**An Australian Study
of
American Forestry**

**By E. H. F. SWAIN,
Queensland Forest Service**

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By

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FOREWORD.

THIS memoir of an investigative tour of Western United States of America in 1916, dated 14th July, 1916, and now revised for publication, is dedicated to the Queensland Forest Service.

To the suggestive criticism of Mr. N. W. Jolly, late Director of Forests, the publication owes much of what value it may have as a contribution to Australian forestry.

For the data contained, I am deeply indebted to the extreme courtesy of H. S. Graves, Esq., The Forester, United States of America ; District Forester Silcox and the many officers of District No. 1 of the United States of America Forest Service ; Dean Skeels and the Faculty of the Forest School, University of Montana ; Dean Winkenwerder and Professor Grondal of the Forest School, University of Washington ; Professor Mason, Forest School, University of California ; and others, through whose kind offices I was enabled to gather a vast amount of first-hand information of a most explicit character, and of absorbing interest to me as a forester.

I was fortunate enough to be able to supplement my valuable experiences in United States of America Forest Service administration and Forest School practice by personal contact with and close observation of large scale timber getting, manufacturing, and seasoning operations in various parts of Western North America, of tree propagating work at the fine Savenac Forest Nursery in Idaho, of forest planting projects on Lolo National Forest, of general forestry matters on the Missoula, Bitterroot, and Flathead National Forests, and of educational policies and methods at the Universities of Montana and Washington.

In selecting from a chaotic mass of notes and data the material used for the purposes of this memoir, and in elaborating the matter so

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chosen, my endeavour has been to present it in such explicit and readable form as to make readily available the lessons it holds for the pioneering Australian forester.

I have accompanied the exegetic chapters with a series of suggestions, based on a combined Australian-American experience, for the extension of forestry systems in this country.

I do not venture to believe that these suggestions represent the "last word" in Australian forestry, or that all of them can be put into operation in the immediate future. My hope is that they may prove suggestive, and conduce to due preparation and planning. The fact that basic conditions in America are practically parallel with those existing in Australia renders American experience particularly interesting.

The concluding recommendations contained herein were made available to the N.S.W. Government in 1916 in connection with the reorganisation of the Forest Service of that State.

E. H. F. S.

15/4/18.

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An Australian Study
of
American Forestry.

Part I

Part I.—An Australian Study.

CHAPTER I.

AMERICA AND EFFICIENCY ENGINEERING.

American forestry is the most recent forestry.

Necessary to its complete appreciation is a comprehension of the forces which have produced it and the influences which have shaped it.

America is a hothouse of ruthless capitalism and fierce competition. Life is largely dollar-driven effort. Development has been forced; at some cost in human material!

Whatever the price, the plucked fruit is ready for serving in Australia, while the thorns remain on the American tree; or in the flesh of the gatherers.

"100 per cent efficiency" is the national philosophy. "The devil takes the hindmost" is the postscript—which is often the chief part of a letter.

If anything, that of Australia has been "The devil take efficiency and we'll look after the hindmost."

A fusion of the two philosophies of America and Australia might lead to happy results—in other things besides forestry.

Bricklaying is as old as the hills. It has been handed down from generation to generation as a heritage of the past. It was assumed that nothing further remained to be learnt concerning it.

Under its magic glass, America discovered that the copied and inherited bricklaying consisted of eighteen distinct movements. It assayed each one of those movements, discarded thirteen as unnecessary and misdirected effort, and on the remaining five it built up the new synthetic bricklaying.

Under the old methods, a bricklayer could lay 100 bricks an hour.

Some unions restricted the output to 375 per day—and 275 when working for the Government.

The new bricklayer averaged 350 bricks per hour, or 2,800 per day!

At the Bethlehem Steel Works, the pig iron gang for many years had been handling an average of about $12\frac{1}{2}$ tons per day per man.

A discarding of lost energy, and each man thereafter averaged 47 tons.

In a bicycle factory, the work of inspecting bicycle balls was being done by 120 girls.

The efficiency engineer appeared. He reduced the hours of labour from 63 per week to 47. He gave each girl four recreation periods daily. He raised the wages 80 per cent. to 100 per cent. He insisted on an accuracy two-thirds greater.

Finally, he cut out the "lost motions," and thereafter 35 of the girls did the entire work of the 120!

In Australia and New Zealand, the cost of afforestation works out on an average at about £7 per acre.

America does the same thing for 25s., with 11s. per day the minimum wage!

Of such is the essence of America, whose spirit is efficiency, and whose genius is organisation.

Her vices may be not a few. But these are her virtues.

All these things have been done by Efficiency Engineering, which was introduced to the world by Frederick Winslow Taylor at the Midvale Steel Works thirty years ago, since when there has been not a single strike at those works.

It has doubled and trebled production; it has solved the problem of uniting high wages with low costs to the consumer: it has substituted co-operation for coercion; it is shaping the industrial destinies of America; it is shaping the development of American forestry.

And thus it is that we ride in American automobiles, listen to American gramophones, use American sewing machines, ply American typewriters—and study American forestry!!

CHAPTER II.

AUSTRALIAN FORESTRY—U.S.A. A LIVING PRECEDENT.

The law of development is evolution. The lines of national development are conditioned by the national temperament. The national law and policy are the expression of the national mind. Militarism may be the accepted gospel in Germany, but not in the Antipodes. German, or French, or Indian forest policy may be good for Germany, France, or India, but not for Australia.

Nor is it possible to transplant and acclimatise a full-grown tree, although a seed or a seedling may succeed.

Germany, France, India, and other countries, where an intensive form of forestry has been practised, have established their forestry systems upon a local foundation. Only the principles of forestry are common to all. The building materials and the architecture, the foundation—and the builders—differ in each.

The most elaborate silviculture is that of Germany. It is also the oldest—the development of four hundred years of favourable conditions, a teeming population, cheap labour, large manufactures, and minute utilisation, a dominated and docile public, and finally high prices for forest products consequent upon a high protection.

None of those conditions exists in Australia—at present. Racially, socially, and politically, none of the countries which are practising intensive forestry resembles Australia. And the disparity in the stage of development is a final handicap.

Thus, while we must remain grateful for their unfolding of the general principles of forest science, and for unveiling to us its possibilities in a remote forestry future, we cannot turn to them as a very present help in our time of present trouble.

It is inevitable that Australia must develop a forestry system of its own. It has a forest flora peculiar to itself and silvical conditions quite unlike those existing in any other country. But, above all, it is a young and wilfully democratic country. It is wholly Anglo-Saxon in sentiment and outlook, untrammelled by any hampering traditions. It is still in its pioneering days, carelessly culling the inexhaustible natural resources of the land. It has scarcely awakened yet to the seriousness of national life and the need for the conservation of resources and energies.

In forestry, its immediate tasks are—the planning of an organisation, and the development of a system.

Precedent is the backbone of existence. Where in all the world is there another country which presents a parallel example, horrible or otherwise—an Anglo-Saxon democracy in the transitional phase between pioneering and waste, and Conservation and Efficiency?

Peculiarly enough, it is the United States of America from which already Australia has borrowed a constitution. There is no other example.

This discovery—and others—sent me to America to investigate American forestry.

CHAPTER III.

DEVELOPMENT OF U.S.A. FORESTRY.

In the essentials, America is the elder sister of Australia.

Both are self-governing Anglo-Saxon democracies, with similar laws and institutions and similar prejudices and sentiments. The differences are of detail and of age.

In forestry, America has only fifteen years' start of us.

At the beginning, America had nearly 1,000,000,000 acres of woodland.

Australia, slightly larger in area, had less than 100,000,000 acres—one-tenth the forest of United States of America.

To-day, four-fifths of the American timber lands are privately owned; the same proportion in Australia is publicly owned.

There are 164,000,000 acres of national forest in the United States of America, each forest averaging 1,000,000 acres in extent.

There will be in Australia, when classification is complete, something like 16,000,000 acres of public forest, each averaging, perhaps, 10,000 acres—ten times the number of American forests, yet only one-tenth the area.

If America's forest position has been precarious, how much more so Australia's?

Youth and profligacy! Pioneering days are wasteful days. The first stage in developing a forest policy is deforestation.

In 1849, an American patent office report referred to the "waste of valuable timber" and denounced "the folly and short-sightedness of the age."

In 1865, came the prophecy in a lengthy article by Rev. Frederick Stair, on American Forestry (Fernow's History of Forestry):

"The nation has slept because the gnawing of want has not awakened her. She has had plenty and to spare, but within thirty years she will be conscious that not only individual want is present, but that it comes to each from permanent national famine of wood."

Thereafter came the opening up of the West, and the tapping of the great forests of the Inland Timber Region; and famine was staved off. At which stage the Australian parallel fails—for want of an inland timber region.

But the fear and expectation were not abated, and in 1872 arbor days became the fashion. A year later, the American Association for the Advancement of Science became concerned, and secured, in 1876, the establishment of a forest agency in the Department of Agriculture.

From that forest agency developed the present Forest Service.

Nothing further evolved until 1882, when, following upon the visit of Baron von Steuben, a Prussian forest official, a forestry congress was held in Cincinnati, and the American Forestry Association was born.

After which, for some years, the forestry movement became the "playball of political wire-pullers" and fell into disrepute.

"Arbor day sentimentalism discredited and clouded the issue before the business world; antagonism of the lumber world was aroused by the false idea of what the reform contemplated, and in the absence of technically-trained foresters to instruct the public and amateur reformers, &c., and to convince legislators of the absolute need for discontinuing the established habits, progress was naturally slow, and experienced many setbacks."

Nevertheless, the forestry movement was progressing, and in 1891 Congress let pass a "rider" to an Act, which authorised the President to set aside forest reservations from the public domain. Some 17,000,000 acres were speedily proclaimed.

Meanwhile, no provision had been made for administration, and a subsequent act to repair the omission failed to become law, "for lack of time to secure a conference report."

Some years later, in 1896, the Forestry Association prevailed upon the Secretary of the Interior to request the National Academy of Sciences to investigate and report upon the inauguration of a national forest policy.

A committee of investigation picnicked in the woods for a period, and a report followed. On Washington's birthday, in 1897, President Cleveland adopted the report, and heroically proclaimed the 20,000,000 of additional reservation recommended, "without the usual preliminary ascertainment of local interests."

An outcry followed, and being recalled in extra session to pass the Annual Civil Appropriation Bill, Congress tacked another "rider" to the Bill, suspending the reservations so proclaimed, "until they could be more definitely delimited, private claims adjusted, and agricultural lands excluded." Administration provisions for the remaining reservations were hung on to this rider.

By this time, the forestry agency, established in 1876, had become the Division of Forestry, and in 1898 fell into the capable hands of Gifford Pinchot, who had acquired some knowledge of European forestry, and who, being ambitious, aggressive, and, at the same time, wealthy and influential, was able to secure such appropriations for its work as to bring the division into much greater prominence.

In 1901, this division controlled the scientific development of forestry, while the survey of the forest reserves was vested in the Geological Survey, and their administration in the General Land Office!

The history of forestry in Australia has been strangely like that of the United States of America, and in 1901 the forestry position in the States was, in many respects, comparable to that now existing with us, following upon, and possibly preceding, a very similar development.

The year 1901 marked the beginning of a new era for American forestry. In that year Theodore Roosevelt became President of the United States of America; and within twelve months the forest reservations had increased to 65,000,000 acres, and the Division of Forestry had grown into the Bureau of Forestry.

Within another three years, the same bureau had become the United States of America Forest Service, with full and undivided control over 162,000,000 acres of national forest, and the federal forest policy was firmly established.

CHAPTER IV.

FEDERAL OR STATE FORESTRY—WHICH ?

American forestry is Federal: Australian forestry is State controlled.

It is argued that forestry is a national, not a provincial function, and that State control tends to the subordination of the national interest to purely local considerations. Conservation of the timber supply and maintenance of stream flow are matters of nation-wide importance. Many of the problems to be faced are interstate in character. Forest fires are not limited by State boundaries. The water supply of one State may be affected seriously by forest destruction in an adjoining one.

The most damning argument against State control is the land history of the States themselves.

Considerable lands were granted all the public land States, and, from beginning to end, their handling of them has been marked by carelessness, inefficiency, waste and "graft." In connection with their disposition scandals of great and small proportions have been so frequent as to be commonplace.

"Vast areas were donated by the States for roads that were never built; water fronts were given away without any consideration; tide and swamp lands were granted on promises that never materialised, and vast areas of the choicest timber lands sold for a song."

The American Union is a coalition of forty-nine small States; the Australian Commonwealth is a federation of seven countries.

In America, the State powers are limited; in Australia, the limitations are those of the federation.

In America the Government is wholly national. State rights are insignificant.

Federal forestry is a natural development of the situation in America, as State forestry is a natural corollary to the present Australian form of Government.

The mountainous configuration of the forest lands of America and the inflammable nature of the forests are strong factors in influencing federal forestry development in America, in view of the interstate influences they exert on water flow and forest fires.

CHAPTER V.

LAW AND POLICY.

Forestry is essentially a science of safeguarding the future consistently with the present. It is "paternalism."

And it is "undemocratic" in that it is opposed to the doctrine of non-interference with private rights; which may explain its flourishing development in Germany.

Yet, even in the American Democracy, the trend of the Federal Government of late years has been paternalistic—even socialistic.

Two courts have ruled recently that owners of timberlands may be

subjected to restriction without compensation, as regards the size of trees they may fell on their property, if the welfare of the State demands such interference.

Which is the old Roman doctrine of "*Utere tuo ne alterum noceas*," so often used by forestry propagandists.

This tendency towards paternalism and forestry may be ascribed in great measure to the educational and publicity work of the early Bureau of Forestry, and the American Forestry Association.

It has influenced the development of the forest laws of the United States of America.

In view of the fact that several of the Australian States project important forestry legislation, it may be interesting and profitable to review the succinct laws of the United States of America on the subject.

Like Topsy, they seem to have "grewed."

The important Act creating National Forests, was just a "rider" tacked on to an "Act to repeal timber culture laws and for other purposes." (Act of March 3, 1891.)

It reads—

"Section 24.—The President of the United States may, from time to time, set apart and reserve in any State or territory, having public land bearing forests, any part of the public lands wholly or in part covered with timber or undergrowth, whether of commercial value or not, as public reservations, and the President shall, by public proclamation, declare the establishment of such reservations and the limits thereof."

The administration of the National Forest so proclaimed was provided for six years later by another "rider" hung on to a hurried Sundry Civil Appropriations Act, passed in an extra session on June 4, 1897.

The tacked-on clauses enacted that—

- "(1.) No public forest reservation shall be established, except to improve and protect the forest within the reservation, or for the purpose of securing favourable conditions of water flow, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States; but it is not the purpose or intent of these provisions, or of the Act providing for such reservations, to authorise the inclusion therein of lands more valuable for the mineral therein or for agricultural purposes than for forest purposes.
- (2.) The Secretary of the Interior shall make provisions for the protection against destruction by fire and depredations upon the public forests and forest reservations which may have been set aside under the said Act of March 3, 1891, and which may be continued: and he may make such rules and regulations, and establish such service as will insure the objects of such reservations, namely, to regulate their occupancy and use, and to preserve the forests thereon from destruction, and any violation of the provisions of this Act or such rules and regulations shall be punished as is provided for in the Act of June 4, 1888 (repealed by the Criminal Code of 1909, which provide a maximum penalty of £200 or one year's imprisonment for forest offences).

- (3.) For the purpose of preserving the living and growing timber and promoting the younger growth on forest reservations, the Secretary of the Interior, under such rules and regulations as he shall prescribe, may cause to be designated and appraised so much of the dead, matured, or large growth of trees found upon such forest reservations as may be compatible with the utilisation of the forests thereon and may sell the same for not less than the appraised value in such quantities to each purchaser as he shall prescribe, to be used in the State or Territory in which such timber reservation may be situated." (Export permitted by Act of March 4, 1915.)

There were several incidental clauses providing for due advertisement of timber sales, safeguarding the right of ingress and egress of settlers and miners, and enacting that the waters might be used for mining, domestic, milling, or irrigation purposes, subject in the last three cases to the water laws of the respective States governing their use and appropriation, while the laws of the United States of America controlled the mining.

An Act of February 6, 1905, gave power of arrest for violation of forest laws. The Forest Homestead Act of June 11, 1906 (as amended August 10, 1912)—

"directed and required the Secretary of Agriculture to select, classify, and segregate as soon as practicable all lands chiefly valuable for agriculture, and which, in his opinion, may be occupied for agricultural purposes without injury to the forest reserves, and which are not needed for public purposes ;"

and authorised him to

"list and describe the same by metes and bounds, or otherwise, and file the lists and descriptions with the Secretary of the Interior, with the request that the said lands be opened to entry in tracts not exceeding 160 acres in area."

An Act of May 23, 1908, provided that 25 per cent. of all money received from each forest reserve during any fiscal year shall be paid to the State for benefit of public schools and public roads.

The Weeks Laws of March 1, 1911, authorised co-operative agreements of States with the United States for the protection of the watersheds of navigable streams against fire and conserving of the forests and the water supply. It provided an annual appropriation not exceeding £420,000 for the examination, survey, and acquirement of lands located on the headwaters of navigable streams; appointed a National Forest Reservation Commission (parliamentary) to handle the matter, and authorised the Secretary of Agriculture to purchase lands approved by the commission and administer them as National Forests.

Such are the forest laws of America. They gave the Secretary of the Interior (afterwards Agriculture) virtual carte blanche to establish his own forest policy and laws in authorising him to "make provision for the protection against destruction by fire and depredations upon the public forests," and "to make such rules and regulations and establish such service as will insure the objects of such reservations," namely, to regulate their occupancy and use and to preserve the forests thereon from destruction."

So wide were the powers conferred that their validity was put to the test in the case of *United States versus Grimand et al.* 220 U.S. 506—in which the regulations framed to control grazing on the National forests, were contested.

The High Court ruled that—

“Under the Acts establishing forest reservations, their use for grazing or other lawful purposes is subject to rules and regulations established by the Secretary of Agriculture, and it being impracticable for Congress to provide general regulations, that body acted within its constitutional power in conferring power on the secretary to establish such rules; the power so conferred, being administrative and not legislative, is not an unconstitutional delegation.”

Forestry is a technical business, and forestry administrations should possess powers wide enough to permit of the management of the forests in accordance with the technical considerations attached to every particular case.

The forest laws of most of the Australian States are hedged by restrictions unknown to the American enactments. What was deemed “impracticable” by the United States of America Congress was attempted by our State Parliaments, which have closely governed and limited the regulations frameable thereunder, and made them subject to Parliamentary approval.

To the Australian forester, the powers possessed by the United States of America forestry administration are enviable—and it is believed that the extraordinary development of the United States forest system is almost entirely due to Congress realising that it was not technically qualified to draw up rules of forest management!

That the confidence of Congress in the forest administration was not misplaced is indicated in the letter of the Secretary of Agriculture to the Forester, dated February 1, 1905, in which the general forest policy under the organic Acts of 1891 and 1897 was laid down for his guidance in framing the regulations and instructions for the use of the national forests. It is worth quoting—

“In the administration of the forest reserves, it must be clearly borne in mind that all land is to be devoted to its most productive use for the permanent good of the whole people and not for the temporary benefit of individuals or companies. All the resources of forest reserves are for use, and this use must be brought about in a thoroughly prompt and businesslike manner, under such restrictions only as will insure the permanence of these resources. The vital importance of forest reserves to the great industries of the Western States will be largely increased in the near future by the continued steady advance in settlement and development. The permanence of the resources of the reserves is, therefore, indispensable to continued prosperity, and the policy of this department for their protection and use will invariably be guided by this fact, always bearing in mind that the conservative use of these resources in no way conflicts with their permanent value.

“You will see to it that the water, wood, and forage of the reserves are conserved and wisely used for the benefit of the home builder, first of all, upon whom depends the best permanent use of lands and resources alike. The continued prosperity of the agricultural, lumbering, mining, and livestock interests is directly dependent upon a permanent and accessible supply of water, wood, and forage, as well as upon the present and future use of these resources under business-like regulations enforced with promptness, effectiveness, and common sense. In the management of each reserve, local questions will be decided upon local grounds, the dominant industry will be considered first, but with as little restriction to minor industries as may be possible; sudden changes in industrial

conditions will be avoided by gradual adjustment after due notice, and where competing interests must be reconciled, the question will always be decided from the standpoint of the greatest good to the greatest number in the long run."

Surely words of wisdom!

CHAPTER VI.

BIRTH OF THE U.S.A. FOREST SERVICE.

Democracy also has its disadvantages. One of them is that national development is subject to a many-sided and fickle public will.

In a democracy, therefore, a necessary step towards reform is the education and cudgelling of the public to the necessity of reform.

Whence the development of publicity as an essential part of the machinery of democratic government.

Up to 1905, the work of the old Bureau of Forestry had been propagandist.

During the first twenty years of its existence, it produced 20,000 pages of printed matter.

Later, it became more advisory; working plans—so-called—were prepared for public owners; its publications became more technical.

Up to 1905 the surveying of the National Forests had been controlled by the Department of Geological Survey.

It had completed some 70,000,000 acres, out of 162,000,000 acres—at a cost of £300,000, or about one penny per acre.

Up to 1905, the administration of the National Forests had been vested in the General Land Office. A force of superintendents and rangers existed, wholly supervisional and essentially "practical," condemning technique, and without any real conception of forest management and the task before it.

The assemblage of these scattered sections of the forest control created a living force, which, as the newly constituted United States of America Forest Service, started out immediately on a career of extraordinary development.

On the flood of the tide of educational enthusiasm following the establishment of forest schools at Cornell in 1898, Yale in 1899, and Michigan in 1903, arrived the new American forester, crammed full of technique and energy.

The first phase was that of the purely European ideas. The new department attempted strenuously to copy German technique, before it had acquired any fundamental knowledge of American conditions or how to adapt forestry practice to those conditions. European forms had to be followed. All else was regarded as forest quackery. Working plans bulked largely in the scheme, and the initiation of intensive silviculture was begun forthwith.

This was revolution rather than evolution. And it failed—because of that fact, and because in Europe business training was a minor quantity in forestry. The administration bumped against the practical problems of the moment, the biggest one of democratic government. It fell foul of the conflicting interests of the lumberman, the grazier, and the settler. It was styled academic, inane, ignorant, incapable, incompetent, and unjust. Significantly enough, neither graft nor dishonesty was amongst the charges levelled at it.

Its first problem, however, was not silviculture, but administration. It had to protect its vast forests from fire and trespass, so that its timber and grazing resources could be utilised economically and systematically. These facts overshadowed the plagiarist policy, and with an enormous domain to be handled and only the nucleus of a forest force at its disposal, it was inevitable that the new Forest Service should find itself immediately overwhelmed with problems of administration. The forests of the United States of America were peculiarly subject to destruction by fire, owing to their inflammability and the steep configuration of the land they occupied. Fire protection was the dominating need, calling for the organisation of the forest and its force for defence. Trails, ranger cabins, telephone lines were required. A timber sales policy had to be developed. Grazing lands within the forests had to be administered. The foundations had to be laid before technique could be added.

Followed a period of very rapid change, due to an earnest striving after development. The administration was strong, aggressive, and venturesome. It over-reached itself on occasion, but its mistakes chastened rather than discouraged it. And they focussed attention on the problems, compelling solution. Development, after all, is the correction of the errors of venturesomeness. Final solution comes only after initial failures.

Very largely, the influence of the expanding science of management made itself felt in the development of the new service. Intensive investigation and experiment were features of its growth; the fitting of the individual and his work, and the fixation of individual responsibility, standardisation of the best methods, planning, due recording of accepted procedure in the wonderful National Forest Manual—all these things made for an extraordinary expansion.

It is ten years since the United States of America Forest Service was launched into existence. To-day it ranks as one of the greatest Forestry Departments of the world. It controls some 164 tremendous forests, averaging 1,000,000 acres each. It has a force of 3,875 persons, of whom 3,275 are employed upon the National Forests as supervisors, deputy supervisors, rangers, and guards, and 600 are engaged in administrative, scientific, and clerical work at the Washington and district headquarters. In 1915 it negotiated 90,000 transactions, sold 850,000,000 feet of timber (log measurement) for £255,000; and grazed 9,000,000 head of stock for £236,000.

Its total receipts were £517,000. Its expenditure was £1,545,000.

Its motto is the national motto, "100 per cent. efficiency." And it lives up to it.

CHAPTER VII.

U.S.A. FOREST SERVICE ORGANISATION.

The work of the United States Forest Service is described as consisting of "the administration and protection of the National Forests, the development of their resources, and research into technical problems connected with forestry, and the discovery and diffusion of knowledge concerning the best use of forests and forest products."

Its organisation is of more than ordinary interest to us, because of the similarity of basic conditions, and of tendencies of development. The Australian organisation is as yet merely one of sketchy supervision with

limited functions, the nucleus of a forest force. It is more than probable that similar tendencies will lead to a development along the lines followed by the American service.

The American forest administration is confined exclusively to the 164,000,000 acres of National Forests, which are grouped within seven different forestry districts, each controlled by a district forester responsible directly to the forester at Washington on points of general policy, but otherwise vested entirely with authority to plan and manage his district in his own way.

Each of the million acre forests within a district is in charge of a forest supervisor, who is the general manager of his forest, planning the work and seeing that it is carried out, subject to the general direction of the district forester. He is responsible for the supervision, protection, and improvement of the forest.

His place in the scheme of organisation comes closest to that of forest guard in the New South Wales plan, but his responsibilities and functions are wider in accordance with the more expanded forest policy.

He is allotted a personnel for carrying on the work of the forest, which is determined by the district forester from annual estimates submitted by him.

He has full authority over all forest officers detailed to his forest, and "may make such assignments and delegate such authority as he may consider necessary, provided such assignments or delegations of authority are not specifically prohibited."

The forest supervisor is often a graduate in forestry. The position is filled by promotion from the classified positions of the Forest Service.

The district ranger occupies the position in the organisation analogous to that of forest overseer in New South Wales, or resident forester in Queensland. It is a position which will have to be provided for in any extension of forestry practice in Australia, more especially in the western grazing forests. Probably, returned soldiers of suitable bent could be utilised.

The district ranger in the United States of America Service controls one of the eight or nine divisions of the forest—averaging 100,000 acres each, subject to the direction of the supervisor.

He has entire charge of the routine work involved in the supervision of grazing, timber sale, free use, special use, and other contracts and permits, the direction of the protection and improvement plans, and the examination and reporting on applications for any use of the forest, including settlement and other claims. He exercises, within his district, the delegated authority of the supervisor for the administration of the forest. His headquarters are either at the nearest business centre or permanent headquarters are provided on the forest.

He is given charge of the temporary labourers (called forest guards), working on the forest.

This constitutes the general administrative and supervisional forest force. Where the work is heavy or involved, the organisation is filled out by the appointment of temporary assistants, or specialists are detailed from the district office.

A typical organisation is that of the Lolo National Forest (Montana):—

- Supervisor.
- Deputy Supervisor.
- 8 District Rangers.
- 33 Forest Guards.
- 4 Timber Scalers.
- Casual Labourers.
- 1 Forest Clerk.

“The work involved in making forest surveys necessary to the preparation of definite plans of management for timber, grazing, settlement, special uses, administration and protection, is performed by officers such as forest examiners, logging engineers, lumbermen, grazing examiners, members of the district office, or by the supervisor or deputy supervisor.”

This corps of specialists ordinarily is concentrated at the district office. The specialists may be attached temporarily to a forest on special work, under the direction of the supervisor, or they may act as co-operative inspectors for the district forester.

The work of the district office is organised under the offices of operation, lands, silviculture, and grazing, each of which is administered by an assistant district forester, specialising in the work.

The office of operations has general supervision of the finance, personnel, equipment, and supplies of the service, and of all fire protection, forest survey, and permanent improvement work on the National Forests.

The office of lands “examines and classifies lands within the National Forests, to determine their value for forest purposes, conducts the work in connection with claims on the National Forests prior to proceedings before United States “registers” and receivers, and assists the chief engineer of the service in connection with the use of National Forest lands for hydro-electric purposes.

The office of silviculture supervises the sale and cutting of timber on the National Forests, and co-operates with States in protecting forest lands under the Weeks Law (watersheds). Reafforestation and afforestation, working plans, forest investigations, market and utilisation problems, forest products, industrial investigations, and co-operation, are its other lines of work.

The office of grazing supervises the grazing of live stock, and the allotment of grazing privileges. It is charged also with the work of improving depleted grazing areas, and of co-operating with the Federal and State authorities in the enforcement of stock quarantine regulations.

