarse, rapid-grown trees from shelter belts and so on, the timber of *P. radiata* had been considered of little value, but when grown in plantations and carefully milled the wood is of better quality than is generally recognized, and has a wide range of usefulness.

P. radiata is one of the easiest trees to transplant, and one-year-old seedlings are most suitable for plantation use, except in the more severe districts of the South Island, where two-year-old transplants may be used. This type of plant may also be used amongst rank vegetation such as tall bracken fern, and for shelter belts where the plants can be given an especially careful handling.

A suitable arrangement for shelter belts are trees spaced 12-16′ apart in single rows. The exact spacing varies with the type of belt needed. In plantations the spacing varies in accordance with the possibility of pruning and thinning. When early thinning is not possible or desired the spacing should be about 8′ by 8′ but not over 9′ by 9′, while when early thinning is possible the spacing may be 6′ by 6′.

P. Pinaster (synonym *P. maritima*).—This is the pine which has been so extensively planted in sand-dune-reclamation work in France. It has also been used for plantation work in South Africa and Australia, but only to a limited extent in New Zealand. It is especially suited for planting in sandy soils near the sea coast. This tree has many varieties, and great care should be taken in seeing that good types are planted, as many of the trees in the Auckland Province are of a poor type. The best types are tall, erect trees of moderately fast growth, and I have seen this type on clay land 100′ high and 30″ diameter.

The timber is somewhat coarse and only of moderate strength, but has a wide sphere of usefulness, including sleepers, if previously treated. It is also used for pit-props, and makes a satisfactory fuel, while in parts of the Auckland Province it is preferred to *P. radiata* for fruit-cases.

The tree will stand somewhat more frost than *P. radiata,* but does best in a temperate climate. It will grow on a wide range of soils, but does best on light soils such as a sandy loam. Some types, especially the poorer ones, are inclined to develop rather strong lateral branches, and it is probably best to plant it fairly close, i.e. 6′ by 6′ or not more than 7′ by 7′, and follow by sufficiently heavy thinnings when required. Carefully handled, one-year-old, bare-rooted seedlings can be readily transplanted. While not so rapid a grower as *P. radiata* the better types of trees grow well, and under reasonably suitable conditions may be expected to grow 2′ 6″-3′ in height and $\frac{1}{2}$-$\frac{3}{4}$″ in diameter annually, in well thinned plantations.

P. Laricio (Corsican Pine).—This species is mainly recommended for such purposes as shelter-belts in exposed situations, and not for plantation use by the small private owner, for whom there are many more suitable species. Heartwood development is very slow in this pine.

It is quite a hardy tree so far as N.Z. conditions are concerned. It requires somewhat careful planting, and for shelter-belts 2- or even 3-year-old transplants are recommended. Growth is somewhat slow, height increment averaging not much over 24″ per annum, except in particularly favourable localities. It is not recommended for localities where *P. radiata* will make thrifty growth.

P. muricata (Prickly-cone Pine).—*P. muricata* is suitable for shelter in saline localities, and, while not so rapid in growth as *P. radiata,* produces shelter in a relatively short time. For permanent shelter-belts it is probably better than *P. radiata.* It has moderately dense foliage, and is sufficiently hardy for most localities in N.Z., and will thrive on a wide range of soils. Usually it does not attain to such large sizes as *P. radiata,* and may be considered well grown when 80′ high and 2′ in diameter. The wood is only of moderate grade, but is an excellent fuel. Unless special circumstances indicate its use there is usually no advantage in growing it in plantations where *P. radiata* can be successfully grown. It is very important to see that the best type of tree is grown.

P. ponderosa (Western Yellow Pine).—This species is recommended for shelter on very cold "frost flats" where *P. radiata* will not grow. It is very susceptible to damage by hares and rabbits. The planter must be warned that growth is very slow at first, and little shelter can be expected until the trees are about ten years old. It is also suited for planting on "frost flats" in plantations of other species. As indicated it is very hardy, and well wrenched two- or even three-year-old transplants are amongst the easiest plants to establish.

Well grown timber is of good quality, and is widely used in North America.