Accounting is in the peculiar position of being practically outside the district office organisation. It is controlled directly from Washington by the chief of the office of accounts, who has a district fiscal agent stationed at each district forestry office, solely to deal with accounts. The forest officer does not collect forest revenue. The debtor is required to pay directly to a United States depository to the credit of the fiscal agent.

Somewhat similar is the Queensland system, where the district land agent acts in an accounting capacity.

Law matters are situated much the same. There is a district assistant to the solicitor appointed for each district office.

The work of the seven forestry districts of the United States of America is correlated and controlled by the forester at Washington, who is the chief of the Forest Service, under the Secretary for Agriculture.

He is assisted by an associate forester and five assistant foresters controlling the branches of operations, lands, silviculture, grazing, and research.

The branch of research has supervision over the investigative work of the service, including silvicultural studies, studies of State forest conditions, investigations of the lumber and wood-using industries and lumber prices, and the investigative work carried on at the Forest Product Laboratory and the forest experiment stations.

The forester exercises as such the delegated authority of the Secretary of Agriculture, "to issue such instructions to the officers and employees of the Forest Service, and to establish such procedure for the guidance of the users of the National Forests as may be necessary to carry the regulations into effect."

The forester enjoys much the same powers of management as those of a commission in Australia. The political head does not participate.

CHAPTER VIII.

PERSONNEL POLICY.

Industry is normal—idleness abnormal.

"Activity means growth and development—inactivity means decay and death."

In the "Physiology of Faith and Fear," Dr. Sadler demonstrates the destructive effects upon the human body of fear, worry, uncertainty, discouragement, grief, and hate. Mental peace, courage, and happiness are constructive.

Inharmony is the sand which shreds the bearings of the industrial machine.

The atmosphere which invests an organisation is the peculiar aura of its management. It is a palpable influence acting for destruction or construction as it is good or bad.

Frightfulness and militarism are going out of fashion. The new discipline—the new spirit of management—appeals to higher motives than fear.

It is an instinct in man to devote himself to a cause—even to that of forestry.

Says Emerson: "Nothing great was ever accomplished without enthusiasm. The way of life is by abandonment."

"Any gang of ditch-diggers will pitch in and make the dirt fly, in order to outdistance another gang. Love of the game is strong in every normal human being." (Dr. Blackford.)

"Among the fundamental principles of the universe is the law of growth. When there is no opportunity for advancement or promotion, a man may work under the spur of necessity, but his work has in it nothing of that joyous abandon which arises from constructive thought and feeling and results in efficiency." (Id.)

"When a man hates his work, when he is dissatisfied and discontented in it, when his work arouses in him destructive thoughts and feelings rather than constructive, there is something wrong, something abnormal. He is trying to do work for which he is not fitted, or he is in the wrong environment, or under wrong management, or he is physically or mentally ill." (Id.)

Ninety per cent. of people have entered their present employment blindly and by chance, irrespective of their fitness or opportunities. Seventy-five per cent. of people are in the wrong avocations. These are the estimates of experts.

"The ideal for every employee, therefore, is that he should be employed in that position which he is best fitted to fill, doing work which by natural aptitude, training and experience he is best qualified to do, and working under conditions of natural environment—tools, rates of pay, hours of labour, and periods of rest, superintendence and management, future prospects and education—that will develop and make useful to himself and his employer his best and finest latent abilities and capacities." (Id.)

Such are the teachings of the Emerson School of Scientific Management, which emphasises the idea of fitting the job to the man rather than that of the Taylor school of fitting the man to the job.

Both schools have influenced the development of the United States of America Forest Service. The influence of the Taylor school is seen in the management of the Savenac Nursery; that of the Emerson school in the adoption by District No. 1 of the Blackford Employment Plan.

The Blackford Employment Plan is the practical application of the principles above enunciated. It is a scientific vocational analysis of the employee and the fitting of him with his proper job and environment.

The outline thus given will serve to explain the attached copies of forms used by District No. 1 of the United States Forest Service in selecting men for positions in its employment.

It is merely another instance of its ideal of "thoroughness."

The Forest Service Manual sets down that besides having suitable knowledge and experience, "officers are required to be honest, industrious, sober, and courteous. Efficiency is the primary quality upon which the advancement of each individual depends."

D1-P3

(For use in all cases
except temporary labour).

APPLICATION—PERSONAL RECORD—TEMPORARY EMPLOYMENT.

District No. 1.

Permanent positions in the Forest Service are secured only through Civil Service examination. For detailed information concerning examinations and requirements, address U.S. Civil Service Commission, Washington, D.C. Information concerning character of work and definition of duties can be secured from Forest Service, Missoula, Montana.

1.—GENERAL IDENTIFICATION AND HISTORY.

Name : Telephone No.
 Address, local :
 Nationality : Extraction :
 Date of birth :—Month Day Year Age
 Under 21 years, give name and address of father :

 Single or married : How many dependent on you for support ?
 Names of relatives, if any, employed in Forest Service

 Who shall be notified in case of accident ? Name
 Address :

2.—PHYSICAL CONDITION.

Have you any of the following disabilities ? (Answer "yes" or "no" to each inquiry. In case the answer is "yes," describe fully, using separate sheet if necessary, heading it "In re : 2.—Physical Condition") :

Sore eyes or any defects of vision ?
 Do you wear glasses ? For what reason ?

 Any defect of hearing ?
 Any defect of speech ?
 Any injury, deformity, or defect of hand, arm, foot, or leg ?

 Tuberculosis in any form ?
 Asthma or shortness of breath ?
 Any chest, lung, throat, mouth, or nasal disease ?

 Rheumatism ?
 Paralysis ?
 Rupture ?
 Any bladder or kidney disease ?
 Any disease or infirmity not referred to herein ?

Are you subject to :

Headache (severe), protracted, or frequent ?
 Convulsions or fits ?
 Nervous exhaustion ?
 Palpitation or any disease of the heart ?
 Stomach trouble ?
 Any symptoms of disease or disability not referred to herein ?

Describe fully here all disabilities, defects, or infirmities which you now have or may have had in the past :

.....

3.—PHYSICAL DESCRIPTION.

Submit the following information, carefully filling in all the blanks :

Exact weight, in ordinary clothing, without overcoat or hat.....lb.

Exact height, without boots or shoes.....feet.....inches.

Colour (Give exact colour)	{	Eyes	Texture (describe as fine, medium, or coarse)	{	Skin
		Hair			Hair
		Skin			
		Beard			

All applicants will be required to submit four photographs of self, showing :

- (1) Face in exact profile ;
- (2) Face, front view ;
- (3) Body, full length, preferably with as few clothes on as possible ; and
- (4) Hands, held open with fingers parted, showing back of one hand and palm of other.

Amateur photographs, postal card size or larger, will be acceptable, provided a plain background (such as a sheet, solid coloured screen, or curtain) is used.

4.—SELF-CHARACTERISATION.

Characterise yourself briefly by checking off opposite the following classification of positives and negatives:—

<i>Positives.</i>		<i>Negatives.</i>	
Careful	Good Memory	Careless	Forgetful
Courteous	Obedient	Discourteous	Disobedient
Punctual	Orderly	Tardy	Disorderly
Accurate	Cheerful	Inaccurate	Gloomy
Industrious	Patient	Lazy	Impatient
Sober	Quick	Intemperate	Slow

Give more in detail any particular or special information you desire on any of these qualities, using separate sheet, which you should head "In re : 4.—Self-characterisation."

5.—PREVIOUS EMPLOYMENT AND REFERENCES.

Give following information, covering past 5 years :—

Names of Employers.	Addresses.	Positions Held.	Give Exact Dates of Employment by Months and Years.	State Salary and Reasons for Leaving.

Were you ever employed in National Forest work ?

Under whom ? What Forest ?

How long ?

5.—(a) EXPERIENCE AND TRAINING.

What practical experience have you had in :

Logging Camps
 Surveying
 Timber Estimating
 Reconnaissance work
 (Timber, Grazing, or other).
 Ranger or Guard work

State your educational training as follows :—

Name of School :
 Number of years' work completed :

Subjects studied :

Mensuration :	Silviculture :
Management :	Surveying :
Botany :	Miscellaneous :

Forest Officers Note :—This is a special sheet for applications for Guard positions. Insert in the blanks set out according to the kind of position it is desired to fill.

6.—PREFERENCES AND DESIRES.

What kind of position do you prefer ?

 Locality preferred ?
 When can your services begin ?
 Length of time employment is desired ?
 What salary expected ?

Full signature of applicant :

Date :

It adds: "To judge a man's efficiency, it is necessary that the officer in charge shall have an intimate knowledge of his character, mentality, and ambitions. This can be obtained only by actual contact, and advantage should be taken of every opportunity to get into personal touch with a man and to watch his work in the field. . . . Officers should not hesitate to extend praise for good work, in fact, it can almost always be given without danger. At the same time, errors or lack of industry should be pointed out as soon as discovered."

Again: "The members of the regular force on the forests are not specialists, but must be proficient in all lines of work. Experience is required to develop this proficiency, hence supervisors should give their officers opportunity to obtain wide training and experience, and should make assignments with this end in view."

Thus, it is part of the plan to take rangers into supervisors' offices, supervisors into district offices, district foresters into head offices, for a month or so at a time "on detail"—with a view to enlarging their experience, broadening their outlook, and, consequently, increasing their value to the service.

Meetings of the rangers of a forest are held annually, to keep them in touch with the entire work of the forest, to give forest officers the benefit of one another's experience, and to promote esprit de corps. Supervisors and district foresters' meetings are held similarly.

Finally, as part of their duty, rangers are given instructional assignments during the winter months, consisting of courses of study and reading to develop their efficiency.

It is laid down that "the grade of efficiency demanded by Forest Service work cannot be obtained by the mechanical enforcement of rigid rules such as govern military organisations." A different type of service is required, based upon close observation of the character, ability and experience, and judgment of each individual.

"Instructions, and not orders, should be issued by superiors to subordinates. A dictatorial manner or a lack of courtesy merely arouses resentment and tends to kill the self-respect, self-reliance, and initiative which a good forester must have."

Human nature is the same in Australia as in America, and the tendency in both countries is to depart from the militaristic type of discipline.

"On the other hand, subordinates should carry out their instructions with intelligence, energy, and loyalty, in order that peremptory orders may not become necessary."

"Each man should exercise unfailing tact and comradeship, and the most persistent and conscientious efforts to assist and co-operate with his fellow officers."

"When making personnel assignments, the supervisor should carefully consider the fitness of the man for the particular project. This precaution not only obtains better results, but is more just to the man. No one should be assigned to work which he cannot satisfactorily perform. Fully-qualified men can be obtained, however, only rarely, and in order to ensure the greatest possible degree of success, the officer in charge should see that inexperienced men are furnished with the most explicit instructions. These instructions should cover, not only the methods of doing the work, but should include suggestions as to proper equipment and any other information which may prove of value."

Inability to perform properly the duties of his position involves "demotion."

Disciplinary measures consist of—

- (a) Reprimand.
- (b) Disciplinary transfer.
- (c) Disciplinary furlough.
- (d) Suspension.
- (e) Demotion.
- (f) Compulsory resignation; and
- (g) Removal.

“In taking action, however, it should always be kept in mind that the object is the improvement of the service, and not the infliction of punishment or a means of satisfaction for any error, injury, or inefficiency on the part of a subordinate. Generally, severe measures have no greater influence than light ones, and the policy should be to administer only such disciplinary measures as will protect and maintain the standards of the service.

“It should be remembered also that disciplinary measures will never equal in effectiveness close inspection to prevent misconduct or inefficiency, and that a warning or reprimand administered promptly will, in most cases, render severe measures unnecessary.”

Forest officers, even forest clerks, are required to keep a diary, recording every day's service. This diary is subject to periodical inspection.

“When it is considered desirable by either the district forester or the supervisor, the forest force may be required to accompany the monthly service report (attached) with a brief summary of the diary for the month.”

But the diary is “a record, and not the measure of efficiency, and no criticism of forest officers' actions will be based upon it unless substantiated by investigation.”

On 1st May of each year the supervisor is required to submit an efficiency report on each member of his force; this report includes his annual promotion recommendations.

On 1st April of each year the supervisor submits a report to the district forester, containing—

- (a) A statement of the business of the forest,
- (b) An outline of its organisation,
- (c) An estimate of the allotments and appropriations required during the ensuing financial year.

Generally, the district forester then makes a tour of the forests, enquiring into the matter of appropriation, and finally submitting complete estimates for the district to the forester.

One of the outstanding features of the administration is that, having carefully selected its officer, it trusts him. If his estimates are approved, the

officer has virtual *carte blanche*. The service sanctions his policy by granting him the funds. From district forester down, the same principles apply. Officers are unhampered in their work by red tape or divided responsibility. Responsibility is fixed and centred in the individual. Success or failure is the supreme test.

An ideal atmosphere for effective work has been created. There is a marked *esprit de corps*. The forest badge is worn with a certain pride. Every officer is an enthusiast, he has devoted himself to the cause of forestry, and is striving for maximum efficiency.

The whole Forest Service moves like a machine in an atmosphere of harmony. Every officer is allotted his own particular task, and there is mutual trust and co-operation and esteem.

It is not surprising that development has been so remarkable.

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An Australian Study
of
American Forestry.

Part II

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Part II.—An Australian Study.

CHAPTER I.

FORESTRY EDUCATION.

Close in the wake of the developing forestry movement of the United States of America followed a flood of enthusiasm for forestry education.

In 1898 the first professional forest schools were opened at Cornell University and at Baltimore, almost simultaneously, under the auspices of two German foresters, viz., Dr. Fernow and Dr. Schenck. In 1899 a third was attached to Yale University, and in 1903 the University of Michigan adopted the fourth; after which, forest schools sprang up all over the United States of America like mushrooms in the night.

At the present time there are something like twenty-five educational institutions which give a four-year graduate or undergraduate course leading to a degree in forestry; ten which give a one to three year undergraduate course; and no less than thirty which give a "ranger," short, or general course.

This was really frenzied over-production, tending to overcrowd the profession before it had established itself.

Nor was there a clear conception of the particular needs which were to be supplied. American forestry was in the nebulous formative stage, and no definite lines of development had emerged. The schools hurriedly undertook to train men for work which had not yet been planned!

It is no wonder that the spirit of American forestry was lost in an absorption in European forms. The schools attempted to turn out technically-trained professional foresters, capable of developing far-reaching policies in intensive management of National, State, and private forests, and competent to apply them in actual practice. Confusion and indefiniteness made itself apparent. Great universities impartially and indiscriminately admitted to their graduate forestry courses undergraduates in art, science, agriculture, engineering, and even literature and law!

Plenty of mediocre men were produced, but many of these schools failed to produce real foresters or even men of high technical training. In the great forest regions of the West arose a tendency to sneer at technical forestry and its graduates, who were generally put at the common work of the forest ranger, frequently never rising above it to practise their profession.

It is true that the demand for technical men was limited, and that native force of character and ability counted for more than the highest educational attainment in these developmental days. It is true that "seniority" was a powerful qualification, as in Australia. But it is also true that these new forestry schools did not really supply the type of man required by the pioneering forestry movement.

In 1909 came the first attempt to standardise forestry education in the United States of America. Through the initiative of Gifford Pinchot, the first forester of the United States of America Forest Service, a conference of forest schools was held at Washington, D.C.; to consider "the scope, grade, and curriculum that would afford the best training for foresters of the various grades, and a committee was appointed to prepare a plan for the standardisation of forestry education in the United States of America.

Apart from general instruction in forestry, supplementary to the study of agriculture, &c., or as part of a general education, the committee recognised two distinct grades of forestry training, viz. :—

- (1.) Advanced professional training.
- (2.) Secondary education for forest rangers.

In the first case, it was laid down that the educational requirements should be "at least equal to those of the other learned professions, such as civil and mechanical engineering, law, medicine, &c."

The need for a thorough foundation in subjects of general educational character was clearly realised, and a collegiate training in history, economics, English and foreign languages, as well as in botany, geology, and other auxiliary scientific subjects, was advocated. "It was agreed that the course should comprise at least four years of undergraduate work, and in the case of post-graduate schools there should be at least one year of post-graduate work in technical forestry, making a five-year course altogether."

In the second case, secondary education in forestry was said to be chiefly concerned with rules of thumb and their local application, not requiring as a foundation so high an order of general educational attainments. It aimed at teaching the trade, rather than the science, and giving a practical training rather than an education; and its object to "turn out skilled workmen capable of doing all of the less technical operations required in managing forest lands and of directing unskilled labour, as foremen." It endeavoured to fit men for the positions of rangers, guards, fire wardens, patrolmen, lookout-men, lumbermen, timber cruisers, logging contractors, and managers of woodland estates.

The committee affirmed—

"It must be squarely recognised that the purpose of ranger schools is not to train professional foresters, and that their graduates are to occupy relatively subordinate positions at low salaries!"

The entrance requirements were to be a high school training or its equivalent, good health, character, and physical fitness. The age was to be 18-25 years.

"The course of training was to be one year of forty weeks. The subjects were to be—

- (1.) Fundamental—Fire protection, forest engineering, surveying, estimating and scaling timber, forest botany, elementary silviculture, lumbering, and preparation of forest maps.
- (2.) Secondary—More advanced silviculture, more advanced lumbering, forest insects and diseases, camping and woods transportation, first aid.
- (3.) Special—Elementary business law, State forest law and policy, Federal forest law and policy, elements of bookkeeping, time-keeping, and official accounting, local forest zoology, the protection and cultivation of fish, the protection and breeding of economic wild birds and animals, grazing and other secondary uses of the forest, topographic surveying and mapping, forest mensuration, elements of forest management, utilisation of special forest products, principles of agriculture."

I think that here, once more, there has been blurred conception and false perspective. Once more European forms overshadowed American ideals.

It is true that a hard and fast line between trade and professional forestry-education exists in most of the older countries where forestry has been practised intensively for many years.

It originated, undoubtedly, in the initial endeavour to increase the efficiency of men of ranger-grade already employed, who had had no opportunity for preliminary training. To develop it to the extent of training students solely to perform the work of perpetual subordination, however, is to damn them entirely. To a certain extent, the practice of intensive forestry has influenced the adoption of a distinction; but I view it rather as the product of the European tradition of professions for the aristocracy and trades for the peasantry.

It is incomprehensible that the system should find favour in a democracy such as America professes to be, unless one regards it as due to the fascination of the fetish of European precedent, and the immediate influence of German foresters in the United States of America. Rather should the basic idea be to afford every forestry apprentice an equal opportunity by training to achieve promotion from humble beginnings to the highest positions available to his effort and merit.

During recent years, the trend of feeling has been away from this hard and fast division of forestry into profession and trade; mainly owing to the fact that "full technical training" as defined by the Conference of Forest Schools does not sufficiently emphasise business training and forest economics, and a familiarity with existing conditions.

Forestry to be regarded neither as a profession nor a trade, but as a vocation, and forest schools should "bear the same relation to forests and forestry and lumbering and wood-using industries that a school of mines bears to mines and metallurgy and mine industries, or a school of agriculture bears to farms and the agricultural sciences, and the cultivation, harvesting, and marketing of food stuffs. Such schools will be in part industrial and give vocational training, rather than high professional training."

These schools would have a much wider field of usefulness than either a professional or a ranger school. They would provide the type of men most needed in the present pioneering stages of American and Australian forestry. To use a much-abused phrase, they would furnish the "practical" man rather than the "theorist."

"What such a school should be" is developed by Dorr Skeels in a paper on "Forest Ranger Education," delivered before the Society of American Foresters in February, 1916. He affirms the axiom that it must be determined first by "what a forest ranger should be."

That, of course, depends somewhat upon the country and the century, and the forest situation in particular.

His conception of a forest ranger in the National Forest Service is a man whose "training should be so thorough and broad as to equip him for any of the work for which the eastern schools train rangers, as well as to equip him for any of the work of a more difficult and responsible nature which lies entirely without the province of the eastern school, because the work of a Government forest ranger is a public service of national importance . . ."

"The forest ranger is now an important official of the service. He has charge of a district, the extent and importance of which would be a responsibility and a source of pride to the ober forester of a German State."

"He is not a drawer of water and hewer of wood, but rather an important official, intrusted with the business of organising and operating a forest district. He is intrusted with the care of valuable resources. He directs the work of subordinates and employs and pays wages to labour. The welfare and content of individuals and families, and even of entire communities, or villages or towns, depend upon his judgment, ability, and integrity. He must transact business and meet on a level with men of ability and education and culture. He has to do with the management of land and must be able to make surveys and construct maps and to read them and use them. He has to do particularly with timber, and must understand wood and its uses and values. He must know how to determine the methods and costs of production. While attending to the harvest of the present crop, he must look to the continuity of a future supply. His work is by no means merely that of administration, and is, in no little part, silvicultural. Unless for every dollar paid to the ranger and his subordinates there be paid to overheads a nearly equal amount for supervision and direction, he must understand the basic principles of tree culture and the care and protection of woodlands, and the guidance of their growth and maturity."

"We are by the point when we may complacently dally with the idea that the ranger need be only superficially trained in the practical phases of his work, or that a technical training in the sciences of forestry will leave him unfit to practise the arts of forestry."

"In my opinion, hardly less important to the Forest Service than the quality of the work secured is the proper training of subordinates to assure a sufficient supply of satisfactory men as material for promotion.

"The work of the forest ranger is necessarily largely of an executive nature, and if his training has been sufficient, the very nature of his work is to prepare him for administrative positions of more importance."

Thus is developing the idea that the forest ranger is to be trained in the "theory and principle," as well as the "art and method" of all the primary branches of forestry. Surely this also will be the Australian attitude, both because of its democratic tendencies and because Australian forestry is also in the pioneering stages, and "what a forest officer should be" is much the same in both countries.

The West is to be the place for these great new undergraduate schools of forestry, among some of the vastest forests in the world. Already there are at least two such schools in existence, one attached to the University of Montana at Missoula, of which Mr. Skeels is Dean, and another, its closest rival, that of the University of Washington, at Seattle.

Both of these schools I visited. In the first I gained an intimate view of its organisation and methods—the substantial development of the ideas set forth by Mr. Skeels in his paper above referred to.

Both schools give a four-year undergraduate course in forestry leading to the degree of Bachelor of Science in Forestry—B.S.F.—with a fifth year of specialisation leading to the degree of M.S.F. in—

- (a) Technical forestry ;
- (b) Logging engineering ; and, in the case of the Washington School, also in
- (c) Forest products ; and
- (d) The lumbering business.

Both enjoy equally the advantages of—

- (1.) Situation in the heart of tremendous timber regions, where huge timber-getting operations are in progress.
- (2.) Proximity to large National Forests.
- (3.) Attachment to a university, and enjoyment of the teaching, social, and gymnastic advantages consequent thereto.
- (4.) Proximity to a large city.
- (5.) Generous staffing and equipment, and strong faculties.
- (6.) Present or prospective ownership of large school forests for management.
- (7.) Services of Forest Service experts for instructional purposes.

The Washington School is older and much the better equipped. Its strong points are its Timber Testing Laboratory and wood preservation and utilisation equipment, and its proximity to the great manufacturing, milling, and wood-treating industries of Seattle.

The strong points of the Montana School are its Forest Service courses, and its proximity to the headquarters of District No. 1 of the United States of America Forest Service men, and the district office experts co-operate with it in instruction.

The curricula of the two schools are compared in the attached tables. It will be noted that, consequent upon its specialisation in wood technology, &c., the trend of the Washington School is towards the production of candidates for the lumbering industry. On the other hand, that of the Montana School is towards the production of candidates for the Forest Service.

For which reason it engaged most of my attention.

In addition to providing for those who plan to enter the forest services, both schools have developed "short courses" of instruction for those already employed, who have not had the advantages of a preliminary training, and are desirous of increasing their efficiency.

These courses are of three months' duration, and may be pursued either for one or two years. They are held in the winter, when there is little field work which can be done on the forests. The work is intensely practical and suggestive.

Not only are the forest ranger's needs considered, but also the lumberman's. Suitable courses of study are provided for each type, and opportunities for specialisation are afforded by elective courses from the regular curriculum.

These short courses supply a very practical need and are very largely availed of. Their importance is increasing with every year of work.

The curricula of the Montana and Washington schools are compared in the attached summaries.

CURRICULA COMPARISONS.

FIRST YEAR.

Montana.

1. *General Forestry* : An introduction ; Mensuration—volume and growth estimating.
2. *Geology* : Dynamic and structural ; composition of rocks and soils.
3. *General Botany* : Review of vegetable kingdom ; algæ to ferns ; dicotyledons ; classification.
4. *English* : Composition ; preparation of reports.
5. *Trigonometry* : To right and oblique angled triangles.
6. *Algebra* : Elements of Analytical Geometry and Calculus.
7. *Surveying* : Compass—chain—transit—tape ; computations ; triangulation ; traverse board ; plane table.
8. *Drawing* : Elementary Mapmaking and lettering ; compiling maps ; blue-printing to photography.
9. *Shop work* : Wood and forge—camp carpentry and blacksmithing.
10. *Physical Culture*.
11. *Spring Camp* : Surveying and forestry.

Washington.

1. *General Forestry* : Nomenclature and classification of trees ; introduction to forestry.
2. *Geology*.
3. *General Botany* : Morphology and histology (an entrance requisite).
4. *English*.
5. *Mathematics* : Numerical and graphic methods ; plane triangles ; co-ordinate geometry ; derivatives and integrals.
6. (Algebra is an entrance requisite.)
10. *Drill*.
- 11.
12. *Woodcraft* : Food lists ; camp cookery ; woods clothing ; camp equipment ; first aid.

SECOND YEAR.

Montana.

Forest Management—Forest Engineering.

Surveying : Topog. and Mapping ; Stadia, levelling, slide rule, planimeter, geodesy ; Forest Service methods ; contour maps ; R. R. surveying ; grades and profiles ; highways and bridges.

English or German.

Lumbering : Forest utilisation and exploitation ; properties and qualities of wood, etc. ; wood uses ; timber testing and treatment ; by-products.

Forest Mensuration : Log scaling, lumber, grading and tallying. Cruising : Estimating standing timber, &c. ; volume, growth-date for working plans.

Physics : Mechanics, molecular physics ; heat, electricity, sound, and light.

Botany : Histology, morphology, and physiology and dendrology.

Washington.

Forestry.

Surveying : Engineering, lettering, and map-drawing ; chain, compass, transit, and level.

A modern language.

Forest Mensuration : Log rules ; computing volumes ; form factors ; volume tables ; growth ; sample plot yield tables.
Scaling and cruising.

Physics : An entrance requisite.

SECOND YEAR—continued.

Montana.

Washington.

*Forest Management—Forest Engineering.**Forestry.**Biology : Element- Analytical Geometry.
ary Zoology and Advanced Trigonometry.
Entomology.**Shop Work—Forge
and Machine.***Descriptive Geo-
metry.***Shades Shadows,
and Perspectives.**Spring Camp : Forest measurements and
lumbering.**Chemistry : General.***Mechanical Engineering—Shop Drill.*

THIRD YEAR.

Montana.

Washington.

*Forest Management—Forest Engineering.**Forestry.**Forest Mapping : Compiling topographic
maps ; forest maps.**Forest Topography : Plane table, transit
and triangulation ; Elementary
Railroad Surveying.**Forest Reconnaissance : U.S. Forest Ser-
vice methods.**Reconnaissance.**Lumbering : The industry ; grading ;
marketing and selling ; prices and
freights ; milling methods and mill
study, costs, &c.**Political Science : Elements of economics.**Fire Protection : Publicity ; prevention
laws ; detection ; organisation of
patrol suppression ; fire-fighting
methods.**Tree Diseases.**Highways and Bridges : Their design and
construction ; trail building, &c.**Improvement and Construction : Roads
and trails ; bridges ; cost data.***Silviculture : Forest Silviculture.
ecology and types ;
nursery practice ;
planting.**Silviculture : Forest ecology and types ;
nursery practice ; planting.**Forest Policy : Ad- Graphic Statics.
ministration ; nat. Integral and Differ-
forest laws ; ential Calculus.
classification ; tax-
ation ; organisa-
tion.**Botany : Classifica- Applied Mechanics.
tion of forest trees
of U.S.A. woods.***Mech. Engineering.***Biology.***Forest Management.**Forest Entomology and Biology.***Physics.***Hydraulics.**Physics.***Geology—Physical.***Geology—Mining.***Political Science.***Chemistry.***Chemistry.***Chemistry.***English or German.***Water Supply and
Irrigation.**Railroad Surveying.***Mathematics.***Elective.*

FOURTH YEAR.

Montana.**Washington.**

Forest Management—Forest Engineering.

Forestry.

Forest Management: Forest problems; regulation of forest uses; timber sale contracts; classifications; organisation; personnel; revenue; European systems.

Forest Management: Valuation; finance; administration; management; working plans.

Administration: Organisation of National Forest work; timber sales; grazing; claims; office system accounts; costs-keeping, &c.

Elementary Law Forest Economics.

Improvement and Construction: Headquarters telephone lines; reservoirs and dams.

Forest Appraisals: Costs of exploitation and manufacture; valuation of stumpage.

Silviculture: European silvical systems; working plans; regulation of yield.

Advanced Silviculture.

Forest Pathology: Diseases of timber.

Forest Ecology: Effect of climate and soils on distribution.

Forest Engineering: Hydraulics, stream gauging, water-power plants.

Logging Engineering: Logging methods; application of motive powers.

(Given in fifth year.)

Motive Powers: Electric, steam, and gas engines.

* *Silvics—Review.*

General Lumbering.

* *Forest Geography.*

Cruising and Scaling.

* *System: Botany.*

Zoology: Animals.

* *Physics.*

English.

* *Wood Technology.*

* *Logging Engineering.*

* *Forest Policy.*

Forest History and Policy.

Steam Engineering.

Electrical Engineering.

Mechanical Engineering.

Forest Engineering Course.

FIFTH YEAR.

Montana.**Washington.**

Forest Management—Forest Engineering.

Forestry.

(Montana treats generally as part of Lumbering, second year.)

† *Seminar.*

(Important—Not given by Montana.)

† *Timber Physics*: Wood strengths, &c.

(Part of Lumbering—Montana, second year.)

† *Scientific Management*: Fundamental Principles.

(Montana, second and third years.)

† *Utilisation*: Secondary forest products.

† *Forest Mensuration*: Timber estimating and mapping.

(Montana, fourth year.)

† *Forestry*: Advanced dendrology.

† *Advanced Forest Management.*

Logging Engineering.

Forest Engineering Course.

* Elective.

† Forest Management Course.

It is axiomatic that what a forest school should be depends, in the first instance, upon what its graduates should be: its constitution depends upon its objects.

The essential purpose of projected Australian forest schools is to produce officers for Forest Service work not as it is now nor as it will be in a far distant future, but as it should be for the extension of efficiency in the handling of immediate problems. Its especial task is to train men to carry out the practical work of forest rangers and overseers; but with such a professional foundation that they may expand that function to a broader and higher phase, and with due experience qualify for promotion to the superior grades of the forest service, where they will be called upon to handle weightier matters and solve the more complex problems of forest administration.

The immediate problems of Australian forestry are those mainly of organisation, investigation, and standardisation.

The making of topographical surveys and forest classifications and valuations, the preparation of forest maps, the planning of forest protection and improvements, logging engineering, the appraisal of stumpage values and consequent logging and milling studies, the development of timber sale policies, forest mensuration and finance, forest laws and regulations, administrative methods and systems, the study of silviculture, of problems of natural and artificial regeneration and of forest tending, the development of silvicultural systems, the working out of marking rules and conditions of exploitation, the study of trees and their growth, of little-used woods and products and their extended utilisation, timber grading and seasoning, inauguration of modern logging and milling procedures, regulation of forest grazing, publicity and education of public opinion, labour-saving and efficiency engineering, the planning and standardisation of methods and the development of systems, the conduct of general research into all matters of forestry expansion and the publication of the results; and finally, the preparation of text books on Australian forestry—these are some of the questions demanding the attention of the Australian Forestry Schools and their trainees.

In organising the forest school in the Philippines, the "necessity for research work was felt from the beginning, and every effort was made to accomplish as much as the limited funds and personnel would permit. The work was placed in charge of a division of investigation attached to the forest school, to which was attached a forest of 15,000 acres offering many local opportunities for local research work, and affording a demonstration ground for the students. Here are located a forest nursery and tree plantations maintained largely by student labour. The members of the division of investigation constitute the teaching staff of the school." (Major G. P. Abern before the Society of American Foresters—December, 1915.)

Of an original forest area of 800,000,000 acres, the United States of America Forest Service now holds only 164,000,000 acres. The balance, comprising the greater part of the forest estate, is in the hands of large timber corporations who secured them for a song in the earlier days. The springing-up of forest schools throughout the country was in large measure a direct response to the needs of these timber companies who required foresters to manage their lumber-lands. The Forest Service came later.

As a consequence, the forest schools are all either private concerns or off-shoots of universities, and, although there is a Forest Service section of research, there is no purely Forest Service scheme of staff training.

Forestry in Australia is essentially a Governmental concern. We are in the early stages of pioneering, and our first functions, therefore, are to solve the silvicultural problems besetting us, and to build up forestry staffs capable of establishing effective silvicultural systems. Each State Forest Service must have its department of research, its experiment stations, and demonstration forests, its nurseries, its administrative headquarters. It must have a staff competent to carry on investigations and administer the forests.

But education and research go hand in hand, and considerable advantages flow from the combination. Economy is the first of these, but, further, the concentration of these functions at the centre of training would permit also of the appointment of a much stronger faculty, and the provision of much larger equipment than otherwise would be possible. Moreover, the students would have the opportunity of intimacy with Forest Service tasks, and could be employed in furthering actual Forest Service work.

The function of an Australian Forestry School, therefore, should be not alone instructive, but also investigative and experimentative. In some measure at least, it should be a clearing house for new ideas and systems which it is expected to incorporate into forest practice. Its director should be a forest officer in close touch with current Forest Service administration.

The officers of the Forest Service should be available as special lecturers or field instructors.

The School should be located on a State forest and at the headquarters thereof, within easy walking distance of a town, and in the centre of logging and milling operations. If possible, it should be associated with a forest nursery and experiment station and a demonstration forest and arboretum.

Its equipment should include a herbarium and museum, forest library, research laboratory, log deck and timber collection, a small forest nursery and arboretum, drafting and lecture rooms equipped with gas and water, workshop and gymnasium and recreation grounds, the most modern surveying and timber cruising instruments, microscopes and cameras, logging and milling apparatus, modern furniture (constructed of the lesser-used native woods), filing cabinets, map files, typewriters and desks, mimeographs (Edison No. 76), office materials, drafting materials, bushcraft materials, Forest Service books, forms, maps, &c.

In the platforms of both Federal political parties for years past has appeared a plank relating to the establishment of a Federal Bureau of Forestry. Whether forestry in Australia ever becomes a Commonwealth matter or not, it is probable that a forest school and institute of research will be needed in each State. That is the tendency of the day. The Commonwealth, however, holds forest lands in Papua and the Northern Territory, which it must place under expert management in course of time. Until the population of these Commonwealth areas becomes sufficiently large, it will be impracticable to place a forest school within the Territory. In view of the identical forest problems of Queensland, the most appropriate arrangement would be to have the Commonwealth staff trained at the Queensland school.

The training should consist of a three or four years' undergraduate course for cadets, and one or two (three months') short courses for officers already in the services.

The term should be one year of forty weeks, with a month's vacation at Christmas, and two months' field work in the winter or early spring, when assessment and nursery work, &c., are in full swing.

The students should be not less than seventeen years of age, of good health, character, and physique, and with educational attainments equivalent to those required for entrance to the public service or for the junior university examination. It is desirable that they should include elementary biology, zoology and geology, mathematics, physics and chemistry in their training. The prerequisites for admission to the Washington School are—English, algebra, plane and solid geometry, physics, history, botany, a foreign language, and an elective subject.

The conditions of entrance should be on an apprenticeship basis with compensation.

Preference should be given to junior clerks and cadets already in the services.

A syllabus is suggested in the attached draft. Largely, it is a matter of development, and should be elastic enough to permit of alteration from time to time. The details should be left to the determination of the Principal of the School.

Forest surveying, reconnaissance and mapping, and the preparation of working plan reports are the strong needs of the Forest Services, and should be features of the course. As the timber sale policy extends, as the State enters more intimately into relations with the timber industry, as it advances further and further into the realm of practical and educative forestry, it will be requisite to develop a scientific system of stumpage appraisals, to know the timber business from beginning to end, to educate the industry to better methods. Lumbering, stumpage appraisals, and logging engineering are important subjects to be taught. Possibly special courses therein could be provided for men interested in the timber industry. The new science of management should be regarded as an essential part of the subject of forestry administration, which should deal with all branches of Forest Service routine. Silviculture, forestry, and botany are fundamental subjects, and their teaching should be spread over the whole three or four years' course. Bushcraft and everything relating thereto should be dealt with in the first and second years.

AUSTRALIA.

FIRST YEAR.

Forest Botany—The vegetable kingdom:—

- (a) The forest and the trees; nomenclature and classification of timbers, and forage and useless trees—typical species.
- (b) Ecology, forest types, forests as a whole, silvical characteristics, forest regions.

Forestry—

- (a) The Forest Service, the forester, the forest.
An introduction to forestry.

- (b) Introduction to forestry economics—forests as a resource; history of conservation; forests and climate; soils, &c.; indirect utilities.

Bushcraft—Camping and transportation; veterinary science; carpentry; first aid, &c.; food lists; camp cookery; camp equipment.

Scientific Management—Principles and examples; labour-saving; application to forestry.

Surveying—Elementary. Strip surveying—chain and compass; transit, stadia, plane table; triangulation computations.

Mapping—Elementary. Map-making; compiling maps; lettering; blue printing to photography.

Trigonometry—To right and oblique triangles.

Shop Work—

Military Drill—

Winter or Spring Camp—

SECOND YEAR.

Lumbering—Wood technology and identification; wood-uses; timber-testing and treatment.

Exploitation and utilisation.

Geology—Dynamic and structural; rocks and soils.

Forest Mensuration—Log rules and scaling; computing volumes, instruments; standing timber; form factors; volume tables; field tables; sample plots; cruising.

Botany—Histology, morphology, and physiology of dicotyledons.

Bacteria to phanerogams.

Surveying—Topography—Abney and barometer; levelling; stadia, slide rule and planimeter; Forest Service methods; railroad surveying; grades and profiles; highways and bridges; survey of a forest in second or third years.

Mapping—Topographical; forest maps.

Forestry—Forest history.

Biology—Elementary. Zoology and entomology.

Bushcraft—A continuation.

Silviculture—Development of forests—their care and protection—fire, insects, disease, wind, drought, &c., grazing.

Military Drill—

Camp—Forest survey and valuation.

Elective Chemistry—

THIRD YEAR.

Physics—Mechanics; molecular physics; heat, electricity; sound and light.

Silviculture—Seeds and seedlings; nursery practice; transplanting and planting. Natural regeneration in the forest. Silvicultural systems; cutting systems; improvement.

Forest Reconnaissance—Field practice in Forest Service methods; valuation surveys.

Forest Mapping—Compiling topographical maps; forest maps.

Lumbering—The industry; grading and tallying; marketing and selling—milling methods and mill study—sleeper and girder getting, &c.; freights—costs.

Forestry Administration—Forest classification; working plan reports; headings for reports; report writing; office methods—bookkeeping, filing, &c., costkeeping.

Forest Engineering—Improvements and constructions; roads, trails; bridges; buildings; reservoirs, dams.

Military Drill—

Winter Field Work—

Seminar—

FOURTH YEAR.

Forestry Administration—Forest problems ; regulation of forest uses ; timber sale contracts, &c. ; revenue ; organisation and personnel ; forest laws and policies. Evidence—cases ; police court procedure ; routine work ; probable lines of development.

Silviculture—Silvical systems ; working plans ; regulation of yield ; management ; finance.

Forest Appraisals—Costs of exploitation and manufacture ; valuation of stumpage.

Logging Engineering—Operative cost factors ; logging plans and machinery ; applied mechanics ; motive powers (electric, steam, and gas engines).

Grazing—

Military Drill—

Seminar—

Investigation—

Thesis—

Geology and physics are other necessary subjects. A certain number of electives should be added.

As far as possible, the method of teaching should be "centrifugal" rather than "centripetal," opening with the broad phases of forestry and developing the technical details subsequently—the natural method by which one learns most things in life. The conventional one of "laying a foundation" of technique is unnatural, and tiresome to the student.

The staff would consist, probably, of the following members:—

1. *A Principal*—

Controlling the local policy and administration, subject to the Director of Forests.

He would be lecturer also in, say, forestry, silviculture, dendrology, forest reconnaissance, appraisals, administration, scientific management, lumbering, and forest mensuration, grazing, and bushcraft.

2. *A Forest Engineer*—

Lecturer in forest surveying, topography, and mapping ; higher mathematics, physics, logging and forest engineering.

Assistant lecturer in lumbering, forest reconnaissance, mensuration, administration, and bushcraft.

Investigator and compiler in the above subjects.

Consulting engineer for the Forest Service.

3. *A Science Master*—

Preferably a technical forestry graduate.

Lecturer in botany, dendrology, biology, and geology.

Assistant lecturer in silviculture, forestry, and grazing.

Investigator and compiler ; in charge of herbarium and library.

4. *A Forest Assessor*—

Assistant lecturer in bushcraft, scaling and cruising, forest assessment and surveying, lumbering and administration.

Supervisor for the school forest.

Investigator and compiler—in administrative problems, logging, milling, appraisals, and general forest studies.

5. *A Secretary*—

General record and correspondence clerk, stenographer, mimeographer and compiler, &c.

6. *Special Lecturers*—

Visiting scientists and experts.

Local and visiting forest officers.

Local high school teachers to teach languages and elective subjects.

Local doctor, to teach first aid.

7. *General Labour*—

A cook.

A nursery labourer—to act as assessor's assistant, planter, gardener, and handy man at the school.

Cook's assistant and house help.

A rough sketch of the general outlay involved under this scheme indicates a capital cost of £3,400, and an annual maintenance charge of much the same amount, *vide* the following:—

Capital Cost—

Principal's residence	about £800
School—2 lecture rooms, 2 offices, a herbarium and museum, &c., and a large drafting room	600
Six bunk-houses and bath-houses	500
Kitchen and dining hall	200
School equipment and furnishing	250
Tents, tools, and field equipment	100
Additional residence	500
Water supply and small sawing and seasoning plant	300
Clearing and laying out grounds	150
Total	£3,400

Maintenance Cost—

Interest on capital at 6 per cent.	£204
Salaries:	
Principal	600
Forest engineer	400
Science master	300
Forest assessor	300
Visiting lecturers	200
Labour	500
Students (12) allowances, at 10s. per week	312
Food, &c.	500
General	184
Total	£3,500

In considering these figures, it must be remembered that the scheme provides not only for the training of cadets, but also for short courses for officers already employed; and, not least, the carrying out of investigative, experimental, and planning work in practical administration problems.

The figures provide for the keep of the students, and an allowance of 10s. per week.

An alternative scheme would be to eliminate the board and residence provision, and arrange for such in the adjacent town.

The cost of the two months' field work provided for in the curriculum is not included in the annual charges, because it is believed that it will be more than balanced by the value of the work accomplished.

It is possible that arrangements could be made to distribute the students among the assessors, experimentalists, or general field staff as winter assistants for special survey and assessment projects, with the incidental aim of affording actual bush experience.

If board be provided, arrangements should be on the cafeteria, or self-waiting principle.

As regards the forest engineer, I recommend the despatch of an Australian graduate in engineering to the United States of America for a special course in forest engineering; alternatively, the employment for a term of five years of an American forest engineer.

An essential part of the scheme of forestry education is the short course of instruction for officers already employed.

In fact, the first work undertaken by the school might be a "short course," so that the ambitious element to be found in every Forest Service may be fitted to at once advance the immediate aims of the Forestry Department, and develop a higher phase of work.

The training might be given in the summer months, when field work is least pressing and inviting. It should consist of three months' instruction on the lines adopted by the Montana and Washington schools, *vide* the attached summary.

The course should feature forest survey and assessment, scientific management as applied to forest administration, forest mensuration, and forest appraisals.

A second year short course could be furnished later, if found advisable.

Short Courses—Curricula Comparisons.

Ranger.

FIRST YEAR.

Montana.

Washington.

	<i>Silviculture</i> : Tree requirements; regeneration; systems of cutting nursery work and planting.
<i>Scaling and Cruising</i> : Scale rules; defects; cruising.	<i>Forest Measurements</i> : Log rules; heights and diameters; volume tables; scaling and cruising.
<i>Surveying and Mapping</i> : Instruments; levelling; map-making.	<i>Forest Surveying</i> : Engineering drawing; topography, and map drawing; chain, compass, level, clinometer transit.

Ranger.

FIRST YEAR—continued.

Montana.

Geology : Dynamic and structural ; principal rocks and soils.

Forest Administration : The natural forest and the ranger.

Tree Diseases.

First Aid.

English.

Elementary Mathematics.

Advanced Trigonometry, &c.

Washington.

Geology : Common minerals ; soil classification ; ore samples and mining ; lode and placer work.

Characteristics of Trees : Identification and classification ; distribution and use.

Forest Administration ; Policies and methods.

Forest Botany—*Morphology and identification.

Forest Law : Interpretation, precedents, trespass, evidence.

Diseases of Trees : Fungi and decay.

First Aid : (Local Doctor.) Bandages, shocks, bruises, cuts, burns, and poisoning.

English : Composition.

SECOND YEAR.

Montana.

Botany and Silviculture : Classification of trees ; the growth and distribution. Silviculture systems.

Advanced Topographical Surveying and Contours, &c.

Lumbering : Wood—Utilisation ; logging engineering.

Logging Engineering.

Physics.

Forest Appraisals.

Insect Control.

Hydraulics.

Seminar.

Fire Protections.

Forest Improvements.

Grazing.

Washington.

Silviculture : Ecology ; *Lumbering.* forest regions and types ; silviculture systems of management.

Forest Measurements : Forest measurements. Volume tables ; valuation surveys ; annual growth.

Forest Surveying : Forest Surveying. Traversing, triang. and topo.

Forest Management : Compound interest ; valuation ; rotation ; taxation.

Logging : Logging machinery and railroads ; topo. maps and surveys. *Logging.*

Wood Utilisation and Preservation : Wood utilisation. Properties and uses of woods ; problems in wood preservation.

Forest Economics : Forest Economic problems *Economics.* in re lumber industry.

It is not possible to release the supervising staffs for three months, but every candidate for the position of forest assessor should be required to take the course before appointment. The forest assessment staff should be increased very largely in view of the amount of forest organisation work to be done.

* Elective first and second years.

In this way efficiency methods would be most quickly diffused throughout the Forest Service and the consequent development would be rapid.

The alternatives are eventual replacement by younger and better-trained men, which would not be fair to the older officers—the American policy—or the postponement of new methods until the older officers had left the service—which would not be fair to the public.

CHAPTER II.

U.S.A. TIMBER SALES POLICY

“For the purpose of preserving the living and growing timber and promoting the younger growth on forest reservations, the Secretary of Agriculture, under such rules and regulations as he shall prescribe, may cause to be designated and appraised, so much of the dead, matured, or large growth of trees as may be compatible with the utilisation of the forests thereon; and may sell the same for not less than the appraised value.” (Act of June 4, 1897.)

This is the authority under which the timber on the United States of America National Forests is disposed of. It is a sales, not a royalty system such as we have at present in practically all the Australian States with the exception of Queensland.

Of the timberlands of the United States of America, only one-fifth are National Forest—the remainder are privately owned, generally by large lumber companies; they compete with the National Forests, and practically dominate the market. The Forest Service has not a monopoly and is not compelled to dispose of its timber willy nilly. For some years after the dedications were made, in fact, timber was held in reserve and no sales whatever were negotiated.

In this respect the situation differs from that of Australia, where the Government forests control the market by possession of a virtual monopoly, and by reason of that fact and the shortness of the supply are forced by the public demand to market their timber resources whether they feel prepared to do so or not.

The United States of America timber sales policy is controlled by a special office of silviculture of the Forest Service. Originally based on European technique, it has been compelled to come to American earth by the exigencies of the situation and the period, and is now a very practical present-day policy. Measured by the Australian standards of the moment, it is elaborate, yet as compared with the intensive methods of the Continent, it is a very “extensive” scheme.

The Act of 1897 provided that National Forest timber may be sold “at not less than the appraised value.”

Whence developed the science of appraising timber stumpage on the National Forests.

A topographic strip survey and timber assessment on similar but much more detailed lines than those followed by us form the basis of operation.

This provides four maps, which show—

- (1.) Topography, culture, and improvements.
- (2.) Timber types and age classes.
- (3.) Timber estimates by 40-acre sections.
- (4.) The projected improvement plan.

Armed with these and estimates of the timber stand, the Forest Service logging engineer visits the site of the proposed sale and proceeds to make an investigation of its possibilities.

He considers the silvical requirements of the site, the rules for the marking of the trees which may be felled, the question of brush and waste disposal, and protection of the young growth, and the methods of cutting prescribed by the Forest Service.

He then "determines the boundaries of the sale area, eliminating unmerchantable timber and ground on which logging is impracticable, the proportion of each species which can be cut under the methods of marking established for the chance or forest type, and the estimated cut by species and lumber grades."

He works out the general scheme of exploitation which should be adopted, the size and type of the mill, and the duration of the operation. He locates the main artery of log transportation, whether driveable by stream, railroad, sledge road, or flume, and projects the logging spurs, chutes, and skid roads.

He then divides the area into exploitation units and computes for each the cost of felling and skidding from the stump to the landing.

He works out the costs of the whole enterprise and its upkeep, and calculates the operating expenses from logging and transportation to manufacture.

Finally he considers the quality of the timber and ascertains the value of the manufactured product in the available markets.

He calculates what may be a reasonable profit for the purchaser, depending on the size and permanency of the operation and the degree of hazard attending it. Twenty per cent. on the investment is adopted as a general standard.

Having made an intensive study of investments, costs, and profits, with all the data before him he determines the stumpage rate on royalty to be charged, that is the actual value of the timber as it stands on the stump on the sale area. The logging chance is then submitted to public competition.

The cost of brush disposal, protection of the young growth, methods of cutting and other requirements of the Forest Service, is duly allowed for in arriving at the decision.

Such is the science of stumpage appraisals as developed by the United States of America Forest Service in an endeavour to determine the market value of the timber in its forests.

Queensland incorporated the principles of this system in her timber sale policy from the outset.

The New South Wales practice of charging a fixed royalty is one purely of expediency and must disappear with the establishment of business forestry. It has served its purpose, but must be replaced in the very near future by a well-considered plan of timber valuation leading to a selling rather than a taxation policy.

The adoption of "super-royalties" in the north-west district of New South Wales is a successful attempt to initiate a rudimentary selling plan. Its development along similar lines to those of the United States of America appraisal scheme is necessary.

As far as practicable, appraisals are made in anticipation of applications and in connection with general reconnaissance work. It is the duty of officers to ascertain the areas most in need of cutting, to have them ready for sale, and direct applicants to them.

An important aspect of the American method is that it is but a very short step from planning and regulating a logging enterprise to actually managing it. I think that within ten years the United States of America Forest Service will have taken that step, and that a possible development should not be lost sight of in our own forestry plan.

For each forest minimum selling prices are prescribed, which represent approximately "the point at which it is believed wise public policy to withhold timber from sale rather than to sell it at the market value then obtainable." Such minimums, however, do not apply to dead, fire-damaged, insect-infested, or badly diseased timber, which is sold as soon as possible and at rates which will induce its removal before serious deterioration or spread of the damage to other timber occurs. These minimums are fixed by the district forester.

Similarly the purchase of overmature and inferior timber is encouraged, and when necessary, the less mature areas are withheld until such timber has been cut.

Every contract exceeding five years provides for the readjustment or reappraisal of stumpage prices, generally every three years.

Timber must be advertised for sale. The purchase is completed by the making of an agreement between the Forest Service and the operator, and the entering of the latter into a bond of from 5 per cent. to 10 per cent. of the value of the timber sold, for the due observance of the conditions of the contract. The purchaser must submit satisfactory evidence of his financial ability to conduct the operation and fulfil the terms of the agreement.

The welfare of the future stand is the main consideration in every timber sale contract. The desires of the purchasers are carefully considered, but the silvicultural needs of the forest are regarded as paramount. The aim is to obtain the best forest conditions possible, and a utilisation as complete as circumstances permit. No sale is made unless it is practicable to specify methods of cutting and brush disposal which will retain a sufficient stand for protection, and a future cut, or which will ensure the restocking of the cut-over area with desirable species.

There is no such thing in American practice as a fixed minimum girth, which is also a rule of expediency, and insufficiently flexible for effective silvicultural management.

The general rule is to retain from 5 per cent. to 10 per cent. of the merchantable timber in volume for reseedling in connection with clear cutting, and from 25 per cent. to 40 per cent. for a future stand where partial cutting is adopted.

No tree may be cut under any consideration unless it has been marked for felling by a forest officer.

Marking is regarded as of the utmost importance, and takes precedence over ordinary administrative routine. A marking board consisting of the district forester or chief of silviculture, the forest supervisor, the forest assessor, and the officer who is to be in charge of the sale mark representative areas and establish the methods to be followed.

The system of marking and the proportion of timber to be cut is explained to the purchaser by marking sample areas before the contract is executed.

The requirements of the contract are also explained, and the officer who prepares the agreement is held responsible for its clear understanding by the applicant.

The marking is checked before the sawyers leave the logging unit, in order to designate additional trees which have been overlooked.

It is the policy to secure the closest utilisation practicable, even if the same financial returns might be obtained for less material.

"Merchantability" is defined very precisely and every timber sale contract contains exact specifications of the material of which utilisation is required.

Standard clauses are those requiring the cutting of all marked or dead trees which contain one or more merchantable logs; or which are of a sufficient height to constitute a fire menace, or which are diseased.

Low stumps, and the lopping, piling or scattering, and burning of brush and waste are other standard requirements.

The Timber Sale Contract is a lengthy and formidable document and contains many conditions and restrictions. I was able to bring back with me several sample copies of such agreement, which in the essentials are identical with those used in connection with the "super-royalty" and special licence schemes of New South Wales.

Contracts may provide that in addition to the stumpage purchased, a specified area will be reserved from sale until the termination of the contract and then appraised and advertised for sale. As far as possible, the rate at which timber is sold from any area is such as to ensure a reasonable operating life for new mills constructed in connection with sales. But the mill power is accommodated to the yield, not the yield to the mill.

One interesting proviso is contained in the following direction:—

"Where partial cutting is practised, the less destructive of the known and practicable methods of logging will ordinarily be required. Specifically steam logging will usually not be permitted in partial cuttings where horse logging is practicable. The introduction of new logging methods will not be permitted except after satisfactory showing that they are no more destructive than the former methods."

No timber may be cut under any sale contract until it has been paid for!

A deposit must accompany every bid for advertised timber, sufficient to cover the value of the results of two months of active logging. An amount must always be on deposit large enough to ensure against overcutting. Purchasers are notified well in advance when an additional deposit is required.

Failure to make prompt payment upon request is cause for suspending operations.

No timber cut under any contract may be removed from the cutting area until it has been measured and branded.

The Forest Service employs scalers who do nothing else but scaling. Measurement is according to the Scribner Decimal "C" rule, which by measuring the small end diameter and the length gives approximately the sawn output. Scaling by this method is quick and cheap. With the modern band saw, the output often exceeds the scaled contents slightly—an overrun; but it is a method which might be adopted in Australian practice with advantage.

Every log must be numbered and the measurement entered against its number in the scaling book. Logs are measured generally in the standard 16 feet lengths.

In order to produce uniform methods of log scaling, a check scaler is employed to check the measurements of the other scalers who are required to approximate to his standards. Curves are prepared to show divergencies from the check scaling.

Complaints are settled by a check scale. Additions in the scale book are checked in the supervisor's office.

Weekly cutting reports are submitted to the supervisor. These are compared with the timber sales record card for errors in entries brought forward from the last report and for correction of the rates. The total value of the cut to date is checked with the total deposits, to guard against cutting in excess of payments.

A report of timber sold or cut is forwarded monthly to the district forester, who submits a similar report to the forester, giving quantities and values for each forest.

Timber sales are divided thus—

By amount—

Class A—Ranger's sales—not exceeding £20 in value.

Class B—Supervisor's sales—not exceeding £20 in value.

Class C—Supervisor's sales—exceeding £20 in value.

Class D—District forester's sales up to 30,000,000 feet.

Class E—Forester's sales over 30,000,000 feet.

By advertisement—

Unadvertised—Not exceeding £20.

Advertised—Exceeding £20.

Ranger's sales and supervisor's Class "B" sales may be made by estimate in lieu of appraisal.

A maximum annual or periodic cut is fixed by the Minister for every forest, with a view to restricting the amount removed to the current production, i.e., a sustained yield basis; and also to conserve the supply of timber required for local use.