P. Strobus (Weymouth Pine, or White Pine of eastern North America).—In its native habitat the wood of this species is regarded as one of the highest grades of lumber available, but the best of the original stands have long since been cut. The wood is light in weight and in colour, somewhat soft, and works particularly well. It is not durable in the ground.

It should only be grown on fairly good, sandy, porous loams in areas of moderate rainfall, and preferably not exposed to strong prevailing winds. Rate of growth is intermediate, i.e. average height-increment per year is about 24-30". It should be planted fairly close in order to kill the lower lateral branches and to regulate the diameter growth, in order to ensure a good-growth grade of lumber. It will withstand moderate and even fairly heavy shade, and may be of use in underplanting. The young plants in the nursery are of very slow early growth, and three-year-old transplants are recommended. The species may be a profitable one to grow, since it will produce a different class of lumber than most of the species now being planted; however, it is rather too slow in growth. It is not recommended for extensive planting, and in any case the quality of the planting area should be carefully ascertained before commencing operations.

Pseudotsuga Douglasii (also known as *P. taxifolia.* Common name, Douglas Fir, and, of the timber, Oregon).—This species comes from the coastal belts of western North America. It thrives best in an area of fairly high rainfall, and on fresh, porous, and moderately deep soils. It is of moderate height-growth by N.Z. standards, growing in height 20-30" annually, once past the period of establishment. It is an ornamental tree, and well adapted to shelter-belts except in very exposed sites, as the numerous lateral branches covered with dense foliage keep alive close to the ground to an advanced age.

The wood of the native-grown trees has an excellent reputation as a general-utility and constructional timber, but care needs to be taken in N.Z., as there are indications that the wood of young, rapidly grown trees is lacking in quality. However, when grown in close spaced plantations and with fairly long rotations—say over sixty years—the quality should be moderately good. Spacing should be about 6' by 6' and not much greater, as the lateral branches are very persistent, even after their death. It is adapted to planting on the sides of plantations, and possibly for underplanting under light cover as the young plants will thrive in light shade.

Douglas Fir is moderately frost-hardy and transplants reasonably well. Two-year-old transplants are the most suitable type of stock to use.

Sequoia sempervirens (Redwood).—This species is a native of California, where in the mature forests it produces a very heavy stand of durable and valuable timber. Growth generally is very rapid, and Redwood is likely to produce a volume quite comparable with *P. radiata,* though it should be grown on a longer rotation to maintain

the quality of the wood. While the locally-grown wood is not of the same high quality as the slowly grown wood in native stands, it is still valuable and adapted to a multitude of purposes where strength is not essential. Redwood is undoubtedly a species to be considered in afforestation in N.Z., but is of less importance for timber production on the farm, though it can be used for shelter and is also a very ornamental tree.

It is wind-firm and healthy, and will withstand moderate frost. It is more particular regarding soil moisture than other soil properties. The drainage must be good, and the soil fresh, with the soil moisture reasonably constant throughout the year. It will endure appreciable shade, and may be planted under light-foliaged species and under native scrub. In fact during early youth the young plants actually thrive better under moderate shade than in the open.

It transplants reasonably well, and though one-year seedlings may be used it is usually better to use two-year transplants when only small numbers are being dealt with.

Cupressus macrocarpa (Macrocarpa).—This tree is too well known to require a lengthy description. Its chief disadvantage is that it has a spreading habit, and when used as a hedge it covers a wide spread of land in maturity; but where it can be trimmed, as in short belts protecting farm buildings, it has few rivals. It has dark, dense foliage, and readily retains its branches down to the ground level. It grows fairly well under a moderately wide range of conditions, but does best on well drained soils and in seaboard areas. It needs special care in transplanting, and this is probably one reason why it has not been more extensively used in plantations. For small areas the farmer is recommended to use "trayed" stock.

The tree matures heartwood early, and is sufficiently durable for fencing-posts. It makes an excellent fuel, and there are few conifers more suitable for general farm purposes, but its branchy habit is a drawback. When planted for shelter it may be spaced 12-16′ apart, according to the type of hedge, but in the plantation it should be closely spaced, say not over 6′ by 6′, while if early thinning is possible 4′ by 4′ is not too close. This is essentially a species in which close spacing and subsequent pruning of dead laterals should give good results.