The established limitations are reviewed annually by the district forester, but remain binding until changed by order of the Minister.

It is the policy to increase the cut up to this maximum. Market surveys of each district are made, showing local consumption and sources of supply; and data on specific areas are furnished to possible purchasers.

Forest supervisors and examiners (assessors) are required to make frequent personal supervision of sales. As far as possible this supervision is supplemented by systematic inspection by members of the district office.

A systematic record is made of the conditions of each sale area and the action taken by officers.

A regular part of the administration is an intensive study of all cutover areas. The results of cuttings are checked as to windthrow, efficiency of protective measures, success of reproduction, and encroachment of brush, &c.

The sale of forest products not specifically covered by regulation is conducted by the forest supervisor.

The development of timber sale policies in Australia lies along the lines adopted by the United States of America Forest Service, and already initiated in Queensland.

Cutting on other areas than State forests should be encouraged, pending establishment of a sales and silvicultural system on the State forests.

CHAPTER III.

MODERN TIMBER GETTING AND MANUFACTURE.

SCIENTIFIC POWER LOGGING.

Despite high freight charges, high duty, and somewhat higher wages, America is able to produce timber so cheaply as to be in a position to compete in Australia with the home product.

The average mill price for all kinds of timber in America in 1912 was 6s. 4d. per 100 feet, while Oregon was only 4s. 10d. ! In Australia, the average price is between two and three times this amount.

My impression before visiting America was that floatable woods and permanent streams were the secret of this cheapness of production.

I found that America was abandoning very largely the method of water transport in favour of railway carriage.

I saw the Columbia River in a flooded state with the banks clogged with stranded logs which it would never pay to extricate; only odd logs were floating down stream. I was told that the actual loss in log scale from sunken, stranded, and damaged timber varied from 10 per cent. to as high as 40 per cent. of the logs despatched.

The secret of cheap timber lay actually in the adoption of scientific power logging, now universally employed in America. The logging engineer is an outstanding figure in the lumber industry, and logging engineering has become a distinct profession.

America had originally about 850,000,000 acres of forest and approximately 5,200,000,000,000 feet of timber. The stand per acre was heavy. Clean cutting was largely adopted. There were no girth restrictions. Lumber companies possessed large timber holdings.

These conditions made possible a gigantic scale of timber exploitation, and induced the development of power logging.

Such ideal conditions for power logging are infrequent in Australia; nevertheless, timber-getting methods are capable of very great improvement, and much can be done to cheapen timber production, and by consequence to increase royalty values for the State.

The basis of the American logging system is the logging railroad.

Pole roads with animals as draft power were the first adopted owing to their cheapness and low cost of maintenance. They were primitive devices and are now obsolete.

Stringer roads having sawn wood or steel rails, and possessing larger capacity succeeded the pole roads.

The first steel road was built in 1876 in Michigan, since when steel logging railways and power traction have found favour all over the country.

It is interesting to note that the Shay locomotive was designed for logging purposes, by E. E. Shay, a Michigan timber exploiter.

Location of the road is of the first importance. A topographic map, such as results from a close strip survey, is regarded as essential to the road scheme which is the especial work of the logging engineer. It is felt that even a good railroad engineer without logging experience is unsuitable, since he is generally unable to subordinate his ideals regarding standard railroad construction to the demands of practical logging. Timber railways generally are cheaper than trunk lines because of sharper curves and higher grades.

Plans for logging roads prepared by the Forest Service engineer in making his appraisals are available to the operator, but he is at liberty to follow his own schemes so long as they are not of detriment to the forest.

Transport of the timber from the stump consists of—

- (1.) Assembling the logs at a dépôt (skidway) near the point of felling.
- (2.) Hauling the logs to the railway landing.

The two may be combined.

The logs may be snigged by animal power without vehicles to a dépôt 500 or 1,000 feet away, or, on prepared ways, up to a mile away.

For longer distances, sleds or wagons are used.

On the Pacific Coast of America long distance snigging has been replaced largely by power skidding, of which the slack rope and cableway systems are the chief types.

The slack-rope system requires a heavy pulling cable and a lighter messenger cable for returning the main cable from the skidder to the point from which the logs are dragged.

A landing is built at a suitable spot along the railroad and a donkey engine installed at one end of it. When the area tributary to this location is exploited, the engine is removed to the other end of the landing. The messenger cable is carried out to the end of a run, six or eight runs ahead of the end in which the yarding is to begin; it is then taken to the end of the first run that is to be logged and brought along that run to the engine, where it is connected to the main cable. At the angles it is held in position by snatch blocks. The placing of the messenger cable, several runs ahead, obviates a frequent change of position and also keeps it out of the way of the logs as they are being hauled in.

The cableway system consists of a wire cable suspended between tall supports 600 to 1,000 feet apart. On this cable travels a trolley operated by an outhaul cable and a skidding line which is attached to the log. The logs are dragged half elevated.

Exploitation rotates round the near support, and some eighteen or twenty far supports are employed for each set up. An area of 25 or 40 acres is dealt with from one set up.

This system is advancing in favour very rapidly. It has been employed on the Pacific Coast with marked success for handling small and medium sized timber. It is said that the cost of logs on the car is about one-third less than for similar timber logged under the slack-wire system.

An advantage from a forestry point of view is that this cableway system is the only system of power logging yet devised which is not extremely destructive to seedling growth. It has the defect that it damages standing timber.

CABLE WAY SKIDDING

Oil fuel is used extensively in donkey engines in lieu of coal and wood. It is claimed that the forest fire danger is diminished by the use of oil fuel, and the efficiency of the engines is increased 15 per cent. to 25 per cent., thus achieving a considerable reduction in logging expenses.

The "snaking" system, such as is being used at Woolgoolga, New South Wales, is a third method, not so largely employed in America.

THE BONNER SAW MILL.

Aerial tramways are used on steep slopes where other forms of transport are not practicable.

Timber slides and chutes are very often employed down slopes. On the Pacific Coast, chutes are built at the terminus of a skid or pole road where the logs are dumped into a stream.

Traction engines are used for transporting logs where the amount to be hauled is not great enough to warrant the laying down of a railroad, where the grades are unfavourable for the use of animal power, or where timber of large size and weight is to be handled.

A novel engine is the Holt caterpillar gasoline tractor, which has a tread chain traction device in place of back wheels. It is suitable for use on soft sandy roads, weighs eight tons, and can carry 18,000 feet of green lumber over 12 per cent. to 14 per cent. grades at $2\frac{1}{2}$ to 5 miles an hour. It uses 2-4 gallons of kerosene or gasoline per hour, and carries a fuel tank of 70 gallons and sufficient water for four or five days' running.

This traction seems to solve the problem of timber exploitation in the Pilliga Forest, New South Wales, where the stand is too light for railroad construction, the distance too great for bullock haulage, and the roads too soft and the water too scarce for the ordinary traction engine.

An average lumber camp has a crew of about sixty men, and employs about thirty horses.

Some of the modern camps are quite elaborate. One of them—the Cherry Valley Camp—provides spring beds, hot and cold baths, laundries, and electrically lit libraries and reading rooms for the crew.

The aim of this camp betterment scheme is to hold the workers interested and content, and to maintain a permanent crew at a maximum standard of efficiency, and so secure the biggest possible cut.

The modern American sawmill is one of the most remarkable examples of American engineering efficiency.

Location alongside permanent and plentiful water is essential, largely with the object of water storage for the logs in the mill pond.

The railroad track where it is parallel to the edge of the mill pond is laid at an angle which sets the outer rail 12 to 15 inches above the inner rail. The trucks thus are tilted to one side, and when the car stakes are removed, most of the logs roll out into the pond.

I visited the Bonner mill of 700 h.p. in Montana, situated 25 miles from the logging area. Sawing was proceeding at the rate of 750,000 superficial feet sawn output daily, and there was stored in the Blackfoot River beside the mill a four months' supply of logs! They were piled up in a water area extending beyond sight and then almost obscured the surface.

Americans excel in method. Their enterprises are planned carefully. They have a passion for detail and efficiency.

Nowhere is this exemplified better than in the running of a large sawmill.

From the mill to the log pond extends a chute carrying a great hauling chain studded with "dogs." Log drivers on the logs in the water push them against the chute. They are seized automatically by the "dogs" and lifted one after another, in a seemingly endless row, up the chute into the mill, streams of hot water spraying them clean as they go. The logs are sawn with the bark still on. At the top of the chute the log-scaler measures them with the simple and effective Scribner Decimal "C" scale stick, digs out any stones,

A FOUR MONTHS' LOG SUPPLY.

&c., from the bark, and records the measurements, as they move. Another man standing at a lever diverts the logs on to one or other of the slanting platforms alongside the travelling benches. Thence they roll to the bench, which moves quickly up and down, carrying the log to be sawn past the huge double-edged band saw which cuts it coming and going. At the middle of the bench stands the ratchet man, who adjusts the log so that various width pieces are sawn from it. On either side of him are labourers whose duty is to "stick" and clamp the logs into position as they fall on the bench from the platform.

The sawyer stands near the travelling bench beside the band saw holding the levers, one operating a giant steel "nigger" which prods the logs into position as they are rolled from the platform to the bench, the other controlling the travelling bench as it goes to and fro past the band saw at his will. The three men on the bench sway violently with its motion, which achieves a lightning rate as the bench is returned empty for another log.

On the other side of the band saw stands a man who diverts the sawn planks on to a rollway, along which they swiftly pass to a point where the waste is diverted one way, and the good planks travel through an edger which at touch of a lever sets the width as desired. The plank and its two edges proceed upon the travelling rollway to a point where stands the only man who touches the timber from the time the log leaves the water to that when it emerges from the other end of the mill completely manufactured!

His duty is to seize the edges and divert them from the rollway to other ways.

A little further on the edged timber is diverted on to a travelling way at right angles, above which, in a slung chair, sits a man before many levers, which he pulls as the planks pass beneath him, causing small circular saws to rise at desired distances so as to cut the boards to various lengths.

After which, they travel along a wide and lengthy grading table before a grader who marks them according to their quality, and from thence are taken to stacks, which are moved bodily on other rollways into carts also fitted with rollers, and taken to the seasoning yards and ultimately to the planing mill.

The waste, after it is diverted, is sawed automatically into lengths, and passes into a chute past sorters who divert the better pieces to the lathe mill or the firewood stack. Finally the absolutely useless pieces fall into a furnace and are burnt.

All sawdust and shavings are sucked into huge pipes through which they are taken to the boiler-room, where they are used as the fuel for running the mill. The stoking is automatic. The sawdust is damped by a water spray as it passes, to prevent dust.

Throughout is order, system, cleanliness, and utmost utilisation.

In view of the intention of various Australian States to establish State sawmills, I venture to commend to the notice of the Governments concerned the very efficient methods of sawmilling adopted in the United States of America.

The "American Timberman" of February, 1916, in commenting on the Australian market for American lumber, remarks that "probably 70 per cent. of the machines in the Sydney joineries are American types and have been bought because of their higher efficiency as compared with the machines of other nations." It adds, that "possibly the chief objection to American wood-working machinery in Australia may be said to be the necessity of employing more intelligent and adaptable labour." (!)

I think, however, that the intense concentration required in handling it as the American does is the prime objection of the Australian workman.

AIR DRYING LUMBER.

I do not advocate absolute copyism of American methods in this regard; but I do think, however, that much may be adopted without conflicting with the working ideals of Australia, and with considerable advantage to the State.

A feature of the American lumber industry is the seasoning process, through which a great deal of the timber passes. I visited some of the large creosote plants in Seattle.

It has been the view of the Australian timber-getter that timber which requires seasoning is a very poor thing indeed. This view arises from the remarkable durability of some of our hardwoods, which need no seasoning.

At the same time there are very many of our timbers at present condemned as inferior or useless, which, if subjected to a legitimate seasoning process would be far more useful than the treated timber of America, and would take the place very largely of the softwoods we are compelled otherwise to import.

It is a matter for consideration whether seasoning plants should not be established in connection with the projected State sawmills.

Another feature of the American timber industry is the grading of lumber.

The following grades are recognised—

A Select	No. 1 Common.
B Select	No. 2 Common.
C Select	No. 3 Common.
D Select	No. 4 Common.
	No. 5 Common.
	Culls.

The better grading of our own timber is a very desirable thing. It is a function of a business forestry department to encourage such a measure.

CHAPTER IV.

FOREST FIRES.

PROTECTION PLANS.

American forests are subject, by reason of their magnitude, configuration, and inflammability, their relative inaccessibility, and the sparsity of the local population, to fierce fire ravage.

One who has not seen the sheer wooded steepes of inflammable pine forests of the United States of America can have but a vague idea of their extreme liability to destruction by fire.

Approximately 10,000,000 acres of forest have been burnt over annually, and 12,000,000,000 board feet of timber destroyed.

The average loss every year has been nearly £5,000,000 worth of lumber, and close on seventy human lives.

In view of these facts, it is not surprising to discover that fire protection is the backbone of American forest policy, and the prime cause of its tremendous development. Fire protection proved to be the first and foremost need; and the organisation of the National Forests, the rapid construction of roads, trails, and telephones, and the building of rangers' cabins in hitherto inaccessible mountains are the immediate outcome of pressing demands for fire control.

In 1910—a bad fire year—the cost of fighting fires on the National Forests was £160,000. In 1915 the cost was £13,800.

A comprehensive and effective fire plan has been developed for the protection of the 164,000,000 acres of the National Forests, according to the following standards, which have been more or less generally attained in practice:

- (1.) The maximum area burnt over shall not exceed .001 of total area.
- (2.) 90 per cent. of all fires must be restricted within a 10-acre area.
- (3.) Of the remaining 10 per cent., the average fire area shall not exceed 100 acres.

Prevention is ever better than cure; the administrators felt that no administration could be successful which had not the public with it, and they aimed to develop in the general public the attitude towards a burning forest that every man has towards a burning house.

The public was apathetic. It had to be awakened. Publicity was the solution, and it was applied with vigour. A systematic campaign was undertaken by the Forest Service in conjunction with forestry associations. Straight-out advertising methods were adopted. Signs and posters, books and notices, issuance of forest fire news for publication, education in the schools, personal appeals, lectures and moving picture shows—these were some of the publicity agencies employed.

The Forest Service placarded its domains with official warnings, placed at gates, camps, and watering places where those who do not run might read at leisure and fully digest. Its officers were required to devote a considerable part of their time to making friends with the forest user and securing his interest and co-operation.

A typical Forest Service notice is the following:—

P R E V E N T F O R E S T F I R E S .

Start camp fires only in safe places and extinguish them completely before leaving.

Put out any fire discovered or report it to the nearest Forest Officer. The Laws provide heavy penalties for wilful or careless setting of Forest Fires.

A REWARD will be paid for information leading to conviction of offenders.

By far the most effective work was done by forest associations in “knock-out” advertising.

Just where a forest fire had been extinguished, at the intersection of cool green foliage and a blackened waste, on a roadside, I saw the convincing sign:—

**DO YOU WANT THE FOREST LIKE THIS—
OR THAT?**

THEN PUT OUT YOUR CAMP FIRE !

Another warning showed a homesteader's family fleeing before a furious red and yellow conflagration.

The script was:—

DANGER !

Destruction of Homes and Resources

by Forest Fires

is a loss

To the Entire Community.

YOU SHARE IT.

\$400,000,000

a day

is distributed in Pacific Coast States

by Forest Industry.

FIRE PREVENTION IS PROSPERITY INSURANCE.

BE CAREFUL WITH FIRE.

Still another, on a safety match box, was—

A tree will make a Million matches,

A Match will burn a Million trees.

WATCH THE MATCH !

The campaign achieved its objects. A strong public sentiment has been created. The burning-house attitude has been adopted for the forest. Publicity has justified itself.

Measures of fire prevention are of two classes, (1) to lessen the fire liability, and (2) to reduce the fire hazard.

Under the first head is included the disposal of valuable timber exposed to a very great fire hazard; under the second "the removal of slash or brush, the encouragement of grazing to remove inflammable undergrowth and to keep down grass, also the education of the public in the safe use or avoidance of fire, the enforcement of preventive laws and regulations, and the general surrounding of the use and occupancy of the forest with proper safeguards."

Enforcement of necessary precautions against fire is one of the most important features of Timber Sales Contracts.

The cutting of dead trees which by their height constitute a fire menace is a standard requirement.

The débris remaining after logging is a source of great danger to standing timber, because sparks from locomotive and stationary logging engines often ignite it during the dry seasons.

Where clean cutting is employed, the practice is to burn broadcast after constructing fire lines round the exterior boundaries of the area.

Otherwise the standard requirement is lopping and stacking in teepee shaped piles with small material at the bottom, and subsequently burning under the direction of a forest officer.

A less costly method and one frequently employed is to start one or more fires on selected spots at least 15 feet from any standing tree and to throw on the nearest blaze the brush as it is cut. Studies made by the Forest Service show that not over 2 per cent. of the total acreage of a given operation is burned over when this plan is adopted.

The fire season is during the four months of summer. During this period the operation of steam locomotives and donkey engines is not permitted, unless oil is used as fuel or the boiler is equipped with an efficient type of spark arrester.

When climatic conditions are such as to make the danger from forest fires excessive, the operator may be required to cease logging on five days' notice.

The value of firebreaks, so widely used in European forests, has not as yet been accepted unreservedly for the United States of America. It is recognised that they greatly reduce the hazard and the cost of prevention and control, but it has not been determined what their character should be and what their utility in proportion to their heavy cost.

The advantages of topographic firebreaks on ridges, along contour lines, at the base of slopes and along streams are realised. These breaks, which become part of a permanent system of roads and trails, have been laid out extensively, primarily as roads and as means of access and attack for fire patrols and fire-fighting crews, and for administrative purposes.

Isolating and divisional firebreaks for the purpose of subdividing the forest into smaller units within which fires may be restricted have not been adopted.

During the last eight years, 50 per cent. of the fires in District No. 1 were traceable to the railroads. An average engine throws out about 450 lb. of cinders or ash per hour, which falls 35 to 150 feet away. One hundred per cent. of railroad fires start within 90 feet of the track.

On the Deerlodge Forest the railway companies are required to plough a 6 feet fire line 50 feet from the line on both sides. The intervening space is burnt over. The cost is £40 per mile.

A standard clause in sale contracts where logging railroads are used provides that: The operator shall clear the right-of-way of all inflammable material, including dead trees, for a distance of 100 feet on each side. No refuse may be burnt during the summer months without consent. During these months, the operator may be required to patrol all railroad tracks after the passage of each locomotive.

The Criminal Code of March 4, 1909, provides a penalty not exceeding £1,000 or two years' imprisonment, or both penalty and imprisonment, for setting fire, or leaving or suffering a fire to burn unattended near any timber. The Forest Regulations prohibit building a camp fire in leaves, or rotten wood, or against large or hollow logs or stumps, in a dangerous place, or, during windy weather without confining it to holes or cleared spaces; or leaving without completely extinguishing it.

All forest officers are empowered to arrest offenders.

Fires are not entirely prevented however. There are some which are not preventable, and of thirty-two specific causes of forest fires tabulated by the Forest Service, lightning ranks as a factor of very great importance, hence the necessity of measures of detection and suppression of fires, and the preparation of a fire plan.

It is set forth: "To ensure the adoption of every practicable means for protecting the forest property from fire, a systematic study of the conditions on every forest is necessary. The complete fire plan resulting from this study is simply a description of the fire liability and hazard, and of every means which have been or may be taken to meet any emergency which may arise. The fire plan will be prepared for each forest by its supervisor, and in the light of experience will be modified at the close of each fire season."

"Preparedness" is the keynote.

No plan is considered complete until every possible system has been availed of to reduce the liability and hazard and the cost and difficulty of suppression, or until a system has been evolved which will, at minimum expense, afford the maximum protection which the conditions demand.

Again is called into requisition, as the basis of the plan, the topographic map resulting from the forest survey and assessment. On it are shown accurately the types of cover and cultivation, lines of travel and transportation, location of settlement, sources of supply for labour, equipment food and forage; and location of camping grounds, lookout stations, and natural fire barriers such as water, landslides, barren areas, cliffs, &c.

Arrangements are made with ranchers, liverymen, garages, logging camps, and storekeepers for the supply of equipment and means of transportation, provisions, hay and grain. Ration lists are prepared and agreements entered into with local storekeepers to supply them on telegraphic or telephonic requisition.

Where arrangements cannot be made for transportation, pack trains, teams, wagons, and auto-trucks are purchased.

The whole countryside is canvassed for experienced men who are capable of handling fire-fighting crews.

The addresses or telephone numbers of ranches, logging camps, mills, and power plants from which labour may be obtained are secured.

Provision is made in every timber sale contract for the employment by the Forest Service of the operator's labourers for fire fighting. Arrangements are entered into with local residents to report fires and to assist in prevention and suppression, at a wage of 1s. 8d. per hour, full time to be allowed while reporting fire, and going to or from it. In the absence of a forest officer, such fire-fighters keep their own time and may employ not more than two men to assist them, at a remuneration of 1s. 6d. per hour per man.

Co-operative agreements are made with railroad companies, whereby the free use of trains and speeders is permitted to forest officers for use in fire control.

A system of roads and trails is being built on every forest to act as topographic firebreaks, and to provide ready access to fires.

A huge telephonic installation is maintained by the Forest Service throughout its forests, primarily for fire protection purposes.

Tool caches, containing fire-fighting tools for squads of men, are placed at likely spots throughout the forests.

Each ranger station represents a fire-fighting unit, with outfits for 25 to 50 men.

Large supply warehouses are maintained at the district offices, with equipment for 500 men, including tents, blankets, bedding, cook-kits, and pack sacks, &c.

For eight months of the year the ordinary administrative force undertake the whole work of fire control.

In the four months of summer this skeleton force is expanded to considerable size by the employment of a temporary body of fire-fighters.

Horse and foot patrol men are put on to patrol the fixed risk zone, under the direction of the district ranger. Their duties are primarily to locate fires due to human agency, in those locations where fires generally occur, and to be on the ground to put them out. Incidentally these patrolmen are required to conduct a general information and publicity campaign amongst the forest users.

The patrol route of ten or twelve miles for footmen, and fifteen to twenty miles for horsemen, is covered every day, including Sundays.

The equipment carried includes a shovel, axe, and hoe.

In addition to patrolmen, an extensive scheme of lookouts is arranged. By the use of the Koch profile method, the areas visible or invisible from prominent peaks are determined directly from the forest map. A very good lookout will permit above 50 per cent. of country within a twelve mile circle to be overlooked. That 50 per cent. should be the valuable stand.

Study determines the location of the lookout stations, from which, during the summer months, a constant watch is kept. In addition to the look-out men, a "smoke-chaser" is often attached to these stations. His duty is to start out immediately when smoke is seen, locate, and if possible extinguish the fire.

Lookout stations are connected by telephone to the district ranger's office. They are equipped with a traverse board bearing a map of the forest. Over the map, with the look-out point as centre, is pasted a transparent protractor. The board is kept constantly in orientation. The direction of a fire is ascertained by sighting with an alidade placed upon the map.

The location of any outbreak is determined by the intersection of the sights from two look-out points. A method is in process of development to ascertain location by the intersection of horizontal and vertical sights from one point.

Reports of fires are sent directly to the district ranger, who transmits them to the supervisor.

The whole machinery of the organisation is set in motion. Instantaneously and simultaneously men and supplies are collected and transported to the scene of the fire by automobiles, special trains, or on foot, accompanied by pack trains.

The organisation of the crews, the establishment of camps, arrangements for the preparation and distribution of food and drinking water, attack on the fire, timekeeping and payment of the men, are all carried out on lines laid down in the fire plan.

A typical plan is that of the Clearwater Forest, which has three lookout men and four "smoke-chasers." There are three tool caches, carrying in all tools for seventy-five men. There are available twenty-three head of Government pack horses, thirty head of surveyors' horses, and six others obtainable at a ranch. The forest is twenty miles from a railway station or store.

On the outbreak of a fire, the district forestry office is wired for men, the improvement crew is put on at once, a halfway camp is established, and the pack train proceeds to the station to meet the men and bring them to the camp.

Next day the crew reach the fire.

U.S.A. FIRE LOOKOUT.

The general method of attack after establishing the camp as close to the scene of operations as possible, is to endeavour to encircle the fire, if small, by clearing round it a line free of all inflammable material, with, on the far side of it, a trench cut to the mineral soil.

Where the fire is too large or too dangerous to be encircled, the scheme is to proceed round the flanks and pinch it in. The fire line is built as near as practicable. If the heat is unbearable, backfiring is adopted.

I do not regard the Australian problem as difficult. Bush fires, as a rule, do not attain the dimensions and intensity of the forest fires of America; the forest is more resistant, crown fires are very infrequent, and the forests are of less extent and much greater accessibility than in the United States of America.

One cannot hope, however, to put out a bush fire by pressing a button.

The solution of our fire suppression problem lies in the development of a forest management plan, involving a topographic survey and the laying out of a system of roads; the establishment of forest stations and the employment of forest overseers to supervise the general forest operations.

Upon that organisation can be based a simple fire plan providing for—

- (1.) The attachment of conditions to timber sale agreement, licenses and permits, specifying measures of brush disposal, camp fire precautions, &c.
- (2.) The attachment of conditions to licenses and permits, &c., arranging for the employment of all forest users for fire-fighting, as has been done in the Pilliga Forest, New South Wales.
- (3.) The effectuating of arrangements with local residents for reporting fires and assisting in their suppression.
- (4.) The creation of the "burning house" sentiment among the general public by publicity methods.
- (5.) The carrying out of fire plan studies.

Telephonic communication with forest overseers is desirable. Establishment of lookout stations will be necessary in only a few instances.

The forest overseer would be charged with the execution of the fire plan upon his forest.

I deprecate any reliance upon divisional or isolating firebreaks. The cost of establishing a 100 per cent. system to deal with a 2 per cent. burn is, as I have said before, unwarranted, and much more effective work can be done by direct fire detection and suppression measures.

The chief difficulties to be confronted are—

- (1.) The stockman's practice of burning off to secure a fresh shoot of grass.
- (2.) The lack of an organisation for detecting the outbreak of fire, and for suppressing it when discovered.

The simple measures proposed meet all these difficulties, and provide ample and organised protection to the forest at the minimum cost.

CHAPTER V.

THE FOREST GRAZING BUSINESS.

The management of the forest fodder resource is a very important branch of forest administration and one to which we in Australia must devote considerable attention.

Heretofore, exploitation of the forest pasturage has been controlled generally by the Department of Lands. As the State forests, however, are vested in the Forest Services, grazing problems will become involved with the general problems of forest administration.

In accordance with the policy of the Departments of Lands, the forest pasturage in the past has been disposed of under a leasehold system upon terms varying from one to forty years. Much of the New South Wales inland forest reservation is encumbered by such leases, which are difficult hurdles to be negotiated by the forester anxious to perfect the forest plan.

Recently, a grazing license system was introduced with considerable success, in the North-western Forestry District of New South Wales. It is of interest to note that that license system approximates very closely in principle to the American practice.

The leasing of grazing rights on a National Forest is regarded by the United States of America Forest Service as highly objectionable—

“It would greatly increase the difficulty of proper silvical development, prevent a proper use of ranges under abnormal natural conditions, and tend to exclude the smallest owners. Adequate protection of the forest would be rendered difficult if not impossible, because a lease even though filled with careful restrictions would give the lessee some right to dictate the use to which the area would be put. During the tenure of the lease no part of the tract could be closed to grazing, even though the necessity was urgent to prevent the destruction of seedlings, to secure reproduction on cut over or burned areas, or to protect important watersheds. The privilege would be a fixed instead of a flexible one, and if during the period forage was destroyed by fire, insects, or other cause, the stock would have to be removed from the forest instead of being transferred temporarily to another range. The leasing system would practically result in a number of individual allotments equal to the number of permittees and this would tend to shut out the small owner because he could not afford to hold his stock upon the small area to which he would be entitled. Fencing of the leased areas would necessitate leases for a term of years, and term leases would not only hamper forest management but also preclude recognition of new applicants who might be entitled to range.”

—“National Forest Manual.”

This excerpt adequately sets forth the objections to forest leasing in Australia.

Under the wide powers of the Act of 4th June, 1897, the Secretary of Agriculture has authority to permit, regulate, or prohibit grazing in the National Forests.

The “National Forest Manual” further sets forth—

“Under his direction, the Forest Service will allow the use of the forage crop as fully as the proper care and protection of the forests and water supply will permit. The cattle and sheep which are grazed in the National Forests bear an important relation to the supply of beef and mutton in this country and every effort will be made by forest officers to promote the fullest possible use of grazing resources.”

In 1915, no less than 1,727,000 head of cattle, horses, and hogs and 7,283,000 head of sheep and goats were grazed on the United States of America National Forests.

Although the charges were only nominal—about one-fourth the actual values—the revenue derived was £236,000.

The grazing business is one of the features of the United States of America Forest Service. It is controlled by a specialist assistant to the Forester at Washington, and in every District Forestry Office is an assistant District Forester who specialises in and devotes his whole attention to that one line of work.

The leading objects of the grazing regulations are laid down as—

- (1.) The protection and conservative use of all National Forest land adapted for grazing.
- (2.) The permanent good of the live stock industry through proper care and improvement of the grazing lands.
- (3.) The protection of the settler and home builder against unfair competition in the use of the range.

The basis of the United States of America system is a permit issued on a charge per capita basis and granted generally for one year, though, "where all controversies have been settled and proper numbers of stock are allowed, the Secretary for Agriculture will authorise approval of applications for periods of not more than five years, with the understanding that all permits are terminated at any time and that the renewal of permits will be within his discretion.

The present fees are nominal. The rates are based upon an annual charge for cattle, which varies from 1s. 8d. to 6s. per head according to the situation and advantages of the forest.

Since horses require about 25 per cent. more pasturage space than cattle and do greater damage, the rates for horses are from 25 per cent. to 40 per cent. higher.

For pigs the rates are from 25 per cent. to 40 per cent. lower.

For sheep and goats, the charge is 25 per cent. of that for cattle.

An additional charge of one penny per head is made for the privilege of lambing ewes.

For periods less than twelve months the rate is slightly higher.

All fees are payable in advance and before issue of the permit.

Permits are issued only to persons entitled to share in the use of the National Forest by virtue of prior use, local residence, or dependence upon the pasturage. New settlers are not regarded as having gained a permanent preference until they have demonstrated the good faith of their settlement by three years of residence, improvement and cultivation.

Preference is given to local residents in all cases, and American citizens are given first consideration.

A certain number of live stock is fixed for each National Forest, and permits are issued up to that number so long as no damage is done by such stock.

"A reduction will be made from the number of stock grazed during the previous season if, owing to the number grazed or the method of handling stock, damage is being done to the forest, and in extreme cases all stock will be removed."

"Every effort will be made to distribute the stock satisfactorily in the range in order to secure greater harmony among the users of the forest, to reduce the waste of forage by tramping in unnecessary movement of stock, and to obtain a more permanent, judicious, and profitable use of the range."

The average number of stock which a settler must graze in order to utilise the products of his farm or derive a reasonable profit is determined upon each Forest, and is regarded as a "protective limit" safe from reduction in any renewal of the permit.

In arriving at this average the dependence of settlers upon the National Forest ranges is considered.

Under ordinary conditions the average number of stock per permit is taken as the basis.

To prevent monopoly, the District Forester establishes a maximum limit upon the number of stock allowed any one applicant.

In fixing the grazing periods endeavour is made to meet the general needs of the people and to secure an economical use of the range. The condition of the pasturage rather than the desires of the applicants, however, is the prime consideration. It is deemed unwise to allow stock on Forest Ranges before the feed has started, or while the range is so wet that the stock will cause injury to both forage and tree growth.

An endeavour is made to secure the best use of each class of range by allotting the class of stock to which each is most adapted. The Forest is classified into divisions consisting of national grazing units defined by topographic boundaries.

"Cattle and horses ordinarily graze both ways from a stream, but seldom cross the summits of the surrounding ridges. Sheep and goats ordinarily graze the crests and slopes of a ridge or mountain, but will cross none but shallow streams except on bridges. This should be kept in mind in fixing range boundary lines."

Separation of dairy cattle, stock cattle and steers is regarded as beneficial, and is encouraged as far as possible. Sheep and goats are generally allotted individual ranges.

When the silvicultural needs of the Forest demand it, the Supervisor may close an area to all grazing, or reduce the number of stock allowed upon it, or prohibit its use by certain classes of stock.

"For instance, sheep may be excluded from a Timber Sale area for a certain number of years after cutting; or in a year of scarcity of mast, hogs (otherwise permitted) may be excluded from the oak type. Where planting operations are being carried on, it will usually be necessary to exclude all classes of stock.

"If silvical investigations show that grazing is responsible for the scantiness or lack of reproduction over a considerable area, a portion of it may be withdrawn from range use until young growth has become established, several years later another portion, and so on until the whole area has been treated."

The aim is to secure the welfare of the Forest with the least possible friction or interference with stock interests. If total exclusion of stock from a Forest is contemplated, one year's notice is regarded as being not excessive.

A feature of the U.S.A. forest grazing policy is the principle of a co-operation with Live Stock Associations, the majority of whose members use the National Forest range.

"The primary purpose of all the regulations is to make the National Forests as useful as possible to the people, consistent with their protection and perpetuation. It is clearly impossible to meet the wishes of each individual user, but it may be entirely possible to meet the wishes of the majority if made through an organisation. It is to secure from the people collectively, definite statements of their needs and wishes that the organisation of stock associations is encouraged."

Such Associations are recognised as being in a position to express accurately the wants of the stockmen composing the Association and to give valuable advice regarding the handling of the interests represented. The responsibility of dealing with the suggestions and recommendations made, however, remains with the Forest Supervisor, and the good of the Forest is the governing consideration. The Supervisor may attend meetings of these Associations.

Upon the specific request of the majority of the permittees, and where such rules will tend to prevent damage to the Forest lands or secure a more complete or more economic use of the Forest resources, special rules are made to bring about economies of operation, larger natural increases, improved grades of live stock, etc. The placing of bulls or other breeding animals of a specified grade upon a range may be made a requirement.

Regulation G4 provides that Live Stock Associations may be granted permits to construct corrals, drift and diversion fences, roads, trails, sources of water supply, etc., and the District Forester may stipulate in the permit that during the ten years following, all permittees will be required to pay to the live stock association an amount equal to their pro rata share of the cost of constructing the improvement, which after the tenth year becomes the property of the Government. The cost of construction will be divided by the total number of stock, to find the proportionate cost per head, and payment is made a condition precedent to the issue of a permit.

The District Forester must assure himself that the proposed improvement is actually necessary for the proper management of the stock, and generally beneficial to the majority of the permittees, and that it will be substantially and economically constructed. Permittees are to be safeguarded against extravagant or wasteful methods of construction.

Permittees are required to repair all damage done to the roads and tracks by their stock, to build any new roads found necessary, and to fence any spring liable to damage by trampling.

Salting is regarded as a means of forest protection. Salt and water are two important factors in distributing cattle and horses on the range. Stock will alternate between the two.

Permittees are required to salt all stock regularly at such places and in such manner as the forest officer may designate.

The amount of forage trampled by a closely herded flock of sheep is as great as the amount actually fed. The sheep must, therefore, be bedded not more than six nights in succession in the same place.

A new bed every night—the "blanket" system—is favoured, and through it the Forest Service is working towards a pasture system.

The grazing plan of the United States of America Forest Service has achieved a remarkable success. Originally opposed by stockmen with the fiercest antagonism, there is now a spreading demand for its application to other Government roads, besides National Forests.

Originally the range was free, and subject to close and unrestricted competition, resulting in a rush every spring, and consequent severe overstocking.

The initial problems were to reduce the total number of stock upon the National Forests, and to overcome the increasing deterioration of the pasturage owing to the overstocking.

The office of Grazing Studies was created to further the rational use of

the Forest range, and to collect data and formulate plans harmonising both with the interests of the live stock industry and those of forest conservation. Grazing was to be put on a sustained yield basis.

Whence developed Grazing Working Plans and Grazing Reconnaissances.

Estimates of grazing capacities on the basis of acres per sheep or cow were found unreliable, and as the demand for pasturage became keener, and pressure upon the Forest Service increased to the extent of disputes concerning its estimates of the carrying capacity of the Forests, a new and quite astonishing science of forage assessment developed.

A grazing reconnaissance is carried out on the basis of the foundational topographical strip survey which is progressing on every Forest. The crew consists of a five-men party, each man working singly, and running a four-mile line a day.

Ten pasture types are recognised, viz. :—

- (1) Grassland other than meadow; (2) Meadow; (3) Untimbered weed range; (4) Sage brush range; (5) Browse range; (6) Coniferous timber land; (7) Waste range in dense timber; (8) Browse; (9) Woodland; (10) Aspen.

These types are located, and a forest pasturage map constructed.

In each type sample grass plots are taken, and the forage is harvested and weighed. The density of stocking and the proportion of forage plants is ascertained by actual measurement.

Thus, assuming 108 acres of No. 1 type have a 50 per cent. density of stocking, and an 80 per cent. proportion of forage plants, then—

$$\frac{108 \times 50}{100} \times \frac{80}{100} = 43.2$$

which gives the "forage acres" for the 108 acres of grassland.

By ascertaining the number of "forage acres" per 40-acre section, and the carrying capacity per "forage acre," the actual carrying capacity of the type and the forest is determined scientifically, with a much greater accuracy than is given by general judgments, however expert. It is really the adoption of assessment for grass as well as for timber, superseding experienced "guessing."

Grazing allotments are being made on the basis of "forage acres."

I recommend the general adoption in Australia of the grazing license system of forest pasture disposal, in preference to the rather dangerous leasing method.

The valuable drought-tree forage of the inland Forests should be managed on the same plan. This class of forage is uniquely Australian, and is a resource of great importance to the State: but it is in danger of being exterminated if the prevailing virtually unrestricted exploitation be permitted further.

Disposal should be closely regulated under grazing permits, carrying a royalty approximating as closely as possible to the real and ascertainable value of the forage.

CHAPTER VI.

"SPECIAL USES" OF FOREST RESERVES.

Leasing of National Forest lands for any purpose is regarded by the United States of America Forest Service as objectionable in the extreme.

The National Forests are vast tracts, enclosing settlements of all kinds.

Upon them are found residences, farms, apiaries, schools, churches, stores, sawmills, factories, hotels, sanitoriums, summer resorts, telephone and telegraph lines, roads and railways, dams, reservoirs, and conduits, etc.

All such occupancies, except where specific provision is made in regulations governing grazing, timber sales, water power, &c., are termed "special uses" and are authorised under "Special use Permits"—which are equivalent to our Occupation Permits without their limitation to timber-getters.

No fee is charged in respect to schools, churches, cemeteries, cabins, corrals, stock tanks, drift fences, sawmills sawing timber principally from the National forests, water supply schemes, logging roads, &c.

For other uses the rates and conditions are fixed by Regulation, L. 33:—

Kinds.	Minimum Rates per Annum.	Explanation.
Agricultural and Cultivation	1s to 12s. per acre. Not less than 8s. 4d. for any permit	Not to exceed 160 acres to any one permittee
Apiaries	Minimum £2 2s. and 5d. per hive over 100	1 to 3 acres. Hives to be counted in April and payments due May 1st year each.
Barns, Garages, &c. ..	£1 to £5 upwards ..	2 acres or less
Gravel	3d. to 6d. per cubic yard, Not less than 8s. 4d. for any permit	
Hay Cutting	1s. to 4s. per acre, Not less than 8s. 4d. for any permit	
Hotels and Resorts ..	£5 5s to £50 and upwards ..	1 to 10 acres Not to exceed 5 acres under term permits.
Pastures	2d. to 4s. per acre. Not less than 8s. 4d. for any permit	Not over 320 acres to any one permittee (charge is in addition to grazing fee; $\frac{1}{4}$ to 5 acres, depending on local conditions.
Residences	£1 to £5	$\frac{1}{4}$ to 5 acres
Sawmills	£2 to £40 and upward ..	1 to 10 acres
Stores, &c.	£2 to £10 and upward ..	$\frac{1}{4}$ to 5 acres

Permits may be granted with such conditions as to area, time, charges, etc., as may be provided for in the regulations, or as may be deemed necessary to protect the National Forest.

Permits granted by the Forest Supervisor may be revoked by the District Forester. Those issued by the District Forester may be revoked by the Forester; those granted by the Forester may be revoked by the Minister. Appeal lies in the first instance to the District Forester, from his decision to the Forester, and from his decision to the Minister, in all matters covered by the Special Use regulations.

All permits are revocable at the discretion of the Forest Department.

One single and limited exception to this rule is provided in the Act of 4th March, 1915, which authorises the occupation of "National Forest lands for any period not exceeding thirty years, where the lands are to be used for summer homes, hotels, stores, etc., but no person may be allowed to use more than five acres."

This exception was made to allow of the erection of permanent rather than temporary residences in the Forests, and to safeguard those who had spent considerable sums in improvements under their permits.

The use of National Forests as places of residence and recreation is encouraged, on the ground that the resident becomes a volunteer fire-fighter.

It must be remembered that National Forests are regions rather than areas, and the policy could not be applied with equal force to the circumscribed forest reservations of Australia, but it is quite conceivable that certain of these apiaries, corrals, stock tanks, sawmills, water supply schemes, logging roads, might prove desirable in special cases. "Special Uses" policies for Australian States require to be devised carefully and applied most conservatively.

CHAPTER VII.

REFORESTATION AND AFFORESTATION.

MODERN NURSERY AND PLANTING METHODS.

Of recent years, artificial regeneration of forests by direct planting, has replaced frequently in Europe, the method of natural regeneration previously followed.

The practice has been made possible by increasing timber values, and is a natural consequence under intensive management of the endeavour to obtain quicker and more regular results.

Natural regeneration is safe and cheap. It protects the soil conditions, and the soil life. It shelters the seedlings against weather effects, and the insects which frequent clearings. It restricts the spread of weeds and brush. It is often the only system possible under extensive pioneering conditions, and consequent low timber values.

It is, however, slow, uncertain, and complex. It necessitates careful and systematic preparation for many years before. It calls for a combination of favourable soil, seeding, and climatic conditions at the precise moment when the old stand commences to open. It involves the leaving of a large number of seed trees, which are thereby rendered liable to windthrow. It requires an uneconomical prolongation of exploitation; and in the final stages subjects the regrowth to damage.

Still many of the Australian forests are prolific regenerators. In the early days of settlement, from the Blackbutt forests of the coast, to the Cypress Pine "Scrubs" of the West, one is told of open park-like stretches through which one could see "for miles." To-day those same forests are dense two or three storied thicket, and pole stands "too thick for a dog to bark through," and the original mature scattered overwood, now being exploited, is the open forest of the early days.

Why then plant?

Certainly, planting may be a less complex, a much simpler problem than inducing regeneration where nature is stubborn, and assuredly it makes for regular, even aged woods, clear cutting, and more economical logging. But it is laborious and costly, whilst involving as much risk. And to keep pace with exploitation, the operations would have to be on a scale too stupendous to contemplate in these days of shortened loans.

New Zealand has nailed her forestry flag to the method of planting, and has abandoned almost irrevocably her fine natural forests, because their growth is alleged to be slower than that of imported conifers.

But the cost of planting alien timbers has run into from £7 to £13 per acre, and it is easy to demonstrate by orthodox rules of forest finance, that the final result will be a deficit.

The Australian States may not follow blindly the lead of middle Europe and New Zealand. Their forest flora is too valuable to be jettisoned, and its powers of reproduction too great to be overlooked.

Australia must pin her faith to natural regeneration—the main hope, too, of America. Only in two instances at the present time is planting justified, viz., for the production of cheap imported softwoods not replaceable by indigenous species, and for the afforestation of waste lands, burns, and watersheds.

If artificial regeneration can be carried out in Australia at a sufficiently low cost, its further extension will be justified.

In contrast to the high New Zealand expenditure of at least £7 per acre, the average cost of planting, done in District No. 1 of the United States of America Forest Service in 1915 was only £1 5s.

The distance planted apart was 8 ft. The wages paid were rather higher than the Australian rate. The plants had generally to be taken into the planting area from the nearest railway by packhorses. The cost included nursery expenses.

I was so struck by these figures that I made a particular investigation into this branch of forest practice. I visited the Savenac Forestry Nursery in Idaho, reputedly the most efficient in the United States of America. I inspected also planting operations on the Lolo National Forest. I was able finally to secure a great deal of data from the Chief of Planting at Missoula, Montana, and the Manager of the Savenac Nursery.

The Savenac Nursery has an area of 27 acres, 22 being for transplants, and 3 for seedbeds. It has an authorised stock capacity of 3,750,000. It propagates only about six species.

Scientific Management was initiated in 1913. Very considerable experimentation was carried out. For two years, the study was applied only to transplanting, and under great difficulties. Success has been achieved at last, and as a direct consequence the number of plants transplanted per man per day has been increased from 5,000 to 12,000, and the cost of transplanting reduced by 2s. per 1,000.

The study is being extended to other branches of the work, and scientific management is being introduced throughout.

Transplanting takes place in the spring. At least a week before, the ground is ploughed for the second time, and harrowed, and levelled.

V-shaped trenches are made in the following order:—

F. S. PLANTING BOARD

The rows are 7 in. apart, with five rows to the bed, 2 ft. being left between the beds for irrigation laterals.

The smallest-sized one-horse plough is used. An 8 in. landslide is placed upon it, and the mole-board is cut off at the back so that it will not throw the dirt too far.

When a round trip has been made, the ploughman cleans out the loose dirt from the trench with a specially designed hoe, having a blade 2 ft. wide.

The men who take up seedling stock are selected for speed. They can pull about 30,000 per day.

The seedlings are taken up from the seedbeds in bunches of about seventy-five, with spading forks; the dirt is shaken from their roots; the roots are then pruned with a small butcher's cleaver in co-operation with a wooden block. The seedlings are placed in long narrow boxes called "seedling packets" which hold fifty bunches in two layers. The bunches are separated by long nails driven into the centre of the box. They are protected from drying out by placing round each layer a strip of moist burlap.

1	Trenching Plow
2	Trench Cleaner
3	Seedling Packet
4	Transplant Board
5	Planting Rake

The trees are not puddled or washed at the nursery from the time they germinate until they leave.

The packets are placed four in a crate, and taken to the transplant ground each morning and noon, on a slide drawn by the plough horse.

The essential machinery of transplanting consists of two ingenious labour-saving devices, the introduction of which into Australia should result in very considerable advantage.

One is the "threading board," which consists of two light planks hinged together, and closing upon each other, thus holding in place the seedlings which are set out evenly along it, their roots outwards. This board is placed in the trench, and the soil pressed round, after which it is opened and lifted, leaving the seedlings *in situ*.

(a.) THE OLSEN PACKING BOX.

(b.) THE OLSEN SHIPPING ROLL COMPOSED OF HESSIAN, PAPER, AND WOOD WOOL.

A considerable saving in materials, labour, and weight is effected.
The paper makes the roll wind proof.

It has been constructed with minute care, after close experimentation, and is so worked out that the time required for one man to plant a board, is exactly the time required by his fellow-worker to put the seedlings in another one.

It is $8\frac{1}{2}$ ft. long, holding seventy-five plants in seventy-five notches, placed $1\frac{1}{3}$ in. along its inner edge. It is fitted with a self-clamping hinge. I secured a drawing of it, a copy of which is attached.

The other invention is the "threading table," which is a portable bench with a trap slide in the centre, down which the filled threading board is pushed to a shelf below opening on to the back of the table. Above it is a rack for holding the "seedling packet." It is walled and roofed in with canvas to shelter the threader, and to prevent the seedlings being blown from the board during threading operations.

At this table stands the threader, who sets the seedlings in the board ready for planting.

Planting and trench making

1. Planter for Crew N^o 1

2 " " " N^o 2

3 Plowman

4 Foreman

5 Threading tent

Each man carries also a planting tool specially devised for the work. It resembles a short one-hand hoe. (See illustration.)

The empty board is placed by the planter upon the table in front of the threader, opened up. The threader pulls it towards him with his right hand, taking a bunch of seedlings from the packet above the table with his left. The seedlings are worked forward with the fingers of that hand, and placed in the board with the right.

A poor tree is culled before it is dropped in the board, if seen before doing so. If not, it is left in place, but a good plant is put alongside it. When the board is finished it is closed, and pushed with one hand in one movement down the trap slide ready for the planter, who, approaching from the back, puts his empty board on the table, and takes the full one to plant. Only the two boards are used per crew.

The planter walks to the trench, and facing the land slide, sets the board on the edge of it, tilting it slightly backwards. He then takes the specially designed planter's rake (*see illustration*) and scrapes the loose dirt against the board, packing it firmly as he walks along it and back again. He throws the rake ahead a little in readiness for the next trip, and opens and lifts the board, leaving the seedlings planted. He then returns to the threading table for another board.

The number of seedlings planted is tallied at the end of each day by counting the rows. The following morning the threader and the planter are given a time-sheet, showing the work done the previous day.

Threaders and planters are paid on a sliding scale.

Each spring before the scale is used, various men on the nursery force are tried out, and those best suited to the work are chosen. Generally, boys make the best threaders, and short husky men the best planters.

The wage scale in 1915 was—

Boards per hour.						Wages per day of 8 hours.	
						<i>s.</i>	<i>d.</i>
36	...	...	...	...	...	11	5
37	...	...	...	...	...	11	10
38	...	...	...	...	...	12	1
39	...	...	...	...	...	12	4
40	...	...	...	...	...	12	6
41	...	...	...	...	...	12	6
42	...	...	...	...	...	12	9
43	...	...	...	...	...	12	11
44	...	...	...	...	...	13	1
45	...	...	...	...	...	13	4
46	...	...	...	...	...	13	6
47	...	...	...	...	...	13	9
48	...	...	...	...	...	14	0
49	...	...	...	...	...	14	3
50	...	...	...	...	...	14	4

The record was 64 per hour for two hours. Under normal conditions on a 2,000,000 job, the crews will average 40 boards per hour each.

From these wages, the men pay 1s. a meal—the actual cost.

Transplanting costs in all 3s. 2d. per 1,000.

The organisation for the whole work of transplanting is shown in the following table:—

TRANSPLANT CREW, SAVENAC NURSERY, 1915.

* The foreman makes the irrigation laterals in the centre of the 2 ft. space between the beds, as each bed is planted.

Stock distribution is now being placed under scientific management.

The Feigly Tree Digger is used to lift the plants. It resembles a plough, but has a share like an L-shaped knife, with a wedge-shaped piece of iron attached to the blade, an inch back from the cutting edge. It is drawn by two horses in tandem along the row of plants, and severs the roots, about seven inches below the surface, raising the plants so that the slice of earth breaks up when it falls back into place behind the Digger, leaving the trees so that they can be pulled from the ground quite easily, yet without exposing the roots.

Where formerly it took one man with a spade to lift what two men could pull, with the Tree Digger two men can lift enough to keep twenty men pulling.

Considerable loss resulted from the use of the Digger during the first experimental stages.

The order of lifting is as follows:—

The men follow the Digger, pull the plants and tie them up in bunches of a hundred. These bunches are laid down, and the roots covered with a handful of dirt.

The bundles are packed immediately before they have to be despatched. The bunches are thrown into the wagon and conveyed to the Packing Machine. This really consists of a box mounted on legs, and having one hinged side.

Two 6-ft. lengths of yarn placed 1 ft. apart, and having stapled to them at 18 in. distance, two wooden cleats, are placed at the bottom of the Packing Box and hung over both sides. A strip of burlap 6 ft. by 21 in. follows, and finally a sheet of wrapping-paper. The bunches of plants, after a moderate root pruning, are then laid in the packer with the roots inwards, in two layers, which are well packed by wet shingle tow. When the container is full, the ends of the burlap and paper are drawn together at the top, and wrapped around a stick 1 in. by 2 in. by 2 ft., whose ends protrude about 2 in. beyond the edge of the burlap. A 16-in. "wrench" is applied to these ends, and the stick is turned so as to fold the burlap over it, and tighten it as much as desired. A catch on the packer holds the wrench in position, while the yarn is tied tighter round the bundle, which is then ready for shipment. The hinged side of the packer is then let down, and the bundle taken out.

An average bundle weighs 90 lb., and contains 4,000 plants. The bundles are easier to handle than wooden boxes, and much faster to pack. The plants do not dry out or heat.

Each bundle is stencilled to show the number of trees, species, and age class.

Formerly, boxes were used. The Packing Machine and the bundle method are the invention of the Nursery. The cost of packing has been reduced thereby from $3\frac{1}{4}$ d. to $\frac{1}{2}$ d. per 1,000 plants.

The age of transplant stock when shipped for planting out is as follows:—

Pinus ponderosa—1—2 (3 years, being 1 year seedling and 2 year transplant).

Pinus monticola—1 and 2—2.

Pinus strobus—1 and 2—2.

Picea engelmanni—2—2.

Larix occidentalis—2—2.

Thuja plicata—2—2.

The methods of sowing are of interest. All coniferous seed is sown broadcast in the beds, which are 4 ft. by 48 ft. with 2 ft. paths. A sufficient quantity of seed for 48 square feet is placed in pails set 12 ft. apart in the rows. The sower walks down one side and up the other, from pail to pail. of the row, casting the seed from the path to the centre in quarter circular sweeps.

The seed is covered with river sand. The depth of the sand cover has been proved to be of vital importance. For White Pine a quarter inch is the best, and one pound of seed with this depth of cover is as good as two pounds at half an inch.

The sand is distributed with a shovel, levelled off with a straight-edged board, and packed with a water-weighted roller.

I was shown a machine which is now being developed for the purpose of spreading an even depth of sand and rolling it at the same time. It consisted of a carrier from which the sand poured on to a travelling canvas operated by cogs from the roller wheels. It is a machine which should exercise an important influence on nursery practice.

The unit crew for sowing consists of two men to wheel and spread the sand, one to weigh and sow the seed, and two to level off the sand and roll the beds. This crew can sow and cover two hundred 12 ft. beds per day.

Apart from general policy, the nursery managers are given an almost free hand, in accordance with the general American habit of non-interference with management, and judgment by results. The system makes for progress.

Detailed cost-keeping records are a feature at the Savenac Nursery. The cost of production varies from 12s. to £1 4s. per 1,000 plants, but averages 16s. 6d., which, with planting at 8 ft. apart, represents an initial expense for stock of 11s. 2d. per acre.

With the extension of scientific management throughout all the nursery operations, it is expected that this cost will be reduced by a further 25 per cent.

Five thousand one hundred and eighty-seven acres were planted in 1915, at an average cost of £1 5s. per acre, including the cost of the stock.

It is estimated that ultimately this figure will be brought down to £1.

One thousand five hundred and twenty acres were broadcasted in the forest as an experiment at a cost of 13s. 6d. per acre.

The seed spot method is also being tried out. Direct seeding is done on experimental areas chiefly, but is sometimes employed to establish small patches of growth on large burns as a basis for subsequent natural regeneration.

In every district, intensive experiments are required to be made, with a view to determining and developing the best methods.

Forest supervisors are responsible for the effective direction and extension of reforestation work. Assistance is furnished by the District Forester.

In District No. 1 this function has been taken over by the Chief of Planting at the District Office.

The leaving of seed trees during logging for the purpose of reforestation of cut-over areas by natural regeneration is a general practice in the United States of America. Timber sale contracts provide for the ringbarking or felling of defective, diseased, or dead trees, and the burning of debris and brush, and grazing is excluded for some years. A close study of cut-over areas is also made with a view to developing natural regeneration.

These, however, are really the only measures of natural regeneration adopted, and the growing and planting of nursery stock is the chief feature of the reforestation plan.

It is laid down that areas which are not satisfactorily restocked within ten years from the date of cutting are to be taken up as planting projects.

Operations are restricted at present to the most favourable areas, with a view to developing successful methods capable of application to less favoured sites.

When the most suitable areas are not known definitely a planting reconnaissance is made before any other work is undertaken. Its basis is a strip survey disclosing the location, size, and accessibility of the area, its soil, elevation, aspect, climatic factors, and present cover; the species, methods, and seasons promising the best results; and the size and organisation of the most efficient crew and the estimated cost of the project.

The planting reconnaissance map shows—

- (1) Green timber.
- (2) Brush prohibitive to planting (very dense brush).
- (3) Reproduction sufficient (400 or more trees per acre).
- (4) Alienations.
- (5) Proposed camp sites (one to every 800—1,000 acres).
- (6) Proposed tracks.
- (7) Proposed roads.
- (8) Outlines of planting areas according to species, age, classes, and spacing to be used.

On the back of the map are shown data as to—

- (1) Soil.
- (2) Brush.
- (3) Windfall.
- (4) Standing dead timber.

The planting instructions issued by District No. 1 for 1916 work provided for the following organisation for a planting crew of 35 men—

The new men are put in one crew, or in the middle of the line.