C. Lawsoniana (Lawson Cypress).—For medium shelter this is probably the ideal tree, as it is of very dense growth and retains its bottom branches better than any of the other species listed. It has an ornamental form, and is equally suitable for trimmed hedges near buildings as for larger shelter-belts on the farm. It is also eminently adapted for planting on the edge of plantations of more open-grown species.

It is only of a moderate rate of growth, but responds well to cultivation and manuring if used in shelter-belts. It is somewhat particular regarding soil conditions, and for good growth requires a moderately good, fresh, but well drained soil. It should not be planted in badly

drained soils, especially if the soil be heavy. Splendid shelter-belts can be seen in many parts of the Waikato.

The wood is light, soft, easily worked, and durable. Commercially it is known as Port Orford Cedar.

Cupressus lusitanica var. Benthami (Bentham's Cypress).—This is a cypress of moderate rate of growth which is being increasingly used for shelter-belts in N.Z. It possesses many of the general properties of the Macrocarpa, and is recommended for clay soils where *C. Lawsoniana* does not thrive so well. It may be planted in single rows with 8′ between adjacent trees, according to the type of shelter desired.

Cryptomeria japonica (Japanese Cedar).—This species is hardy and healthy in most parts of N.Z. It is of rather slow early growth, but retains its lower branches fairly well and makes good shelter in time. It is also quite an ornamental tree. The tree comes from Japan, and there the wood is considered quite valuable, being durable and of moderate strength and weight. Its value as a timber tree in N.Z. is doubtful.

DICOTYLEDONS OR "HARDWOODS." FAMILY SALICACEAE.

Populus nigra var. *italica* (also known as *P. fastigiata.* Common name, Lombardy Poplar).—This is possibly the most common Poplar in N.Z. It is sufficiently well known to need but little description. It is suited for shelter-belts and for ornamental planting, but the wood is coarse and of little if any value. It is readily grown from cuttings, and will grow on a wide range of soils, preferably where the soil is fresh or moist, but not where stagnant water occurs.

P. serotina (Hybrid Cottonwood or Black Italian Poplar).—This is one of the most hardy Poplars. It is of straight growth, and will grow on a wide range of soils, but should not be planted on shallow soils where drought might be experienced. The timber is reputed to be suited to a number of purposes. The tree is compact in form, but yet aspiring. It may be propagated from cuttings and suckers, while stumps of felled trees coppice well. It is of a moderate rate of growth, and attains to large dimensions, on suitable soils, growing to 100′ in height and 3′ in diameter.

There are several other species of Poplars which may be planted in N.Z., such as *P. regenerata, P. robusta, P. eugenei,* etc. When planting Poplars extensively, the advice of the State Forest Service for any particular district should be sought.

FAMILY LEGUMINOSAE.

Acacia baileyana.—Of moderate size only. It is a quick-growing ornamental tree with rather spreading branches; bluish-grey, feathery foliage; and yellow blossoms in early spring; hardy to drought, but only moderately frost resistant. Quite suitable for low shelter-belts near orchards, farm buildings, and so on; but, like most wattles, it is of more value as a temporary shelter for 8-10 years than as a permanent windbreak.

A. decurrens var. *mollis* (*A. mollissima* or Black Wattle).—This is fairly widely grown in New Zealand, but of late it has been attacked by a gall-fungus in many districts. It is a valuable quick-temporary shelter, for production of tan-bark, for fuel, and for fence-posts of only moderate durability.

For quick shelter it may be planted in double rows with the trees spaced 4′ each way. A spacing of 4-6′ is suitable for plantations for fuel-production. When closely spaced this species yields a large return of excellent fuel in 6-8 years, but if used for posts the trees should be at least 10-12 years of age.

It will grow on a wide range of soils, but prefers moderately fertile loams in localities where frosts are not too severe. Does not readily transplant, and is most satisfactorily grown from seed sown *in situ*. If planted it should be in tubes or from "trayed" stock.

A. melanoxylon (Blackwood).—This wattle is to be seen in many parts of New Zealand. It is only of moderate rate of growth, but produces a valuable timber of good quality suited for a wide range of purposes.