It is laid down that—

- (1) The camp should be ready before the crew arrives.
- (2) Before work is commenced the man in charge should go over the planting area with his foreman and plan;
 - (a) A system for working the crews whereby they will start work each morning and finish at night throughout the job, as near camp as possible.
 - (b) The best system to follow in keeping crews supplied with trees and water. Trees and water should be packed on horses whenever possible.

Each man is given a planting bag full of plants. The bag is carried over the shoulders. The foreman and end men are required to have them filled ready for the men before they leave camp. Wet burlap is wrapped round the roots in the bag to keep them moist.

TREE PLANTING.

PLANTING

The trees should be planted as indicated below

*Drive mattock in full length
and as near perpendicular as
possible*

*Raise up on handle
opening bottom of hole*

*Pull back upper part
making a clean square hole*

*Place roots straight down in the
middle of the hole. Have tree the
same depth it stood in the nursery*

*Push the dirt into the hole
at the same time packing it
firmly around the lower roots*

*Pack the upper part.
This tree is set correctly.*

The collection of seed for nursery use is part of the regular work in each district. It is concentrated on areas where seed of the species and locality desired, can be gathered at the lowest cost. Extensive collection is not attempted in seasons when the cost is likely to be excessive on account of poor crops.

All planting operations are "closely studied by district and forest officers to ascertain the reasons for success or failure, and enable the experience gained to be intelligently applied." Detailed periodic inspections and sample plot measurements are made and their findings reported.

Good hole - Tree too deep

Good hole - tree improperly packed leaving air space below.

Shallow hole - roots curved toward surface

Shallow narrow hole - lower roots curved toward surface.

Poor hole - made by pressing down on handle of mattock

Curved lower roots and air space due to "neck" in the middle.

I see no reason why American methods should not be applied to Australian conditions, after intelligent modification where required. If their application achieves the same financial result, then they will save the State, in course of years, a huge sum of money.

CHAPTER VIII.

FOREST CLASSIFICATION.

A "LONGSIGHT" POLICY.

The early solution and rapid development of American forestry, are founded upon the clear cut, direct, initial policy of forest classification.

The Australian theory has been "classification first, dedication afterwards." The American was "dedication first, classification at leisure."

The first has resulted in a fierce scramble between lands and forestry interests, with the nine points of possession in favour of the former. Meanwhile forestry practice is postponed.

A TREE-PLANTING PROJECT.

The second has resulted in the immediate establishment of forestry practice. Classification was subordinated to the paramount purpose of the dedications—and is not yet complete. But it is being done co-ordinately with the purpose of the National Forests.

Under the Act of 3 March, 1891, the President was empowered to create National Forests, and vast tracts averaging 1,000,000 acres apiece were proclaimed as such.

A following Act of June, 1897, stipulated that it was not intended to include lands "chiefly valuable for minerals or for Agriculture," and the Act of 11 June, 1906, authorised the Secretary of Agriculture "at his discretion" and upon approval or otherwise to locate such lands "which, in his opinion, might be occupied for agricultural purposes without injury to the forest reserves, and which are not needed for public purposes," and to request the Secretary of Lands to make them available in areas of not exceeding 160 acres.

Under this Act preference was given the first applicant for the examination of tracts. This preference clause was taken advantage of by land agents to instigate floods of applications for new tracts—at a fee of from £1 to £20.

Just as often as not the land applied for was located on a rocky mountain side unfit even for goats, and the application was turned down.

Whereupon the resentment of the land-seeker was skilfully deflected by the land agent against the Forest Service on the score of error, misrepresentation, and fraud.

Much the same thing has occurred in Australia.

The amendatory Act of August, 1912, which completed the classification scheme, "directed and required the Secretary of Agriculture to select, classify, and segregate as soon as practicable," all such lands, and granted liberal appropriations for the purpose.

In some respects, the classification problems of American forestry were much simpler than those of Australia. Most of the National Forests were situated in the high rugged mountain regions of the west, where agricultural lands are very limited. Furthermore, such lands as in Australia would be regarded as suitable for mixed farming consequent upon the much more productive climate could not be classified as such in America, owing to the coldness, dryness, and high altitudes. A further feature was remoteness and inaccessibility, as opposed to the proximity of our own forests to civilisation.

Apart from the segregation of agricultural lands within a forest, the general character of the lands contemplated by the dedicatory Acts of 1891 and 1897 had been defined in a joint letter to the President by the Secretary of the Interior (Lands) and the Secretary of Agriculture, dated 7 February, 1910, as follows:—

- (1.) Lands wholly or in part covered with brush or other undergrowth, which protects stream flow or checks erosion on the watershed
- of any stream important to irrigation, water power, or to the water supply of any city, town, or community or open lands on which trees may be grown, should be retained within the National Forests, unless their permanent value under cultivation is greater than their value as a protective forest.

- (2.) Lands wholly or in part covered with timber or undergrowth, or cut over lands which are more valuable for the production of trees than for agricultural crops, and lands densely stocked with young trees having a prospective value greater than the value of the land for agricultural purposes, should be retained within the National Forests.
- (3.) Lands not either wholly or in part covered with timber or undergrowth which are located above timber line within the forest boundary or in small bodies scattered through the forest, making elimination impracticable on limited areas which are necessarily included for a proper administrative boundary line, should be retained within the National Forests.
- (4.) Lands not either wholly or in part "covered with timber or undergrowth except as provided for in the preceding paragraphs, upon which it is not expected to grow trees, should be eliminated from the National Forests."

This is boundary work, and each forest in its entirety and all large units of forest land must meet the requirements of those four rules, or otherwise should be eliminated.

The "principles and procedure governing the classification and segregation of agricultural lands" under the Homestead Laws of 1906 and 1912 are likewise laid down and set forth in the publication bearing that title.

Here the Forest Service only was concerned; it was "directed and required to select, classify, and segregate as soon as practicable, all lands within the boundaries of National Forests that may be opened to settlement," those lands were such as, in its opinion, might be occupied for agricultural purposes, without injury to the forest reserves and which were not needed for public purposes.

Classification was left practically in its hands.

The policy of classification has been minutely worked out, and carefully standardised.

By "agriculture" was understood the production of farm crops under established farm methods.

But "land that would produce timber may also produce certain farm crops in a limited way, with sufficient expenditure of money and labour." It was deemed out of the question, therefore, "to attempt to segregate from the timber land all land having agricultural characteristics."

It was felt that to "warrant its segregation for settlement the land must have sufficient positive value for agriculture to make probable its occupancy and use for that purpose. The soil must be cultivable and capable of permanent agricultural use."

The requirements were, therefore, laid down—

- (1.) The land must have a positive value for agriculture.
- (2.) It must be of greater permanent value for agriculture than for the primary purpose for which the forests were created, viz., timber production or watershed protection.
- (3.) Its occupancy for farm purposes must not injure the National Forest.
- (4.) It must not be needed for public purposes.

The tract must be shown to have "some real agricultural value."

An isolated area is not assured of permanent use for agriculture unless large enough to constitute a practical farm unit, but the same area adjoining other agricultural land would be certain to become part of a permanent practical farm unit.

The acreage necessary to constitute a living area is set forth—

"One hundred and sixty acres—or the maximum—at high altitudes where hay and hardy vegetables are the chief products; 40 to 60 acres of irrigable land at lower altitudes where the leading crops are grain and forage, with some fruit and vegetables; 20 to 40 acres in the Southern States where the leading crops are semi-tropical fruits and vegetables with some grain and forage."

It is added—

"Owing to the necessity of keeping some stock on each farm to consume wastes, to perform work, to furnish meats, dairy and poultry products, and also to furnish fertiliser, it is doubtful whether any farm as a rule should be smaller than 20 acres."

If a given tract of land is found to be of greater permanent value for agriculture than for forestry, the land is to be made available, otherwise not. The question of accessibility to market in regard to agriculture, or inaccessibility in regard to forestry is not to be taken into consideration.

Heavily timbered lands are not to be thrown open under any conditions.

Unfortunate experience has demonstrated repeatedly that to do so is to retard agricultural development rather than hasten it. The timber value invites speculation and crowds out the farmer. The homesteader invariably sells to some lumber company as soon as he gets his patent.

"In 1901, under an enthusiastic demand to throw a portion of the Olympic National Forest open to settlement, and which demand was said to be in behalf of *bonâ fide* settlers, 705,000 acres of lands were released. It was urged at the time that business was suffering; that the entire section in which this forest is situated was at a standstill; that development was retarded; that actual settlers were desirous of taking up lands and making homes thereon, and that if something were not done, chaos would result. In ten years 625,000 acres of this land are in the hands of private owners who are holding it for its timber." (Fifth National Conservation Congress Report, 1913.)

Much the same thing has taken place in Australia.

Again, if the land is of such size and character that ultimately the public interests are best served by its being under cultivation rather than under forest, the timber is sold under clear-cutting conditions and the land is made available after exploitation has taken place.

Which is much the same idea as that of the New South Wales temporary "timber reserves" save that in the latter case administration is divided with the Lands Department.

"On the other hand, there may occur here and there, patches of land under heavy timber which are cultivable, but which are so intimately an integral part of the forest that they cannot be segregated without destroying, from an administrative standpoint, a forest unit. A certain advantage is gained from a forest standpoint, by a limited amount of settlement in or

near each forest unit, but a forest should not be shredded by alienations to a point making protection, general administration or application of forest management unpractical. In the progress of settlement a point is ultimately reached where a choice must be made between refusing to list additional areas or abandoning the entire forest unit, regardless of the character of the remaining lands.

"Not always will it be either possible or practicable to fairly appraise the agricultural or forest value of a given tract of land by the apparent value of each small unit of area for a given purpose. Agricultural lands are most valuable when subdivided into reasonably small farm units, but forest lands are most valuable when handled in large unbroken units."

"Because of this, care should be taken where great forest value is at stake, to define the boundaries of the forest unit," which will then become a permanent retention area, even though certain tracts therein when valued without relation to the surrounding area, appear to have agricultural possibilities.

In a few special cases, it will be necessary to appraise the land by large units and define such units as permanent retention areas. By classes such cases may be—

- (1.) Where the listing of the land without agricultural soil would shred a large area of forest land without resulting gain sufficient to offset the loss which must follow because the remaining-forest area cannot be practically managed.
- (2.) Where a considerable area of forest is clearly of great economic value to the nation or State, and an attempt to transform it into an agricultural country might result in irreparable disaster by disturbing a well established climatic or economic equilibrium (as in the case of the Pilliga Forest of New South Wales).
- (3.) Where small areas in their present condition are found to be of little forest value and but slightly greater agricultural value when viewed without relation to the surrounding area, but are entirely surrounded by forest lands of a very valuable type, they should be retained if necessary to preserve the integrity of the area as a practical forest unit. Such areas, by a little work or expense, may often be made a producing part of a well-rounded and logical forest unit and thereby greatly increase its value for that purpose.

Watershed protection is one of the dominant purposes of the forest. Under no circumstances should land be released which is necessary for this purpose.

"This refers not only to the alienation of slopes which should be retained as a whole under public control, but to the bottoms of gulches where the removal of the tree or brush cover would, in the long run, result in a scouring by the flood waters with disastrous effects on the waterflow. Watersheds from their very nature must be handled and considered as large units.

"Under no circumstances should land in an important watershed be listed if the slope is so great that the soil is certain to be washed to such an extent as to destroy the fertility of the land."

The law prohibits the alienation of land "where such action would injure the National Forest," or where the land is required for public purposes.

If the listing will seriously interfere with or hamper the administration, protection or use of the National Forest then the listing is injurious.

"It is useless to administer a forest if it cannot be protected. It is equally useless to administer and protect if it cannot be used. It follows, therefore, that not only is it necessary to retain such areas as may be required to protect and administer the forest, but it is also necessary to retain such tracts as may be required for the practical use of the surrounding forest areas."

Exploitation requires mill sites, camp sites, banking grounds, logging roads, chutes, &c. It is necessary to maintain "practical grazing units, corrals, watering places, lambing and round-up grounds, stock driveways, and holding grounds."

Water power development in the National Forests necessitates holding rights of way for reservoirs, dams, canals, &c.

Finally, proper administration demands the retention of "areas needed for ranger stations, pastures, lookout stations, roads, trails, telephone lines, planting or nursery sites, firebreaks, and every other area needed in the work of the forest officer—and such areas needed for public camping grounds, health or pleasure resorts, or other purposes for the use of the public.

In the enforced hurry of classification in the Australian States, the importance of many of these issues often has been overlooked, and adjustments must continue for years beyond dedication, involving resumption and purchase. There has been no preliminary forest plan "without first carefully studying which no forest officer should attempt to classify the land in a forest."

The elimination of agricultural land in the United States of America is done in conjunction with boundary revision. The procedure is laid down for a systematic plan of classification, comprising the following lines of work:—

- (1.) Boundary revision.
- (2.) Extensive examination of areas for which data is available, showing few agricultural possibilities and overshadowing timber or watershed values.
- (3.) Intensive examination of areas believed to have considerable agricultural value and doubtful value for timber or watershed purposes.
- (4.) Examination of small areas upon individual application to avoid the delay of waiting until reached in the progress of the regular classification work.

An extensive classification forms the basis of the system. All written and unwritten information which the service and its officers have already secured is correlated and combined in a report by a forest officer who should have broad experiences, liberal ideas, and extensive general farm experience or who should be assisted by the direction and advice of an experienced agriculturist familiar with the general farm practice of the region.

The report covers:—

- (1.) Value and importance of the forest as a sound timber supply and need of retaining it for timber production.
- (2.) Value and importance of the forest as a watershed and need of retaining it to preserve the natural cover for the regulation of stream flow.

- (3.) The general character of the land which should be classed as agricultural.
- (4.) The need of retaining lands having agricultural or other non-forest value in order to preserve the integrity of the forest and make possible its practical administration, protection, and fullest use.
- (5.) Forest and agricultural history before and after withdrawal for forest purposes and any other facts bearing upon the character and value of the land.

The report is accompanied by a diagram of the forest showing the area classified as non-agricultural and the area pending classification.

The report is artistically typewritten in double columns on atlas-sized paper and is generally illustrated by photographs and is bound in heavy binders, followed by the map of the unit area.

Possible agricultural lands are subjected to a following intensive examination. The examiner is selected by the district forester and must be competent to direct and carry on the timber-cruising, surveying, and mapmaking necessary.

He is required to make a "careful and detailed study of the forest and other non-agricultural value of the area, paying particular attention to the lands classed as agricultural by the expert and should submit the information thus gathered in the shape of a map on the scale of 20 chains to the inch, and a report with recommendation as to what portions of the area should be classed as chiefly valuable for agriculture.

The standardised headings for the intensive report are—

1. Value of the area for forest purposes.

- (a) Value as a source of timber supply, present and future.
- (b) Value as a source of water supply and need for watershed protection.

2. Need for retaining for forest purposes any of the land designated as agricultural by the Bureau of Soils, so as not to prevent the accomplishment of the purposes for which the forests were established.

- (a) To preserve the integrity of the forest unit. It must be recognised that the objects of the National Forests, viz., the production of timber and the regulation of stream flow by the protection of the watershed cover, cannot be accomplished if the forest is allowed to become so shredded by private holdings that it ceases to be a practicable unit for protection and administration.
- (b) For proper administration of the forest including areas needed for ranger stations, government pastures, lookout stations, &c.
- (c) For the proper protection and administration of recognised uses of the forest, including tracts needed for logging rights-of-way, log landings, public camping grounds, areas needed in the administration of grazing, fire protection, &c.
- (d) To prevent the listing of lands chiefly valuable for timber rather than agriculture. Agricultural land carrying a heavy stand of timber of such value that the timber speculator, in the place of the *bonâ fide* home builder, would seek to acquire title will be classified as chiefly valuable for forest purposes, and will not be opened to entry until the timber has been removed.

3. The necessity of withholding land, the disposition of which is provided for by existing laws. In this class are water power or irrigation sites, and mineral or medicinal springs.

4. Exceptional value for the land for special uses not above enumerated, as for example, for town sites purposes, hotel sites, &c. The disposition of such cases will be handled finally in the forester's office with reference to such authority as may exist at the time action is taken.

When lands in the National Forests are finally classified and segregated, their status is permanently established.

CHAPTER IX.

WORKING PLANS AND FOREST MANAGEMENT.

AMERICAN DEVELOPMENTS.

The European working plan is the instrument of a complex forest organisation. It is essentially and intensively silvicultural. It revolves around the problems of sustained yield and regulation of the cut.

The instrument itself is not so much characterised by this complexity as the situation it reflects—the elaborately developed application of the records, teachings, and experiences of centuries of fixed traditions and favourable conditions—conditions too of low wages and high prices which do not and can never exist in Australia.

Forests in Europe are managed almost as intensively as vegetable patches. They are well protected and well organised. They are divided into small working units by complete systems of roads and "rides," and their history and that of every section and almost every tree is known and put on record from year to year. Silvical data are abundant and increment yield and volume figures are available for every unit.

The degree of abnormality has been reduced by long-continued tending and already the forests approximate closely to the "normal," i.e., ideal forest which the Australian Forest Services have yet to develop in the years to come from their present disordered wildwoods.

As a matter of fact, working plans are nothing more than orderly records of information available and the deduced ideas of the manager with regard to the future working of the forest.

After all, no business can be controlled effectively without system, and no system can be maintained effectively without being reduced to written records for the dual benefit of present and future users.

This is the basic principle of scientific management and of working plans.

It matters nothing whether the forest is managed on the basis of sustained yield or without any basis in forestry technique at all. If a high phase of development has been reached, the working plan will be a formidable one; if development is only beginning, the plan will be simplicity itself.

As the forest organisation extends, so also must the working plan—its reflection. There must be a normal and coincident development of both.

But it were absurd to attempt to apply to the management of the primeval forest, the working plan of the gardenised one.

In the period of confused thought supervening upon the inception of forestry practice in the United States of America this very absurdity was attempted, and only now, after fifteen years' experience, are American foresters coming to a realisation of the extent of the absurdity.

This initial period was a period of European ideals, when European systems were to be introduced bodily. Working plans were the last thing in European forestry; they would be the first thing in American. Sustained yield was the basic principle of European forestry; it must be the first plank in the American platform. European working plans were silvicultural in character, so also must be the American.

Since such forest activities as grazing, improvements, fire protection, &c. were absent from European practice, and, therefore, from European working plans, they were overlooked entirely in the preparation of the American.

But since such activities were necessarily the first care of the Forest Service in its work-a-day business, effective systems of management of them were developed without realising that those systems were really chapters of a truly American working plan.

Meanwhile came a reaction against "academic" working plans as superfluous, and from 1905 to 1911, the Forest Service turned its whole-hearted attention to problems of actual protection and administration, working out step by step the details of departmental policy and practice, correcting mistakes, adjusting difficulties, aiming at absolute efficiency in all respects.

Forest survey and assessment constituted a prime need of management, and the Forest Service pressed on feverishly with this work, aiming at the satisfaction of an urgent demand for quick results, for the assessment of a maximum area at a minimum cost. Assessors were hurried from one area to another without time to complete their reports.

The elaborately designed working plan reconnaissance become nothing more than a survey and assessment for purposes of timber sales and classification. But maps and estimates of considerable value were produced in the process. Scattered forest descriptions and silvical data accumulated in reports and on files, suggestions developed with regard to silvicultural systems. Marking rules for different forest types were recommended in timber sale reports.

All this information lay unused, but when it became essential to record it in accessible form, systematisation ensued.

Time had brought a considerable codification of thought.

The "National Forest Manual" laid down that "the object of working plans was to systematise the management of each forest in accordance with the cumulative experience and information which the service had acquired."

The plans were to be subdivided into seven sections in order to provide flexibility in preparation and use—

- (1.) General forest description.
- (2.) Silviculture
- (3.) Grazing.
- (4.) Lands.
- (5.) Protection.
- (6.) Improvements.
- (7.) Administration.

The Forest Service had come to a realisation that there were other activities in American forest management than the silvicultural aims monopolising the European plan.

Sections and parts of sections were to be "revised and made more complete and final in character as the need arose and more data became available. A satisfactory working plan must necessarily be built up gradually as more is learned about the forest or district and about the best ways of handling it." The object was to furnish the information currently needed, and its best application to the present work of the forest in the form which would be of the greatest possible assistance in each phase of administration, not only to rangers or supervisors, but also to the district forester."

Working plans had reached at last a stage of normal development.

In May, 1912, the "standard outline for forest working plans" was adopted.

Its essential purpose was to provide a framework upon which to hang the data that had accumulated in the office files and other records which would be collected from time to time. No expense was to be incurred in specially designing plans, but the matter was to be kept in mind and dealt with as a necessary section of the administrative work.

Timber reconnaissance was to be restricted to areas in immediate demand for purchase, or which were required to complete working plans necessitated by urgent local circumstances.

The "outline" is of peculiar interest as indicating the American struggle for clearness in despite of the native passion for detail. Where the European plan is now a definite set of directions with regard to fellings, regeneration, and thinnings, the American has become both a history and a compendium. Overlooking the inaugural caution against "unnecessary detail," the authors have established the headings for a large book on every National Forest. In offering criticism, however, one may not forget that the United States Forest Service had to deal with undivided regions rather than with chess-board woodlots, and that many issues were involved besides those of pure silviculture. Nor had silviculture yet emerged as the final fact. The search for light was proceeding momentarily, but the clear-cut instructions of the European working plan had not yet crystallised from the mass. The American working plan at this date represents the accumulated information which the Forest Service has acquired with regard to each of its million-acre timber tracts.

I reproduce the "Standard Outline" here:—

OUTLINE FOR FOREST WORKING PLANS.

To be effective, working plans must be designed wholly for use in forest administration. They must be concise, complete, and intensely practical. While they must be based upon the best technical data which can be obtained, and must take into account service regulations and policy and apply all specifically, they must exclude academic discussion, material with no bearing on the plan, and unnecessary detail. Unnecessary discussion may be eliminated by tabulation wherever possible, and by statements of requirements, principles, conclusions, &c., and 1, 2, 3, order. Plans will consist of a statement of—

- (1.) The resources of the forest with necessary description.
- (2.) The conditions governing their use.
- (3.) The measures to be followed in their administration and development.

Unless otherwise specifically provided, the plan should outline the general management for a long period, usually a rotation in silviculture, and in detail

for some such period as ten to fifteen years. The varying divisions of the forest required are indicated under each section of the plan. It is intended that the outline shall be followed only so far as it applies to the local conditions covered by the plan.

I.—GENERAL DESCRIPTION.

General data which relates to two or more sections of the plan, or which can be treated more logically here than under other sections. Under most headings the discussion will be a summary of important points treated in detail in other sections of the plan.

Creation. Area, past and present. Totals of alienated lands by classes. (Tabulated form.)

Physical features. (Concise. Include the information which has a distinct bearing upon or forms the basis for the provisions of the plan.)

Climate. (Data not of direct application may be placed in the appendix.)

Topography. (For use in the division of the forest into working circles, as well as its bearing upon use, development, and administration of the forest.)

Geology. (As it affects soils, &c.)

Soils. (In such form that statement may be applied directly in silvicultural practice, settlement, policy, &c.)

Land Classification. Forest, agriculture, grazing, barren, &c. Tabulated. Brief discussion, if necessary.)

Transportation. (Railroads, water, &c., only as it affects the administration or the development of the forest.)

Settlement. Present and probable future. (As it affects the forest and the plan.)

Industries. Mining, grazing, ranching, lumbering, &c. (Only as they have a bearing on the plan.)

II.—SILVICULTURE.

TIMBER.

Estimates and detailed descriptions of timber.

Estimates by species, separately by divisions, blocks, and other natural or artificial subdivisions. Quality, and condition of timber, age classes if stand is even-aged, accessibility, information on logging, &c., as necessary, cutover areas. (Tabulation.)

Forest Types.—Composition, occurrence, distribution of age classes, and condition of timber. (Concise general descriptions and the fundamental silvicultural requirements and principles which form the basis for the choice and application of silvicultural systems.)

Species.—Concise. Treat, from the standpoint of the type and the stand rather than the individual tree, the characteristics and requirements upon which will be based conclusions regarding the species to be favoured and the relation in the management of each species to the others in the stand or type.

Climatic, soil, moisture, and light requirements.

Growth, form, volume, &c. (Tables to be included in the plan if they will be used frequently, otherwise in the appendix.)

Reproduction. Advance reproduction present. Conditions necessary to secure it.

Value of wood. (Properties, comparative values.)

Causes of injury. Fire, insects, fungi, mistletoe, smelter fumes, weather, animals, &c. (Control under protection.)

Increment. Yield table or other data, or the method used to determine increment. Effect of thinnings on growth, &c.

TIMBER OPERATIONS.

Markets. Consumption and demand, local and general, past, present, and future. Relation to surrounding forests if any. Cut, by years, sales, and free use. (For use in the determination of working circle boundaries and in regulation.)

Prices. (To aid in stumpage appraisals.)

Methods and utilisation. (Methods in relation to preservation of proper silvicultural conditions, also as a basis for costs. Reasonable possibilities in utilisation.)

Costs. (As a basis for stumpage appraisals.)

Objects of management. Watershed protection, species of timber and classes of material, sustained annual or periodical yield, &c. (State specifically in order of importance the objects which materially affect the provisions of the plan.)

Silvicultural systems and their application. For each type. (Concise descriptions of the systems adopted and provisions for their specific application. Include brush disposal.)

Regulation of yield. Rotation, cutting cycles, &c. (Rotation of maximum volume production. Cutting cycles as short as practical considerations will allow.)

Division of the forest into necessary divisions (working circles), areas within which sustained yield, annual or periodic, is now or will ultimately be desirable, based upon markets, transportation, and topography. (This may be done elsewhere in cases where such action will simplify treatment.) Blocks and chances only when they are actually needed to assist in regulation. (Blocks—main logging units or groups of logging units. Chances—single logging units or the subdivision of blocks necessary to carry out the management.)

Annual or periodic cut. The limitation of cut including sales and free use. Accurately for ten years, and approximately for the periods of the rotation. (Include in the plan only the essential features of the method used, and cover necessary details in the appendix. Blank table for tabulation of limitation and amounts actually cut. Sales and free use.)

Sales. (By divisions, if advisable.)

Policy. Restriction and encouragement, and location. (The plan of cutting and specific application to actual conditions of the preceding conclusions and of the service policy and regulations. Past management to be treated only as it will help in an understanding of that proposed.)

Stumpage appraisals. Maximum and minimum rates.

Administration and other features. Special force needed. Costs. (Summary for use in obtaining total forest expenditures in Section VII.)

Free Use. (Principles applying specifically the general free use policy, especially where it is more or less vague and general. By divisions, if advisable.)

Present and prospective annual demand by classes of users and of forest products.

Policy, restriction, or encouragement by districts and classes of products.

Administration. Free use areas. Blanket or year-long permits. Other measures to promote economy. Special force needed. Costs. (Summary for use in obtaining total forest expenditure in Section VII.)

Map or maps showing topography, types, classification of timber, boundaries of divisions, blocks, &c., free use areas, cut-over areas, &c.

FORESTATION.

General relation to ultimate timber management.

Areas requiring forestation. By types. (Brief description. Tabulated.)

Methods and species. (Concise. Base upon results of past work. In addition to sowing, planting, &c., include seed collection, poisoning rodents, &c.)

Detailed plan. (Five years, or if impracticable, omit and provide for annually.)

Areas, methods, and costs. (Tabulated.)

Administrative features. Special force needed. (Regular and special work, such as seed collecting, etc.)

NURSERY.

Ultimate production, species, and numbers.

Methods. (Essential features.)

Detailed plan (five years).

Species, numbers, and costs. (Tabulated form.)

Administrative features. Special force needed.

Map showing areas to be reforested, classified as above, etc.

INVESTIGATIONS.

Which can be conducted inexpensively in connection with the regular administration of the forest, and which should result in practical information needed in the administration. Brief.

III.—GRAZING.

RANGE MANAGEMENT.

Types. (Concise descriptions of each.)

Names of important and characteristic forage plants.

Accurate data on seasons of growth.

Accurate data on forage value.

Acreage. With forage. Waste. (Tabulated.)

Carrying capacity. Present. Possible. Brief descriptions. By allotments or divisions. (Tabulated.)

Demand and other local conditions in the live stock industry which affect grazing on the forest. Relation to silviculture.

ALLOTMENTS.

Arrangement. (Division of the range between cattle and sheep, grazing districts, and individual allotments to be shown on map. Guiding principles, or necessary comment in the discussion.) To secure—

Best division between cattle and sheep.

Full and equal utilisation.

Best division of types and early and late ranges.

Best division of watering places.

Proper silvicultural and watershed protection.

Number and kind of stock grazed. By allotments or divisions. Number of permits by classes.

SEASONS.

To secure full utilisation of the forage without seriously interfering with the natural requirements of plant growth. Each portion of the range should occasionally, every few years, be grazed only during the last half of the natural growing period, in order to keep the plant constitutions strong, and allow some actual reseedling. So far as is consistent with this principle, the green tender feed should be available for the stock during as much of the season as is practicable. This is essential, especially for sheep. This plan may be considered a variation of seasons or a division of allotment.

FEES.

By classes of stock and season. (Tabulated.)

METHODS OF HANDLING STOCK.

Cattle.—Salting and necessary riding by permittees to secure equal utilisation of range, and prevent congregation along streams and water holes, with resulting destruction of plant growth and poor development of stock.

Sheep.—

Size of bands.

Herding. (Develop open quiet herding, and avoid driving back to camp.)

Salting. (Encourage abundant use of salt, it means easier herding, less danger from poison and disease, and less damage to the range.)

Other stock. (When special provisions are required.)

RANGE IMPROVEMENTS.

(Permanent improvements in the Improvement Section.)

Reseeding either with cultivated plants or by restricting grazing for natural reseedling, posting poisonous areas, changes or improvement in stock driveways, extermination of predatory animals, prevention of erosion by proper handling of stock.

POLICY AND ADMINISTRATION.

General principles of policy not already covered. Protective and maximum limits, new owners, advisory boards, etc.

Administration. Extermination of predatory animals, counting stock, or other special phases of the work. Special force required. Costs. (Summary for use in obtaining total of Forest expenditures in Section VII.)

INVESTIGATIONS.

Proper seasons, carrying capacity, poisonous plants, artificial reseeded, demonstration tests of proper utilisation, effect of grazing upon reproduction, and most efficient systems of grazing management to eliminate damage. Herbarium with necessary notes.

Map or maps, showing types, water, fences, corrals, topography, grazing districts, allotments, reserved areas, driveways, or other factors or features which influence or illustrate the handling of the stock.

IV.—LANDS.

SETTLEMENT.

Soils. (Classification with brief description and a statement of comparative agricultural and forest value of each class, based upon land values, forest expectation values, etc.)

Demand for agricultural lands. Past, present, and future.

Policy. (In 1, 2, and 3 order, application of policy based upon the preceding classification, results of past policy, service policy, and any other principles as a guide to examiners. Practicability of detailed classification of certain districts in advance of application.)

Map, showing soil classification, if data is available.

USES AND EASEMENTS.

Resources.

Demand. Past, present, and future.

Policy. (Special features which are important by kinds of uses or easements. Include charge compared with value to users.)

WATERPOWER.

Resources. Streams, sites, power. Cost and market data and stream measurements. (Tabulate.)

Demand. Past, present, and future.

Policy. (Special features.)

ADMINISTRATIVE SITES.

Sites, rights of way, etc., withdrawn, or still needed, and to be withdrawn. Include comprehensive plan of rights of way needed for future sales and other uses, as well as sites and rights of way required in administration. (Tabulate or show on map.)

ADMINISTRATION.

Special force needed. Other administrative questions.

Costs. (Summary for use in obtaining total forest expenditures in Section VII.)

INVESTIGATIONS.

Map or maps showing status, location of uses, easements, water power projects, administrative sites, etc.

V.—PROTECTION.

FIRE.

(By divisions or geographical subdivisions, if advisable.)

Liability.—Statement of value of destructible resources by classes, and for districts or regions. Timber, expectation value of young growth, forage, arbitrary value per acre of watershed protection. (Possible money damage. Tabulate.)

Hazard or risk.—Statement by types or regions based upon character of stand, danger of fires starting, and difficulty and cost of suppression. (Should be based in part upon a study of past experience.)

Protection required. (Principles which sum up on the basis of liability and hazard the relative amount of protection needed in specified parts of the forest.)

CONTROL.

Improvements available. By districts. (Brief description, tabulate if map is not sufficient.)

Communication. Telephone, etc.

Transportation. Railroads, roads, trails, pack trains, etc.

Fire lines. Lookout stations.

Supplies and tools. (Distribution or how they are to be purchased, etc. Tabulate.)

Co-operation. Adjoining forests, between ranger districts, State associations, corporations, individuals, etc.

Organisation and administration—

For lookout stations and patrol. Numbers of men and duties by districts. (Tabulate so far as possible.)

For fighting fires. (Tabulate if possible.)

Regular and temporary force.

Co-operation, labour including users.

Outside labour.

Costs. (Summary for use in obtaining total of forest expenditure in Section VII.)

Specific and detailed instructions to rangers based on the above, and resulting in its direct application, should be issued to all forest officers engaged in fire protection.

Map showing types, topography, improvements, and as much of above information as is possible and advisable. Copies to accompany letters of instruction.

INSECTS.

Extent of infestation and damage.

Control, administrative measures, methods. Special force needed. Costs. (Summary for use in obtaining total of forest expenditures in Section VII.)

OTHER DAMAGES.

Extent. Amount of damages.

Control, administrative measures. (As under Insects.)

GAME.

Policy and administrative measures.

INVESTIGATIONS.

VI.—IMPROVEMENTS.

Improvements. Comprehensive plan of the improvements needed. Location, brief description, estimated costs, indicate those which should be undertaken within the next five years. (Tabulated form.)

Roads, trails, telephone lines, fire lines, administrative fences, stock fences, including the fencing of poisonous areas and bog holes, bridges, corrals, dwellings, other buildings, water development, stream improvement, dams to prevent erosion, other projects.

Maintenance, as above.

Policy and administration.

Improvement policy of the forest. (Concisely by lines of work such as silviculture, grazing, protection, general administration, etc.)

Administrative provisions. Special force needed. Costs, exclusive of the costs of individual projects.

Map showing all improvements constructed and planned, with a sufficient amount of other data to make intelligible.

VII.—ADMINISTRATION.

Administrative districts. Number, area, and relative importance or amount of work. (Tabulate.)

Force. Office and field and assignment. Salaries. Also a brief forecast of future requirements. (Tabulate.)

Permanent, statutory. Semi-permanent and temporary.

General administrative policy of forest. (General relation of important lines of work. Include also points not already covered; fully and briefly in 1, 2, and 3 order.)

Receipts and expenditures and results. By lines of work for fiscal years, past and estimated future.

Administrative provisions for increasing receipts or reducing expenditures.

Map, boundaries of administrative or other districts.

APPENDIX.

Material which should be preserved in connection with the plan, but which will be used infrequently in actual forest administration.

List of species.

Details of methods used in the collection of data, costs, and areas covered. (Reconnaissance.)

Tables, growth, volume, etc., when it is reasonably certain that they will be used infrequently.

Details of method for regulating yield.

Detailed silvical discussions upon which conclusions and principles outlined in the plan are based, if preservation seems necessary or advisable.

General notes upon which the conclusions in the plan were based.

Inventory of existing improvements, if desired. (Tabulate.)

Regulation of the cut on the basis of the sustained yield had been early the objective of the American Forest Service, as it is that of the Australian Forest Services to-day.

Limitations were established for each National Forest and were alterable only by the Minister. But these limitations were fixed when the sales were considerably less than the estimated annual increment, and when the sales approached the limitation the pressure brought to bear was such that resort was had to the specious method of combining with the limitations of one forest the specified cut of adjoining areas, although their outlets often were hundreds of miles apart. In the case of the Whitman Forest, the permitted exploitations of five forests were added together in order to justify a proposal to exceed the sustained yield of the original unit.

The facts had not been faced squarely.

To exploit the forest at a faster rate than it grows is tantamount to cashing the company's capital to pay the dividends.

The principle of the sustained yield is limitation of the periodic cut to the amount of wood accretion during the period. Is is the essential purpose of State forests, which are set apart to perpetuate the timber supply, and the chief justification for their existence as such. It is the only scheme of management under which ordinary business efficiency can be achieved, and mismanagement guarded against. It is the only scheme under which forest industry can be established, and logging and milling plants assured a reasonable life, thus making, by elimination of high depreciation costs, for cheaper timber for the community, and providing the best form of investment. It makes possible permanent transportation facilities and permanent forest communities, and establishes labour conditions, and as such has the best social results—a consideration which no Australian can overlook.

But it is another matter to persuade operators to transfer their operations from handy forests before they have cut them out, to inaccessible forests with often inaccessible markets. In the North-West of New South Wales the forests adjacent to railways are being overcut, while the huge over-maturing supplies of the Central Pilliga cannot be exploited owing to lack of transportation facilities. To prohibit cutting on the accessible forests because exploitation has exceeded the wood increment, is not possible until other sources of supply are opened up, and to do so would destroy the timber industry.

Railways and markets are necessary to the establishment of management on the basis of the sustained yield. It is not so much a question of what should be done as what can be done.

Until railways and markets are available, sustained yield for forests or even working circles, to a large extent, must remain as theories. Limitations of the cut are of value in the pioneer phase, only as a standard and a danger signal. They should certainly be established, so that it will be possible to tell approximately the amount of the overcut or undercut.

To the Australian forester, the lack of increment data is a handicap. We have no reliable information as to the rates of growth, and are at a disadvantage as compared with Europe or America, in that annual rings are no guide, and we must gather our data by prolonged observation of the trees themselves.

Furthermore, it is necessary that we should have beforehand, an intimate knowledge of our forests, so as to ensure that cutting will be concentrated on overmaturing and deteriorating stands, and detailed data as to accessibility, transportation facilities, and markets, so as to safeguard the silvicultural aims against sacrifice to purely local business considerations.

The "United States of America Forest Manual" now sets forth—

"Intensive methods like the management of timber, so as to secure a sustained yield, should not be attempted until required by the demands upon the forest, or other conditions affecting the use of its resources."

In harmony with this policy, the following instructions were issued by District No. 3 for the guidance of its officers:—

"The first step in the management of the National Forests under existing policy is to sell the overmature timber that is deteriorating and to develop a net revenue. Yield regulation must be secondary to the silvicultural requirements and a market. It is clearly valueless to impose a local limitation of cut which is impractical because of the necessity of a large annual cut to justify commercial logging. At least until the overmature timber is removed, therefore, the policy of an annual (rigid) sustained yield will not be applied."

This surely is evidence of the reaction against European ideals.

The Standard Outline, which was an attempt to stimulate and guide the development of working plans, was designed in the hope that forest supervisors during the winter months, would assemble under it, all the data available for their forests. But the outline was so complete as to appear too formidable to deal with. Only a few enthusiasts grappled with it. Not every supervisor was capable of undertaking the task.

A very recent development of this situation is a proposal by D. T. Mason, formerly assistant district forester in District No. 1 and now Professor of Forestry at the University of California, for "a regional silvicultural plan."

I had an opportunity of discussing the matter with the author of the proposal. He contends that the working plan for any one forest covers general principles and practices applicable to all those in the same silvicultural region. He regards as cumbersome under these circumstances, the preparation of separate plans for similar forests, and not good policy, because all supervisors are not silvicultural specialists.

An immense amount of duplication work is involved, and he advocates, therefore, the preparation of "timber plans, not for forests, but for forest regions."

"The idea is to include in one full report for each silvicultural district, all the material dealing with the silvics, silviculture, and utilisation which, under the Standard Outline was to have been included in the plan for each forest."

For instance, under Australian conditions, there would be a "regional silvicultural plan" for the cypress pine type, another for the hoop pine type, another for the eastern hardwood type, another for the Jarrah type, and so on.

Mr. Mason suggests that the preparation of such plans should be allotted to specialists.

Simplification of the U.S.A. working plan was proceeding, and with it the realisation that in establishing a pioneering forestry system, conservative timber-getting and regenerative measures were the first needs.

But still further simplification is proceeding as instanced by the proposal for a simple annual plan based upon and really a corollary of the regional plan. It is actually an annual report upon the work of each forest, affording

OREGON REGROWTH.

an opportunity for assembling and discussing the year's records and results, and of recommending plans of management for the ensuing period. It is really a preliminary working plan adapted to the quickly-moving conditions of the pioneering period.

As silvical data increase and influence the system of management, the annual plan will evolve into the true working plan known to Europe. In the meantime, the "regional silvicultural plan" so-called, represents the separation from the mass, of the idea of silviculture as the central fact of management. It emerges as a compilation of silvical data, upon which the true working plan must be founded.

Such has been the evolution of the American working plan. What should have come first has come at long last.

Organisation and working plans started off at opposite poles in the beginning of American forest administration. Time has elaborated the former, and simplified the latter, until both are now practically coincident and co-ordinate.

The lesson for Australia is that development must be founded on the rock bottom of established conditions.

The vehicles are policy, organisation, silvical research, and annual working plans. Through them the final working plan will be attained.

Policy is the foundation, and it will be furnished, in all good time perhaps, by State legislative enactments. Those enactments should vest in the State Forest Services (a) an adequate forest estate; (b) full technical control; (c) authority to reinvest the forest revenue in the forest. Short Acts are quite sufficient; they should afford the widest possible powers of management to the forest administration, and provide ready means for keeping pace with the rapidly changing phases of extension which must ensue.

The basis of organisation is reconnaissance and division of the area. There must be a wide and vigorous development of forest assessment and survey work, so as to provide necessary maps and figures for management, and in order to indicate the location of exploitable timber belts. The distribution of age classes must be ascertained so that those belts may be dealt with in order of their maturity as far as possible. A stocktaking of little-used species is requisite in order to determine their possibilities and extend utilisation to them, thus removing a very serious handicap to effective forest practice. Silvical investigations must be carried out. There must be a study of the chief forest types and their growth and reproduction. Increment data must be secured. An investigation of markets and industries, including studies of methods and costs of utilisation, transportation facilities and local needs is of prime importance, since such considerations must govern the royalty and timber sales policy.

A standard outline for silvicultural studies should be drawn up, and all information which has been collected should be assembled systematically in it.

There must be a preliminary division of the area into convenient units of management and operation. A resident forest personnel must be appointed. Forest stations and nurseries must be established, also forest experiment stations.

In the annual plan, the managing officer should record the year's operations for the forest, reduction of timber estimates by cutting, fire, &c., the results and information obtained and the work projected for the ensuing twelve months.

Adoption of the annual plan would encourage officers to systematise their data on resources and methods and conditions of utilisation. In course of time and by normal growth, the annual plan would emerge as the true final Australian working plan. But there must be evolution, not revolution.

Limitation of the cut of each forest on the basis of the sustained yield must be an important objective of management. Its adoption generally, however, hinges upon a general accessibility.

It should most certainly be applied in the case of accessible reserves where excess operations can be diverted reasonably to other areas, such as lands in process of clearing for settlement. There is no dearth of such lands in Australia and their resources should be fully utilised, in any case.

In the absence of increment and assessment data, an approximation of the sustained yield, based on a rough stocktaking and a tentative rotation, should be adopted.

Sound silvicultural practice is the prime need of the moment. Operations must be conducted so as to give the maximum opportunity for natural regeneration.

Silvicultural systems are linked very closely with the timber policy, whose first principles should be the safeguarding of the interests of the future forest, and those also of the present industry. Silviculturally speaking, exploitation is, after all, only a means to an end—the end of regeneration and the production of the normal forest.

Clear cutting, with reservation of seed trees, singly or in groups or blocks, is the silvicultural system adopted almost exclusively at present in the United States of America. It is a method for over-mature, even-aged forests under an extensive form of management, and is almost obsolete in Europe.

The forests of Australia are not usually even-aged. For the most part they consist of a scattered overwood of over-mature and deteriorating trees, with an irregular mixed underwood of many species, many of them mere forest weeds. White ants or borers infest the former; bush fires have ravaged the latter.

Removal of the overwood is indicated, but it must be regulated so as to safeguard the underwood, and make for reproduction to the normal extent and composition. Exploitation must be conservative, and defective and useless trees must be eliminated from the stand. Disposal of the débris and brush may be desirable in some instances as a regenerative measure.

But red cedar for fencing, and rosewood for pig troughs! Thus it was in the beginning, and thus it continues, if in diminuendo, to this day. Rioting among a virgin plenty (for the handful pioneering population of Australia) the Australian licensed timber-getter has followed the policy of the small boy let loose in the orchard; he has confined his attention to the pick of the timber stand, and has left behind him a trail of wasted wealth to be offered up as a burnt sacrifice in the bush fires of the coming summer. Of the trees he actually fells for mill logs, he takes two-thirds; of the precious ironbark for sleepers he leaves two-thirds. The important cypress pine resources of the West fare no better, despite local shortage, while the valuable but limited hoop pine scrubs of Queensland are being wastefully culled in order to satisfy the fastidious taste of the day for clear lumber unspecked by a single knot.

The timber-getter transfers responsibility to the miller who refuses to accept any but selected logs. The miller in turn blames both the general consumer who will not have anything to do with second-class timber, the architect who declines to depart from the traditional specification on which he has been reared, and Government departments which insist on the finest quality of wood for every purpose.

This insistence upon picked timber is a pioneering phase, consequent upon a limited need and a comparative original abundance. Australia is still a young country, but its resources in wood are limited. The time for conservation and efficiency has arrived, and pioneering methods must go. Virtually, only one grade of timber is employed at present—the best. The American timber trade recognises ten different classes.

Conservative timber-getting is the first step in silviculture. And, since the fate of the forests is at present largely in the hands of private enterprise, the methods of private enterprise must be regulated. There must be attached to timber sale agreements and licenses, such conditions as from time to time may be found requisite to secure improvement. In this way is being guided the betterment of logging in American reservations—*vide* my remarks under “Timber Sale Policy.”

But conservative lumbering involves a greater expenditure of energy, both mental and physical, and although it achieves substantial economy in the utilisation of the product and the preparation of the ground for regeneration, it makes immediately for added cost in working. And added cost is not shouldered willingly by private enterprise, whose main concern is maximum profit.

The question of royalties, therefore, is involved. As a matter of fact, the correct appraisal of stumpage values is fundamental to forest management. Nor is it an altogether simple task, since it includes not only considerations of silvicultural treatment, but also the necessities of the timber trade. An intensive enquiry into labour, freight, and market conditions is essential to success. No rough-and-ready approximations will suffice, and the subject must be tackled with determined thoroughness, and worked out by thoroughly competent men. There is no greater bone of contention between the forester and the timber-getter than an untrue royalty, and no greater curse to forestry than its arbitrary imposition. Values must be natural.

The “uniform royalty” expedient is one that still survives pioneering necessities in most of the Australian States. Its crudity and general ineffectiveness are obvious, but it seems difficult to break away from a tradition. Progress after all is a mere patching-up in perpetuity. Recently, New South Wales has strained away from its ancient principles and in lieu of the uniform royalty has adopted a “minimum royalty.” But the new minimums are considerably higher than the old “uniform” rates, and if applied as such must have the effect of arbitrarily bolstering-up stumpage values or of increasing the use of imported timbers—when peace permits. There is, however, no definition as to the incidence of the minimum rates.

Of all the Australian States, Queensland has been the most fortunate with regard to timber sale policy. It avoided the wiles of the royalty license method, and from the beginning founded its development upon the solid rock of actual sale on the open market at competition.

Despite inevitable discrepancies of a minor nature, owing to the machinations of groups of buyers, the adoption of the auction principle has culminated in the natural market values that now obtain, and, combined with the governmental policy of building railroads to the forests, has been responsible for the securing of the highest stumpage values in Australia—and beyond. The system is safeguarded by the fixing of upset prices based upon a scientific study of labour, freight, and market conditions.

The Queensland timber sale policy is virtually identical with that of the United States of America. It is a policy which must be copied eventually by all the Australian States, and not only because it ensures the receipt of the true stumpage value, but because it avoids the dangers of competitive exploitation, and furnishes a sure basis for the further extension of systematic forestry.

Under the licensing systems of most Australian States, timber-getters armed with a half-crown license may prospect any bush and contest with other forest freebooters the possession of the forest loot. The system has been responsible for tremendous wastage of the timber resource, and while it lasts, effective management is impossible. Like that of the United States of America, the Queensland timber sale policy awards to the purchaser at public auction the sole right of logging on a defined lot, for the conduct of the operations on which the holder is responsible. It is a simple system, rendering supervision easy and making possible the natural extension of the functions of forestry. It avoids also the necessity for an interminable code of regulations such as too often characterises the forest administration of other Australian States.

The New South Wales exclusive-right idea represents the clumsy patching up of the licensing method into the semblance of such a scheme. It gave to the holder a fifteen years' monopoly of 10,000 acres of then more or less inaccessible timberland, at the prevailing uniform royalty. It provided for no revision of conditions, and virtually took from the forester for the term of the right, all possibilities of instituting silvicultural treatment or of obtaining true stumpage values. So little amenable is it to forestry control that any alteration of a cutting condition involves alteration at the hands of Parliament of the whole code of regulations!

Further patching has produced the special license idea which is much less objectionable because of the greater power of control, although the maximum term of fifteen years is likely to hamper management.

Certainly, a reasonable operating life should be guaranteed established milling plants, in order to stabilise the industry and make both for higher stumpage values and lower selling prices to the consumer. Long term rights, however, are not merely monopolistic, but a virtual deliverance of forest practice into the hands of the enemy. A reasonable operating life may best be safeguarded by the establishment of the principle of the sustained yield, and the making of annual or semi-annual sales up to the limits thereof. Such a policy would remove the danger of monopoly, whilst avoiding the undesirable multiplication of small and temporary milling plants, working on a "boom and bust" principle.

The short-term sale of defined timber lots furnishes a convenient basis for the extension of silviculture. Could the Australian forester take over forthwith the whole work of exploitation in addition to that of thinning, he would be in a position at once to apply the results of his experience. But there are other interests to be considered besides those of pure forestry, and the timber trade has a big say—too big, very often—with regard to the job of logging. Evolution will place the forester in actual control eventually, but, until then, other means must be employed to bring about the introduction of elementary forest practice. The crude expedient of minimum girths has been the mainstay of Australian forestry in the past, and it has served a useful purpose. It is entirely inadequate, however, to meet the requirements of applied silviculture, and must go. In its stead should be erected the principle of marking the trees to be felled. The acceptance of that principle would place in the hands of the forester an instrument wherewith to shape the destinies of his charge along the lines opened up to him by his previous experiment and research. It would make practicable an instant advance into the realms of applied forestry.

A further step in the right direction would be to set apart for direct management one of the timber lots opened up for sale annually on each forest. That lot should be exploited by the forest service itself, with regeneration primarily in view. It should serve both as an example of conservative timber-getting for the benefit of the private operator on the same forest, and as a beginning for the Australian forester in applied silviculture. In principle, the idea is identical with that of the "Area of Concentrated Regeneration" of Troup.

The forest service should undertake also the planning of the road and compartment systems, and the actual work of construction. The timber which has to be removed should be worked up and sold.

There remains the question of setting in order the areas already cut-over under the unrestricted conditions of the past. Victoria and New South Wales both have undertaken a considerable amount of what has been styled "cleaning-up" work. It includes both thinning and regenerative measures, and also overmuch tidying-up of the forest. The work is being carried out by casual labour under temporary bush gangers, or by occupiers of forest leases under the terms of their holdings. The profits from the sale of the trees on the areas treated are credited against the cost of treatment. It is proposed to extend the operations to all the areas of past exploitation.

The project appeals to the people who want public moneys spent in their districts, and there is a danger of its being erected into the be-all and end-all of forest practice. But it is scarcely appropriate to either the needs or the finances of the moment. It lends itself to unsound bookkeeping. It is an inordinate undertaking for unorganised forest services. It is likely to trench too far on funds required for more pressing organising work. It is building without adequate foundation. It is a function, at all events, not for temporary bush foremen and casual labour, but of a trained forest personnel—which does not yet exist. Both forest organisation and silvicultural investigation must precede it. And, when all is said and done, accomplishment waits upon wider markets than at present exist in Australia. The requirements of small communities are narrow. There is little sale for thinnings, and thinning work, therefore, should be avoided. The forests, also, are filled with a miscellany of minor species awaiting a market, and immediate treatment, therefore, involves a sacrifice and expenditure which economic management would not countenance. Markets should be found in the first place. There should be a complete stocktaking of the goods available, a full investigation of their possibilities, a development of appropriate seasoning methods, an establishment of timber grades, a cheapening of costs by roadmaking, etc., and finally, a hustling of markets.

Twenty years ago in New South Wales, such species as blackbutt, flooded gum, and brush box were despised and rejected—as they are in Queensland to-day. Yet in the former State they now furnish the bulk of the milling supplies. Crowsfoot Elm—a valuable timber—occurs abundantly in the hoop pine scrubs—yet there are no buyers. Many such useful woods remain unutilised because they are more or less untried, and the trade has been "brought up" on big-sized logs. But since Australia is importing cheap softwoods from abroad to the tune of £10,000 per day, there should be no excuse for the neglect of the Australian product.

"Organisation and investigation" must be accepted as the keynotes of Australian forestry at this stage. Broad and substantial foundations have to be laid before details can be added. Working plans rest upon division of area and investigation of silvics: division of area depends upon forest survey,

and silvical knowledge upon research; the whole waits upon organisation of a trained forest personnel and the working out of system. The annual forest plan is the vehicle which will bring to Australian forestry the true final working plan, as it is known in Europe.

Such are the foundations. Upon the manner in which they are laid to-day depends the entire future of Australian forestry. To establish them effectively, all the funds available will be required.

Meanwhile, the Crown timber reserves should be withheld as far as practicable from operation. The longer exploitation is deferred, the better the prospects for management. These limited areas ultimately will have to shoulder the whole burden of supplying Australian needs. In the meantime, alienated and alienable timber lands are being cleared for settlement purposes, and large bodies of wood are being wasted. It is most important that this material should be utilised, so that, apart from questions of management, the supplies in the national reservoirs may be to the same degree conserved for the future. Australia is not so blessed with forest abundance that it can afford to neglect this essential economy, or so far insolvent as to be obliged to liquidate its forest estate forthwith. The quest for revenue has been the curse of most Australian forest services. Alienated and alienable timber lands should assume to the utmost the responsibility of supplying present requirements.

The recent history of the North-West Forestry District of New South Wales offers a valuable instance of the carrying out of such a policy. In 1912, timber-getters were weaned from the Crown reservations, which have remained closed to operation ever since. Exploitation was diverted to vacant Crown lands, leaseholds, and private property. As these became cut-out according to the then existing ideas, the logging standards became reduced, until ultimately the closest utilisation ensued. White cypress pine was the major species. A stumpage height of 8 in. and a top diameter of 5 in. were established. Trees down to 7 in. DBH were used; drought-killed stands were converted. The second-grade black cypress was introduced to the market, as were other lesser species.

Meanwhile, the forests had been surveyed, and organisation was proceeding. The closer reserves had been subdivided into convenient units with complete road systems calculated to cheapen transportation. Forest overseers were appointed and timber-getters were employed to convert the trees on the roads to saleable material, mill logs, sleepers, round and split posts and rails, or whatever they were best suited for. Costs were carefully recorded for each operation, and it was found possible to sell below the casual contract rates. Situated on the edge of the North-Western plains, there had been a passive demand for such rough building material. The demand was galvanised into activity by advertisement, and a strong trade developed.

Improvement thinnings were then undertaken in the compartments, and all dead, damaged, defective, and inferior trees were removed, converted, and sold. In five years, the practice of forest spoliation had been replaced by that of forest betterment; 50,000,000 superficial feet approximately of timber of first-class quality from the Crown reservations had been saved; the timber trade had been educated to conservative timber-getting, and real forest practice had been initiated.

When of necessity the timber reservations have to assume once more the burden of supply, they will be in a position to do so with safety, and the fifteen years' gap between the mature and immature stands will have been bridged. The foundations of forestry having been established, the rest must follow in natural sequence.

CHAPTER X.

THE U.S.A. FOREST SURVEY AND ASSESSMENT SCHEME.

Forest survey and assessment work is the foundation of forest organisation and administration.

Boundary survey is necessary for the effective control of the forest business; intensive reconnaissance is essential to the extension of forest management.

The United States of America Forest Service has developed this branch of forest practice to a very high degree of efficiency, and has evolved a standardised scheme for carrying it out which furnishes a very useful guide for elaboration of Australian methods.

Necessarily the plan has to fall in with the United States of America Public Lands Survey system. That system differs basically from the Australian practice, and it is necessary, therefore, to describe it briefly in passing.

The United States of America Public Lands Survey plan dates from the time of the Revolutionary War, when General Putnam conceived the idea of parcelling the country into regular rectangular blocks with 24-mile sides.