FAMILY MYRTACEAE.

Eucalyptus botryoides.—This is a rapidly-growing, valuable species suited to most of the districts of the North Island and to the milder parts of the South Island. It will withstand moderately severe frosts, and under favourable conditions can be transplanted bare-rooted. It is fast-growing, and the best types have a good form, though inclined to branch in open situations. On moderately good soils it is adapted to fairly extensive plantations.

The timber from well grown, mature trees is very valuable. It is hard, heavy, and very durable. It is a tree to be recommended for both farm and plantation.

E. diversicolor.—In its native home of Western Australia this tree is one of the most valuable species. Commercially it is known as Karri, and the wood is of use for all purposes except where natural durability is needed. It is in demand for all sorts of constructional purposes, besides for other uses. The mature wood is red, interlocked in grain, strong, but not durable. Due to the fact that the species gives indications that it will rapidly grow to large straight trees in New Zealand, it should be a profitable tree to grow, though intending planters should be warned that as yet nothing is known of the locally grown timber.

It is only adapted to the milder parts of New Zealand, such as North Auckland and the Bay of Plenty. Simmonds says of it, "The conditions that it appears to demand at our hands are good land, abundant moisture, efficient protection against violent winds, and a mild temperature." It is of moderately rapid height-growth and good diameter-growth, and so far as I know it is quite healthy here.

E. eugenioides.—This Eucalypt comes from the cooler areas of New South Wales and Queensland, and its range extends into Victoria. It thrives best in moderately cool localities, where only light

falls of snow occur and frosts are not too severe. Growth is best on moderately good loams with a free subsoil, and it should not be tried on heavy, tight, wet soils. Unfortunately this species is rather difficult to transplant, and "trayed" seedlings will give the best results.

The mature wood is pale and freely fissile, and though hard it is readily worked. It is one of the most durable of the Eucalypts. The durability of locally-grown wood has been proven. The tree is of rather slow growth for a Eucalypt, but will make poles in 20 years on good soils. To produce saw-timber takes much longer than many other species of the genus. It is essentially a tree for good localities, and needs plenty of space and careful tending to give good results.

E. fastigiata.—This Eucalypt is one of the fastest-growing members of the genus that we have in New Zealand. Trees 40 years of age have measured up to 150′ in height and 30-60″ in diameter, according to the growing-room that they had. Simmonds refers to a tree at Hinuera 154′ high, with a clean bole 70′ long and 3′ in diameter. These are not isolated examples, for nearly all cases show a rapid and well sustained growth. It is a species to be grown for milling timber rather than for purposes demanding durability. The mature wood is pale, freely fissile, and moderately strong. It is inclined to warp badly, but this could probably be overcome by proper treatment in milling and seasoning. As indicated, the wood is of doubtful durability.

The tree is a vigorous grower, and branches strongly in open situations, but in properly spaced plantations it will develop a long clean bole. Spacing should be from 6′ by 6′ to 8′ by 8′. It does not transplant freely, and the best results are secured from "trayed" stock. It will grow well on a wide range of soils, varying from pumiceous to moderately heavy clays.

E. Macarthuri.—This is one of the most useful general-utility Eucalypts in New Zealand, so far as the farmer is concerned. It is easily grown, produces excellent fuel and durable fencing-posts, and is one of the few Eucalypts adapted to shelter-belts.

It is most adapted to light soils, but will grow on most farm soils other than damp, heavy clays. It is readily transplanted bare-rooted, and is of very rapid growth in early life; specimen trees will attain to 50′ in height and 12″ or more in diameter in 8-10 years, though only on favourable sites. Growth usually slows up after about the fifteenth year, especially on heavy soils. When planted for shelter the trees carry good foliage and retain their laterals better than most other Eucalypts. The spacing may be about 8′, but closer is permissible for quick, temporary shelter. A spacing of 6′ by 6′ to 7′ by 7′ is adapted to most plantation purposes.

The wood is usually pale-red, coarse but durable, and usually fissile but inclined to warp. Heartwood is formed early in life, and well grown trees 10-12 years of age will produce durable posts, though better grades are secured from older trees. It is a tree to be strongly recommended to the farmer.

E. Muelleriana.—When planting this species the farmer needs to be sure he secures the best strains, as some inferior types purporting to be *E. Muelleriana* are to be seen in New Zealand. At its best this Eucalypt is a tall, clean-boled, and erect tree of rapid growth, producing a valuable wood which is both durable and strong. Under suitable conditions this species offers a wide range of usefulness. It will grow in the milder parts of New Zealand and withstand several degrees of frost. It is most adapted to " tray " planting, though bare-rooted planting has been done. As yet it is not particularly well known in New Zealand, and extensive plantations of it should not be made except on expert advice.

E. obliqua.—This species has been fairly widely planted in New Zealand, and specimens can be seen in most districts. When the best types are used the trees are moderately rapid-growing. It is better suited to the intermediate localities where moderate frosts occur than to the warmest parts of New Zealand. While adaptable to most soils, it appears to do best on a moderately fertile loam of good depth. It does not grow at its best on gumland, though fairly large trees are to be seen on such land.

Under the name of " stringybark " its wood is being sold in various districts for posts and strainers. Reports on its durability are conflicting, and while specific cases may show moderate durability this is by no means always the case. There are many far more suitable species when undoubted durability is demanded. The wood is pale in colour and easily split, and when properly grown makes excellent saw-timber. In Australia it is regarded as a general-utility timber.

E. pilularis.—Within its climatic range this species is probably one of the most reliable and safe Eucalypts to grow. It is fast-growing and attains large dimensions, growth being sustained for over 60 years. The largest tree that I personally know at that age was 176′ high and 50″ in diameter. Many species in the Auckland Province show that growth is good at all ages on a wide range of soil, including gumland. It will not stand more than light frosts, and is most suitable for the milder parts of the Auckland Province and the seaboard parts of the Bay of Plenty. With careful handling it can be planted bare-rooted, but when trees have to travel some distance from nursery to plantation " trayed " seedlings are desirable.

The durability of New Zealand-grown wood is proved, and the heartwood of trees over 30 years of age has lasted over 20 years in the ground, and is still sound. The wood of saplings 8″ in diameter will last several years in the ground. This species is equally suitable for the farm woodlot as for the large plantation. The mature wood is light to dark brownish-red, and saws and splits well. It is adapted for fencing-posts, poles, piles, or saw-timber.

E. saligna.—*E. saligna* comes from the coastal belts and gullies of New South Wales and Southern Queensland, and is one of the most valuable Eucalypts in those localities. It grows best in a mild climate, but will stand moderate frosts. For optimum growth it is rather particular regarding soil, which should be free, with moist but

not wet subsoil. It grows well on the deeper volcanic loams and medium clays. It can be transplanted bare-rooted, but like most Eucalypts, requires careful handling. Growth is rapid under favourable conditions, and few trees produce a cleaner and straighter bole than *E. saligna.* In 12-15 years it will attain pole size, and in 25-30 years millable size. Under suitable conditions it may grow 4-5 feet in height and ¾" in diameter annually.

The wood is of moderate weight, dresses well, and is in general demand in Australia. The heartwood from mature trees is quite durable. This species is closely allied to *E. botryoides,* and, with that species, is to be strongly recommended. It has succeeded in most parts of the North Island, but is suited for only the milder parts of the South Island.

E. viminalis.—This Eucalypt is akin to *E. Macarthuri,* and, like it, gives shelter in early life, but tends to thin out more later on. It is suitable for high windbreaks. The wood is less valuable for general farm purposes, and is of only moderate durability; however, it is a good fuel. It is also quite an ornamental tree.

It is quite hardy, but rather particular regarding soil requirements if it is to be grown to large sizes. On a good, fresh, sandy loam it frequently makes astonishing growth in early life; but on poorer soils or in dry places growth is slower, the form of the tree is not so good, and the wood is tougher. It can be readily transplanted.

SUMMARY OF PROCEEDINGS OF EIGHTH ANNUAL CONFERENCE.

held in the Dominion Farmers' Institute Hall, Wellington, on Wednesday, 28th January, 1931.

Reports.—The following reports were received and adopted:

1. Executive (with Statement of Accounts)—see Journal of September, 1930.
2. Examining Board—see Journal of September, 1930.
3. Plant Recording—as printed herein.

Election of Officers, etc.—

President: F. J. Nathan, Esq., Palmerston North.

Vice-Presidents: Messrs. D. A. Hay (Auckland), F. E. Smith (Hawke's Bay), P. Black (Palmerston North), J. G. MacKenzie (Wellington), Dr. Easterfield (Nelson), T. D. Lennie and M. J.

Barnett (Christchurch), Hon. Sir T. K. Sidey and D. Tannock (Otago), and R. A. Anderson (Southland).

Executive Committee: Messrs. B. C. Aston, H. Baillie, T. C. Brash, J. A. Campbell, A. H. Cockayne, W. T. Goodwin, G. A. Green, W. C. Hyde, R. B. Hammond, Professor H. B. Kirk, W. S. Mason, W. R. B. Oliver, F. S. Pope and T. Waugh.

Auditor: Referred to Executive for action.

Honorary Fellows: Rev. J. H. Simmonds (Auckland) and J. G. MacKenzie (Wellington).

Honorary Members: R. L. Harrow (Curator of the Royal Botanic Gardens, Edinburgh) and Guy L. Wilson (Knowehead, County Antrim, Ireland).

REMITS ADOPTED.

1. *Amendment of Rules.*—
   (a) Rule 3 (c) amended by deleting the words " or corporate body."
   (b) Rule 6 (b) amended by adding "(12) the accredited representative of the New Zealand Fruit-export Control Board."
   (d) Rule 9 (a) amended by adding after the words " shall consist of " the words " not less than."

2. *Capitation.*—" That the amount of capitation fees paid to local Councils be reconsidered by the Conference."

3. *Membership Privileges.*—" That the Executive Committee be authorised in very special cases to grant membership privileges without payment."

4. *Education.*—
   (a) Sectional Awards: " That consideration be given to the granting of awards of competency in connection with special branches of horticulture and matters relating thereto and, if approved, the form such awards should take." (Suggestions relative to certificates for orchardists were submitted and the question of similar provision for florists and seedsmen was referred to the Executive).
   (b) Appreciation: " That this Conference expresses its appreciation of the help and interest taken by the Technical School Boards of the Dominion in the matter of horticultural education."
   (c) Examining Board: " That the Examining Board as at present constituted, with the addition of Mr. A. H. Cockayne, be the Examining Board for the ensuing year."
   (d) Parliamentary Recess Education Committee: " That this Conference approves of the report of this Committee so far as its expression of the need for further agricultural and horticultural education is concerned."

(e) Horticultural education: "That this Conference indicates its appreciation of the extent to which the educational facilities under the N.Z. Institute of Horticulture Act are being taken advantage of, and that the incoming Executive be requested to take every means at its disposal to increase the interest in the possibilities provided under the Act for acquiring a horticultural education."

5. *Nomenclature.*—
   (a) "That the Fruit Research Committee be requested to undertake as early as practicable the stabilising from the point of view of nomenclature the various varieties of stone and bush fruits." (Mr. Campbell detailed the steps already taken and stated that the Institute is represented on the Fruit Research Committee which is co-operating with the East Malling Station).
   (b) "That the question of plant nomenclature be considered by this Conference."
   (c) "That in the opinion of this Conference no botanic name of any New Zealand plant should be changed without the prior consent of a local committee which should approve of such alteration with a view to obtaining the approval of Kew before the name is adopted for use."

6. *National Societies.*—In connection with the policy to be adopted by the Institute relative to the formation of National Societies in connection with any special plant or plants it was decided that the Executive should submit proposals to District Councils for consideration with a view to further action at the next Conference.

7. *Research.*—
   (a) "That this Conference expresses its appreciation of the support now being given by the Government to research work in connection with all phases of fruit culture and horticulture." (Mr. Campbell indicated the action at present being taken).
   (b) Citrus Test Area: "No decision or satisfactory information being available, Conference be asked to press the matter more strongly."
   (c) Director of East Malling: "That this Conference desires to place on record its appreciation of the value to the Dominion of the visit of Mr. R. G. Hatton, M.A., Director of East Malling Research Station, and appreciates the fact that the Agricultural Department has made arrangements for the interchange of root stock and other propagating material between East Malling and this country."

8. *Forest Preservation.*—
   (a) "That this Conference, believing that better control of both beneficial and injurious wild life—including beasts,

birds, fishes, insects, and plants—is an important and urgent need in this Dominion, wishes the newly-formed Wild Life Council every success in its endeavours to obtain the prompt adoption of improved means of dealing with this vital matter."

(b) "That steps be taken to ensure the preservation of as much as possible of the native bush on the road recently opened from Opotiki to Matawai via the Waioeka Valley, also of the Maungamuka Gorge."

(c) "That where roads pass through native bush an adequate area, of not less depth than ten chains, be reserved for scenic purposes."

(d) "That this Conference urges upon the Government the need for immediate steps being taken to prevent the further destruction by deer of the native forest in the vicinity of Lake Waikaremoana."

9. *National Botanic Garden.*—"That this Conference again urges upon the Government the necessity for the establishment of a National Botanic Garden where plants of economic and horticultural value could be introduced, propagated, tested, and distributed, and that an Advisory Board be created to control this."

10. *Plant Patents.*—"That this Conference urges upon the Government the need for granting protection to the producers of new varieties of plants of their own propagation."

11. (a) *Darwin Medal.*—"That this Conference puts on record its appreciation of the high honour conferred upon Dr. Cockayne."

(b) *Economic Situation.*—"That the Dominion Executive and District Councils should take their place in assisting to restore the prosperity of the people by such horticultural means as may be considered suitable."

REPORT ON PLANT RECORDING.

The 1929 Conference of the Institute held at Auckland passed a resolution recommending that the Executive Council consider and introduce a scheme of plant registration. This proposal was duly considered in conjunction with schemes of a similar nature operating elsewhere, particularly in England and Canada. It was found, however, that the scope of the work undertaken in both the countries referred to was greater than the Institute, through lack of finance, could possibly undertake in the meantime. The certificating of plants and the issuing of awards of merit, as is carried out by the Royal Horticultural Society, suggests a responsibility that the Institute could not reasonably undertake without having at its disposal the facilities for cultivating and testing the plants to which this "hall mark" of merit is proposed to be awarded.

Not only was it felt that no such ambitious scheme could be undertaken, but on the contrary it was realised that while the larger scheme should be the ultimate aim of the Institute, as at present situated, no responsibility in the matter of plant registration should rest with the Institute as an organization at all, other than the recording of the facts relative to a plant furnished by the raiser.

In this connection it was felt that the word "register" might be held to imply more by way of responsibility than the Institute was able to assume; consequently the word "record" was substituted and the scheme adopted was that of "Plant Recording."

The principal value of this scheme lies in the fact that it provides a means whereby the raiser of a new plant can have the facts placed officially on record, thereby having some tangible evidence available for use should his claims and interests in the plant be challenged; and further, that this scheme, simple as it is, forms a basis on which may ultimately be built the larger scheme of registration, certificating, and the issue of awards of merit.

Incidentally the recording scheme provides a free advertisement to the raiser of a new plant, as all plants recorded are notified in the Institute's Journal.

BANKS LECTURE.

This lecture was inaugurated in 1926 as a recognition of the work of the celebrated botanist, Sir Joseph Banks, who was attached to Captain Cook's first exploring expedition to New Zealand. This year the lecture was given by W. R. B. Oliver, Esq., M.Sc., Director of the Dominion Museum, and dealt with "National Botanic Gardens." The lecture proved interesting and informative and was profusely illustrated by lantern slides.

NATIONAL CONFERENCE ON HORTICULTURE.

With the object of co-ordinating all horticultural interests and efforts in the Dominion it was arranged that the annual Conferences of the New Zealand Horticultural Trades' Association, the Association of Directors of Parks and Reserves and this Institute should be held simultaneously in Wellington this year, thus securing the attendance of a large number of horticulturists representing varied interests and enabling, by personal contact, a maximum measure of co-operation. This effort was the first of its kind and its success marks a distinct advance in horticulture in this Dominion.

The bodies enumerated above, in association with the Hutt Valley and Wellington Horticultural Societies, staged the first National Flower Show held in the Dominion. The Show was held in the Wellington Town Hall after the conclusion of the business meetings and continued for two days. A magnificent display of plants and blooms was made and the Show was much appreciated. In opening the Show, Mr. F. J. Nathan, President of the Institute, expressed

regret that plants native to New Zealand were not more in evidence. Amongst the exhibits were a number of fine specimens of the art of members of the Wellington Florists' Exchange.

An official dinner and a sight-seeing tour by 'bus gave members and their friends further opportunities for social intercourse.

INSTITUTE NOTES.

December 1930 Examinations. — The following passes were recorded:—

Junior Certificate: George Frederick Marks (Auckland), Elizabeth Barnhill Thomas (Christchurch), and John Wilson Ewart (Dunedin). In addition there were two partial passes in Botany and one in Zoology.

Diploma (Group B): George White (Wellington).
(Group C): George Donald Wilson (Hastings).

HORTICULTURAL SHOWS:

AUCKLAND HORTICULTURAL SOCIETY.

President: Sir Edwin Mitchelson, K.C.M.G.
Secretary: c/o. Box 124, Auckland.

Dahlia Show: 12-13 March, 1931.
Chrysanthemum Show: 23-24 April, 1931.
Daffodil Show: September, 1931.
Summer Show: December, 1931.

WELLINGTON HORTICULTURAL SOCIETY.

President: Dr. Arnold Izard.
Secretary: J. G. MacKenzie, N.D.H. (N.Z.), c/o. Town Hall.

Autumn Show: 22-23 April, 1931.
Spring Show: September, 1931.
Summer Show: November, 1931.
All shows held in Town Hall, Wellington.

HUTT VALLEY HORTICULTURAL SOCIETY.

President: D. S. Patrick, Esq.
Secretary: A. J. Nicholls, P.O. Box 19, Lower Hutt.

Autumn Show: 15-16 April, 1931.
Spring Show: September, 1931.
Summer Show: November, 1931.
Mid-Summer Show: February, 1932.
All Shows held in King George Theatre, Lower Hutt.

MATAURA HORTICULTURAL AND INDUSTRIAL EXHIBIT SOCIETY.

President: J. L. Mitchell Esq.
Secretary: James Ingram.
Spring Show: October, 1931.
Annual Show: February, 1932.

All Shows held in Society's Hall, Balclutha,

New Zealand Institute of Horticulture (Inc.)

Patrons: Their Excellencies *LORD BLEDISLOE*, Governor-General, and LADY BLEDISLOE.

Vice-Patron: The Hon. The Minister of Agriculture.
President: F. J. NATHAN, Esq., Palmerston North.
Dominion Secretary: A. R. STONE, G.P.O. Box 1237, Wellington.
Dominion Organiser: GEO. A. GREEN, 16 Aratonga Avenue, One Tree Hill, Auckland.

Hon. Secretaries of Local District Councils.

Auckland: N. R. W. Thomas, 54 Campbell's Bldgs., High Street.
Hastings: L. A. Denton, P.O. Box 18.
Palmerston North: J. J. Stevenson, Boys' High School.
Nelson: E. R. Neale, P.O. Box 114.
Christchurch: H. Firman, 89 Western Ter., Beckenham.
Dunedin: Geo. H. McIndoe, P.O. Box 445.
Invercargill: Jas. A. McPherson, P.O. Box 51.

Membership:

Individuals: 12/6 per annum.
Societies, firms, etc.: 21/- per annum.

Journal:

To Members: Free.
To Non-members: 7/6 per annum (in advance).
Single copies: 2/6.
Hon. Editor: W. R. B. Oliver, M.Sc., Dominion Museum, Wellington.

Advertising Rates:

These will be supplied on application.

Examinations:

Examinations will be held half-yearly (June and November). Students desiring examination should make early application to

DOMINION SECRETARY,
N.Z. Institute of Horticulture,
G.P.O. Box 1237, Wellington.