These blocks have been cut up since into "townships" of 6-mile sides, and still later the "townships" themselves were subdivided into thirty-six sections each a mile square. These "sections" again have been parcelled out into "forties," *i.e.*, sixteen blocks of forty acres each.

It was an after discovery that the convergency of meridians towards the North Pole interfered with the ideal of regularity, and "correction lines" had to be introduced on the northern side of the "townships," throwing all errors of convergency into the north half of the north tier of "sections," which were reduced in consequence below the original standard area of 640 acres.

All existing data with regard to the national forests is consolidated in the Forest Atlas at Washington. This Forest Atlas is the "central repository of maps, diagrams, statistics, and history of the national forests."

It comprises now 204 volumes, containing map sheets exactly 18 in. by 21 in., on the standard scale of eighty chains to the inch.

In each District Office is kept a District Atlas, holding copies of the map sheets for the district. It consists generally of twenty or more volumes.

The sheets covering a national forest are assembled into a "folio"; which forms the basis for all further forest mapping.

The United States of America Forest Manual declares that—

"Accurate base maps on a large scale showing the topography and culture are essential for the proper and successful management of the timber and forage, of special uses and settlement, and for the improvement and protection of the forests."

The entire forest survey work is vested in the Office of Geography, whose broad aim is to build up a series of topographic base maps on a standard scale of twenty chains to the inch, with 50 ft. contours, and of sufficient accuracy and detail to serve every purpose of forest administration for at least twenty-five years ahead.

The base maps are to be called "Working Plan Maps," and are to cover eventually the entire National Forest Area.

Their fundamental purpose is to record timber sales and working plan data, and their development is correlated, therefore, with the collection by the Offices of Silviculture, Lands, Operations, and Grazing, of information with regard to stumpage (royalty) appraisals, forest types, age classes, site qualities, soil classification, forage types, fire protection, permanent improvements, silvicultural provisions, timber estimates, and any other purposes requisite for effective management.

For the present the work is to be restricted to areas where operations are in progress or in prospect, or in which there is danger of exceeding the requirements of established plants, or the interests of local communities.

A skeleton map of the area to be surveyed is prepared on a 20-chain scale, and on it is plotted all existing data.

This map becomes the "camp map."

A preliminary field inspection is then carried out by the chief of party, accompanied generally by the forest supervisor and perhaps also by a member of the district office.

It covers the following points:—

- (1.) The desirability and probability of an immediate sale.
- (2.) The specific problems on the forest.
- (3.) The area which should be covered by reconnaissance.
- (4.) In detail, what data will be necessary, and exactly how they will be obtained.
- (5.) The plan of topographic control.
- (6.) The percentage (5 per cent. or 10 per cent.) which should be estimated.
- (7.) The size and organisation of the party.
- (8.) The necessary equipment, transportation facilities, trail construction required, possible camp sites, etc.
- (9.) A tentative division of the area into blocks and chances and, if possible, its relation to the forest as a whole.
- (10.) Deviations, if considered advisable, from the district instructions.

(Instructions for intensive reconnaissance, 1914.)

As a result of this preliminary inspection, a complete plan of work is prepared in the form of a letter of instruction to the supervisor, and is submitted to the district forester for his approval and signature.

United States of America Forest Service mapping combine the features of both cadastral and topographic surveying.

There are three divisions of the work, viz., primary, secondary, and tertiary control.

Primary control has as its object the orientation of the survey on the earth's surface.

It is seldom necessary in forest practice because of the foundational work of the geological and lands surveys.

Secondary control consists of the horizontal and vertical extension from the primary control, of a framework of traverses upon which to hang the topographic details.

In well-surveyed country it amounts only to a retracement of existing land lines and the reblazing of at least every second "section" line. In poorly surveyed areas, it consists of establishing a gridiron of traverses in cardinal directions. In unsurveyed lands, it has to furnish a skeleton of traverses along the ridges and creeks.

The object is "to criss-cross each project with a series of more or less parallel lines and profiles, not over two miles apart, preferably one mile in timber reconnaissance and land classification and not over three miles in grazing reconnaissances. The endeavour is to parcel the area out into forty-acre blocks.

Transit and stadia are most usually employed in secondary control, a light mountain transit with stadia hairs and solar attachment being used. The crew comprises four men, viz., an instrument man in charge, a recorder and computer, a rodman, and an axeman.

Where the cost of brushing for stadia sighting is heavier than that of the necessary chainmen, transit and chain is the method adopted.

In cases where the area is not to be "stripped" owing to its unimportance in the forest scheme, the Johnson plane-table and an 18-inch telescopic alidade and stadia rod are employed. The positions are located by triangulation and the details are sketched in at the same time.

Where speed is essential a three man crew with chain and compass and new Abney are employed.

This year (1916) District No. 1 is trying out the Solar compass and chain method, with the idea of overcoming local magnetic attraction, and achieving a high rate of speed.

Lines are blazed, and permanent monuments established at intervals of about a mile. A guide stake is set up at every ten chain distance to indicate the starting and closing points for strip surveys. Each north and south line is lettered, and each strip station is marked with the letter of the traverse, the number of chains from the south end of the forest, and the elevations. The strips are numbered consecutively.

The limit of error with transit and stadia is set at 4 feet horizontally and 1 foot vertically per 1,000 feet of distance. With the compass and chain, however, two or three times this error is permitted.

Before a traverse is used as the strip starting base, it is plotted in ink on the camp map and the closing error distributed by graphic adjustment.

Tertiary control is the actual work of clothing the secondary control framework with the topographic detail. It is the "intensive reconnaissance."

Ordinarily it is accomplished by "strip surveys." Exceptionally, and where unimportant patches occur, it is carried out by plane-table triangulation and traverse.

On timber reconnaissance and land classification, the strips are placed every ten or twenty chains; in broad grazing reconnaissance they may be as much as forty chains apart.

The organisation of the assessment party depends on the class of reconnaissance to be undertaken.

The officer-in-charge is generally an assessor of ability and experience. He is appointed by the district forester, but is responsible directly to the forest supervisor.

Technical men from the offices concerned are attached to the party, and it is laid down that their number should be "large enough to obtain the technical data required and to develop trained men to take charge of other parties in the future."

A topographic draftsman is appointed to all main parties of more than six men. His duty is to keep the map material up to date and to co-ordinate the estimates made.

The general district instructions are required to set forth in detail the duties to be carried out and the data to be collected by each member of the party. All are to be given an insight into the broader phases of the work, and its ultimate objects.

In order to obviate his becoming "a mere administrative machine," the carrying out of original work is encouraged in the officer-in-charge.

The party is divided into crews. On most projects the two-men crew is adopted, although in grazing reconnaissance a one-man crew may suffice. In the former case, one man—the compassman—does the surveying, and the other—the estimator—the estimating and soil typing.

Usually a crew is assigned to a block of about 320 acres (half "section"), in order that "its familiarity with one strip may help it on the next."

Compass and pacing or rough chaining, are the means employed in "tertiary control." An error of 3 chains per mile or 5 chains in two miles in alignment is permitted.

In pacing, a closing error of 6 chains in 2 miles is allowed. Errors, however, must be noted on the sketch.

Rough chaining is employed to obviate secondary control in dense brush and broken country, or when the new Abney is used.

At the end of each 40-acre block a mark is left for checking purposes.

The elevations are obtained by the aneroid and new Abney and are based on the secondary control.

The compassman uses a small sketching sheet, with a transparent duplicate superimposed. Before leaving camp he transfers to the sketching sheet from the camp map the topographic data secured in primary and secondary control, so that he may tie his sketch into the control.

On this sheet he enters the surveying data, stations, elevations, barometric readings, contours, cultural and topographic features. On the transparent duplicate he shows the soil, grazing, timber type and age, class, boundaries, quality, sites, and names, etc.

The complete sketch of the topography and culture is finished in the field. Contours are drawn in and made to fit with adjoining strips. Each sketch must be corrected at the end of each day's work before it is handed to the camp topographer for fitting with the sketches of strips of other crews into the camp map.

The estimating is done by the rear man of the crew along the strip and within a half-chain of it on both sides. All the trees are tallied by one or two inch diameter classes of species. Heights are obtained by estimating the number of 16 feet (the standard) logs in the tree or the total height. As a temporary expedient pending adoption of other plans, the following method is often used:—

"Construct at the beginning of the work three tables of height (in 16-foot logs or total height) on diameter for 'tall,' 'medium,' and 'short' timber. Then each 40-acre block is thrown into its proper class by the actual measurement of a few representative heights, which are recorded on the bottom or margin of the tally sheet"

"The unit of estimation is the 40-acre block. Tallies are kept separate by types and logging areas, and in even-aged stands by age classes." In uneven-aged stands estimates include (a) all merchantable timber; (b) where needed for regulation a division of the stand into age classes based on diameters; (c) data on age classes below merchantable size for determination of increment and purposes of management.

The officer in charge deals with the more difficult questions such as logging costs, silvicultural systems, cutting policies, etc.

All the topographic detail collected is fitted into the camp map and inked in by the topographer before the party leaves the field, so that the final maps can be prepared forthwith by the district office drafting staff.

Timber types and other special data for the project are not shown on the camp map, which is regarded purely as a topographical base map.

The final maps are prepared from the camp maps, either in the form of tracings from which white prints are made, or as photolithos by photo reduction. It is these white prints which are used to record timber cover, soil, and grazing data.

The final result is four maps, showing respectively—

- (1.) Topography and culture;
- (2.) Types and age classes;
- (3.) Timber estimates by 40-acre "sections"; and
- (4.) Improvements planned.

The estimates are computed and checked in the field or as soon after as possible. For convenience in stumpage appraisals they are summarised by blocks and logging areas and where deemed advisable by age classes for each type, giving in all cases the amounts to be cut and to be reserved.

In map-making, a standard scheme of colours, signs, and symbols has been designed and adopted.

Drainage is shown in blue, contours in brown, and "culture" in black.

There are separate type "legends" for land classification; logging; planting; fire; and grazing.

The basis of the land classification legend is not the forest type, but the density of stocking.

There are five density types, shown in five shades of green, and varying from 2,000 to 50,000 feet (sawn output) per acre. Woodland, scrub, waste, burns, etc. are shown in other colours. The progress of exploitation is shown by hatchings, and the status of land by initial letter symbols.

Forest types are indicated by a very clever scheme of alpha-numeric symbols, which show the composition, character, and stand of any forest, and which is so much simpler and more effective than the symbolisation table I designed for assessment work in the north-west of New South Wales in 1912 that I have no hesitation in recommending its adoption in lieu thereof.

The symbolisation is by letters and numbers instead of by hieroglyphs, and follows a carefully devised plan for assisting the memory.

The Mapping Branch of the Department should be developed into an Office of Forest Engineering, with at least a representative at each District Office.

The importance of this branch of the forestry organisation justifies the appropriation of £10,000 annually for its especial purposes.

CHAPTER XI.

SETTLEMENT OF FOREST OFFENCES.

THE MODERN ATTITUDE.

Changing thought and kaleidoscopic policy mark the tendencies of the time. The stealing of a handkerchief is a medical question of to-day, where it was a hanging affair of yesterday.

Crime is a matter for cure and not for vengeance.

Gaols are translated into hospitals. The crown and sceptre of the "majesty" of the law fall from a faltering grip. "Frightfulness" continues to go out of fashion.

Progress is the rebellious slave of tradition—whose handmaidens are proverbs and phrases.

Nothing has influenced administration of the law so much as set combinations of mere words. "A dangerous precedent," "Making an example," and "As a warning to others" are phrases which have decided the fates of many delinquents.

This phraseological philosophy of the official is contested hotly by the contrary one of "giving a man a chance" and "ordinary commonsense" of "the man of the world"—the philosophy of the "Roads and Bridges" member when defending his erring constituents.

The two philosophies clash, to the accompaniment of frequent explosions; some modification of outlook accrues, but confusion of thought persists and advancement is imperceptibly minute. But it is advancement, nevertheless.

Severity frequently produces the spirit of the "revanche"; mildness often results in co-operation. "The quality of mercy is not strained."

The United States of America policy of settling forest offences is persuasive rather than penal. It is marked by a certain "sweet reasonableness" that is alluring to a degree. More subtle than our own, it aims to deal with the interior motive rather than the exterior deed.

Breaches of the forest laws are regarded as either "innocent" or "wilful," and specific treatment is provided in either case. If, "having exercised due diligence," the offender was unaware that he was trespassing, the act is regarded as innocent; if otherwise, it is "wilful."

"Ignorance of the law" in despite of tradition, is regarded as an excuse in law.

Such "innocence" or "wilfulness" determines the basis for assessment of damages due to the Government.

If an offence be "innocent," the basis is "the difference between the value of the area before, and after, the trespass; *i.e.*, the royalty value of the timber taken plus any incidental damage done to the forest.

If an offence be "wilful," the measure of damages is "the value of the timber in its condition when and where found." Thus if the trespass is discovered after felling, the damages will be the royalty plus the cost of felling; if cut into logs, the cost of cross-cutting is added; if found at the mill, the cost of both cross-cutting and hauling is included; if sawn up into boards, the current market value of the boards is taken.

To those assessments are added the estimated money value of any avoidable damage due to young growth or timber left standing, or of any timber wasted in high stumps or low tops.

If the timber be purchased unwittingly from a wilful trespasser, its value is determined as that at the time of such purchase.

In the case of occupancy, no permits are required for the purposes of travelling, temporary camping, hunting, surveying, or prospecting; if other trespasses occur, the Forest Supervisor is required to make every effort to secure satisfactory adjustment amicably, through interview, and persuasion or compromise.

Where stock are found trespassing on a forest, the owner is to be "ordered to remove it at once." If the situation is urgent, the forest officer may remove the stock—"in any way that does not injure it physically"—and finally, may arrest the person in charge of it.

Even this mild arrangement leaves room for enterprise on the part of the forest officer. I quote an instance of a persistent grazing trespasser who was discovered for the third time on a National Forest without a permit. The forest rangers took possession of the stock and removed it from the area—in such a way "as not to injure it physically." Since the regulation did not say that the person in charge was to be deposited on the same spot, they took him across the forest, and released him on the opposite side. The penalty upon the trespasser was that the forest was thirty miles wide at that point, and before he got round it, his stock had had time in which to scatter.

In the administration of timber sale agreements, any condition "found by experience to be unreasonable or impracticable" is modified forthwith. "Drastic action is not to be taken until every other recourse has been exhausted." The first measures adopted are to request compliance, issue a warning, and finally enforce the penalty scale. When the offences become "serious and persistent," the operations may be suspended. At last, before action for breach of contract is taken, the sureties are given an opportunity to complete it.

"In civil cases, the employer is liable for the wilfulness of the employee if he knew of the trespass and took no means to stop it; or if after the trespass was committed, he knowingly approved or adopted it by receiving the fruit of the trespass; or whenever he employs persons to do the cutting, knowing them to be careless, reckless, and unreliable."

Ordinarily, and especially in civil cases, "while the men who do the actual cutting may legally be held for trespass, it is advisable to proceed against the corporation, company, or individual by whose direction and for whose benefit the cutting was done."

In such trespassing cases, where there is evidence of wilfulness on the part of the stockmen, but not of the owner, the offence is divided into one of wilful trespass against the former, and of innocent trespass against the latter.

Upon discovery of illegal operations, the Forest Officer's first duty is to ascertain the location and status of the area affected. He then serves upon the trespasser, in the presence of witnesses, a written notice requesting him to discontinue the trespass. He records in his notebook the date and particulars of the trespass, and of the serving of the notice.

He may seize the material cut, even if it be on private property, and even if it be sawn up. As a last resort, he may even confiscate the article or building into which the material has been manufactured. If the timber is mixed up with other, he may seize the whole.

If a seizure be made, however, the Government cannot recover the value of the material from the trespasser. Seizure is a method not usually adopted.

The Forest Officer submits his report, on a specified form, to the supervisor, who informs the offender and gives him fifteen days' time in which to present his version of the facts. Whenever possible, the supervisor is required personally to interview the delinquent.

Finally, the Supervisor forwards the whole of the papers, together with his finding, to the District Forestry Office, where the Assistant Forester in charge of the branch affected prepares a memorandum as to the damages sustained, and his opinions and recommendations, and submits it to the District Forester.

If the District Forester be of opinion that the facts do not disclose a trespass, he may close the case forthwith. Where the damages do not exceed £100, he may settle, on his own responsibility, all "innocent" offences, and any "wilful" ones wherein he regards prosecution as unnecessary.

If damages exceed £100, he refers the case to the Forester. If damages exceed £1,000, the case is one for final determination by the Minister.

In first offence cases of "innocent" trespass, where the damage does not exceed £20, the timber may be released on payment of the royalty. The Supervisor is authorised generally to deal personally with all such cases where the damages are under £2.

The American "Crown Solicitor" is "The Solicitor" at Washington. He has a representative who co-operates with the District Forestry Office, and is styled the "District Assistant to the Solicitor"; his duty is to advise the District Forester in all legal matters.

All cases other than those of first offence and involving further action are reviewed by this officer, and the sufficiency of the evidence is determined by him. Then the District Forester writes to the trespasser, offering to settle the matter on a basis determined upon by himself upon the advice of the Crown law officer, and warning the offender against further violation of the forest laws. Fifteen days are allowed for voluntary settlement, and at the expiration of this time, if there has been no response, the matter is referred to the District Assistant to the Solicitor, who writes a second letter to the trespasser. If no reply is then received, the papers are forwarded to the forester, who transmits them through the Solicitor to the Attorney-General for the purpose of instituting a civil suit or, in flagrant cases, a criminal prosecution.

A card record is kept in the Supervisor's Office, to record timber trespasses and their settlement.

The safeguard of the whole scheme is that second offences cannot be "innocent" ones.

The adoption in Australia of the American procedure of settling forest offences is well worthy of consideration. It is one in full accord with the democratic mood and would save, oftentimes, very much friction and worry.

CHAPTER XII.

UNITED STATES FOREST SERVICE OFFICE METHODS.

SOME NOTES.

The office methods of the United States Forest Service are characteristically direct and logical. Essentially, there is an especial place designed for everything, and everything is made to fit automatically into that place. Typically, there is a detailed standardisation of procedure set forth in written departmental directions for the guidance of officers.

A roomy tidiness, an absence of papers, and a surrounding presence of oak cabinets, are the general impression of the observer. These results flow from the filing system adopted.

The correspondence registration system of Australian public departments generally involves the numbering consecutively of every letter received, and the recording of a summary of its subject under its appropriate section in a tome-like correspondence register.

A corollary of the scheme is another tome—the big index—which keeps trace of every letter in its meanderings throughout the service from the time it is first received until it is deposited finally in one of the piled-up bundles of papers in the dusty archives of the department.

This process involves the detention of each letter for the best part of the day in the Record Room, and, while it is effective, it is unnecessarily tardy, cumbersome, and untidy.

The vertical filing system adopted by the United States of America Forest Service obviates the keeping of a correspondence register and an index, and, in fact, the employment of a special records staff.

There is nothing very new about the scheme, which is in general use in the commercial world. The diversity of the subject matter handled, and the intricacies of departmental routine, however, have militated against its employment by the public services.

In view of that fact, it is of sufficient interest to describe here in some detail, the methods adopted by the United States of America Forest Service in applying the vertical filing system successfully to the needs of Government business on a large and complex scale.

Vertical filing means filing papers on edge in the drawers of a specially designed cabinet. All related letters, the most recent one on top, are placed in folders, one of heavy manila paper, which serve also to keep them smooth, flat, and clean. The folders are separated and indexed by "guides" of stiff material, which keep them upright in the drawer. The tops of these guides project, and bear the letter, name, or number of the classification. The indexing of the file is arranged on the basis either of the correspondents' names, the location, or the subject.

Thus the papers themselves are translated into pages, the "guides" become section headings, and the cabinet itself provides the cover. All combined form an automatic correspondence register in the applied science, of labour-saving, and the classification scheme replaces the index.

The main difficulty in applying this system to the needs of the Australian forest services appears to have lain in the formulation of a classification system.

The United States of America Forest Service has evolved a subjective classification arranged on a self-indexing basis. No card records whatever are employed.

Each file consists of two general sections—

- (1) A classified section; in which is filed, behind appropriate guides, all correspondence which bears a subject designation expressed in words (*e.g.*, F. Personnel, Jones, J. H.).
- (2) A miscellaneous section; in which are filed alphabetically, without regard to forests or subjects, all correspondence bearing as a designation the letter Z after the branch or office key initials (*e.g.*, FZ, OZ, OOO).

The mail clerk opens and refers to the respective branches by date stamp, all letters received. Each is there marked with the key initial of the branch and the subject designation, and is then ready for action and reply. Carbon copies are the only record kept of outgoing correspondence, and when a letter is answered, the carbon copy, or the letter itself, or both, are handed to the filing clerk, who at once puts it or them in the cabinet in the folder and behind the guide for the particular branch and subject noted thereon.

When correspondence is withdrawn from the file, a memorandum is substituted in its stead. When necessary, cross-references are made, by filing under the second subject involved an extra carbon copy. Miscellaneous correspondence is transferred from current to closed files annually; classified correspondence is transferred as may be found advisable.

All the records of an officer may be assembled in one central file room, or separate files may be kept in each branch. In the Missoula District Office, the latter alternative is adopted, and as a consequence no special file clerk is employed.

The success of the system depends in some measure upon the general administrative practice. In the United States of America Forest Service, business is very largely decentralised, and the District Forester is given much wider discretionary and executive powers than are at present vested in our own managing officers. As a consequence, there is an increased local transaction of business, and a reduced circulation of correspondence between head office and the district branches.

The New South Wales system provides for the reference to the District Forester of all matters affecting his district. He refers them similarly to his own divisional officers for report, upon receipt of which he furnishes recommendations for the guidance of head office. At head office the report and recommendations are summarised in a minute for the Minister, upon receipt of whose approval or decision, the reply is written to the persons concerned, and the papers are forwarded to the District Forester to note and return.

In case of delays, reminders are sent periodically to the District Forester, and by him to the divisional officers.

In contrast thereto, the American system arranges for the recommendations to be furnished by the District Forester in the form of a letter prepared for the signature of the Director or Minister. Three copies are made at the same time. One is retained by the District Forester and two accompany his letter to head office. When the Minister or Director's approval and signature are affixed, the letter is despatched, and one of the carbon copies, similarly signed, is returned to the District Forester, who substitutes it for the one retained by him as a record. The third carbon copy at head office becomes the head office file copy.

When a request is made by the District Forester for approval of any action he proposes, he leaves an approval space in the lower left-hand corner, thus:

Date.....19.....

Approved.....

Director or Minister.

Two carbon copies are prepared at the same time, one of which is retained while the other accompanies the request to head office. Upon approval by the Director or Minister, this second copy is returned to the District Forester to show the course decided upon.

No fresh letter is prepared when a carbon copy will suffice. Whenever a communication is written at head office for despatch to a District Forester, or referring to his district, one, two, or three carbon copies, as is requisite, are prepared at the same time and forwarded for the information of the District Forester and the Supervisor and ranger concerned.

When forwarding a document to head office, the District Forester endorses his recommendations directly upon it. A letter of transmittal is never written.

To follow up requests to field officers for reports on action, one white postcard and three yellow slips (3 in. by 5 in.) are used. On the four, the date, subject, and key initials are entered by carbon duplication. The postcard and two of the slips are forwarded with a request for the report. The third slip is placed as a reminder in a small box styled the Promise Card Box. The District Forester forwards one of the two slips received by him to the field officer concerned, and puts the other in his own Promise Card Box. The field officer notes on his slip the date on which his report will reach the District Forester, and returns the slip to him. The District Forester substitutes it in the Promise Card Box in the place of the one retained. He then notes the date of the projected report on the postcard, and mails it to head office, where it is filed in place of the third slip retained there.

The same process is used to record all promises involving future action. A standard promise card box, daily and monthly guide cards, and plain white cards constitute the equipment. A promise must be definite, and the date of proposed fulfilment must always be given. It is recorded at the time it is made on a plain white card, thus:

Date of fulfilment.....
Name.. ..
Subject of Promise.....
Date

If the promise for any reason cannot be fulfilled, the person to whom it was made must be informed and the card redated.

The substance of any letter received is never used as a preamble in the reply. Reference is made to the letter by quotation of the file numbers or initials. The form "Your letter of March 30th has been received" is adopted.

"Dear Sir" and "Very truly yours" replace our own formal and cumbersome "Sir" and "I have the honour to be, Sir, your obedient servant."

All letters are double-spaced except quotations which are single-spaced. Ministerial letters are written in blue elite; others in standard black pica.

Letter size paper is used; foolscap is conspicuous by its absence. It is regarded as cumbersome and wasteful.

Correspondence and final reports are written on white paper, while memos. and scratch copies, even though typed, must be on yellow. In all cases, every piece of writing must be dated, and signed or initialled.

Mineographs are used very largely for duplication purposes. For district offices the Rotary No. 76, and for supervisor's offices, the Edison No. 61 are employed. Calculating and other labour-saving machines are to be seen in every branch.

The vade mecum of the forest service is the "National Forest Manual," a veritable encyclopedia of instruction for forest officers, which details the standardised procedure to be followed in every possible contingency. It is an expression of the scientific management policy—the recording of method. In order that it may be revised as desired, it is bound together on the loose leaf principle, and revision is made by the substitution of reprinted pages.

Practically every one of the United States of America office processes developed in this chapter could be incorporated into our own systems with every promise of increased efficiency and expedition, and added economy.

CHAPTER XIII.

FOREST SERVICE PUBLICITY AND PUBLICATIONS.

The case for publicity in forestry matters is summed up in the findings of the Forestry Committee of the Fifth National Conservation Congress held at Washington, United States of America, in 1913.

That committee reported—

"Progress in forestry depends more on what the public will permit than upon foresters and timbergetters. Consequently public education is of primary importance.

Education is a matter of publicity, and publicity is a trade in itself. It cannot be practised intuitively.

Since no one else has the interest or the requisite forestry knowledge, foresters and timber people must learn this trade.

It is not forests, but the use of forests, that we seek to perpetuate.

Therefore, to be sound and convincing, educational publicity must include the timber business. So long as the public believes forestry good, and timbergetting bad, there will be confusion and no real progress."

In a democracy, progress can be achieved only through a majority. A minority by itself can never succeed. Legislation is a response to public stimulation.

"We cannot hope to have the industries dependent upon the forest fostered and protected as they deserve to be, until the public and legislators regard them as they do agriculture, for example, and have equal understanding of their governing conditions and needs. They will not attain such understanding unaided; the aid is limited by their demands for it; they will not demand it because they do not understand the need."

Which, apparently, amounts to a deadlock.

The solution, according to the committee, is to acknowledge that forestry is a business, and that "it pays to advertise." A necessary part of a forester's equipment is a training in publicity.

There are already public departments in Australia which have recognised the uses of advertisement. In not one of them is the need for publicity and publication work greater than in forestry. Apart from propaganda, publication of results is essential to the proper conclusion of investigative work, and the standardisation of method.

The United States of America Forest Service has appreciated these facts.

One of its numerous branches is the Division of Publications. One of its important officers is the editor, who "has charge of all work designed to promote general education in forestry by the diffusion of information concerning forests and their best use, through the supply of information to newspapers and other periodicals, through the giving of addresses, or through exhibits in co-operation with schools."

Regulation A9 states that—

"In general, the papers on file in the offices of the forest service relating to the transaction of national forest business are public records, and as such are open to the public. Information should not be refused to persons whose interest is legitimate. Recommendations on matters pending should not be made public."

The "National Forest Manual" affirms that—

"It is desirable that all proper opportunities should be afforded the public to understand the work of the service, and the principles and application of forestry."

District Foresters and Forest Supervisors are authorised to respond to legitimate demands for information. They are required to be "accessible to newspaper men" and to furnish them with "copy." The proviso is that "controversy, self-advertisement, and partisan discussion of questions of policy must always be avoided, as well as criticisms of any other department."

District Foresters may permit also the giving of formal addresses by forest officers, although in the case of important meetings, where expenditure of time and money is involved, approval must first be obtained.

The Office of Geography at Washington is equipped for all classes of photographic work. It issues cameras and supplies to competent forest officers, and takes photographs to accompany reports and furnish evidence (temporary pictures); recording changing conditions (progress pictures); illustrating publications (special pictures); and covering subjects not in the service collection (new pictures).

It supplies photographic and lantern slides to forest officers for office use, for instructive display, for use in giving addresses, for illustrating reports on articles, or for their office photograph album. It may furnish them also to co-operators outside the service, and to publishing houses for illustrating books and newspapers.

It is authorised to sell at cost plus 10 per cent.

Forest libraries are attached to District Forester's and Supervisor's offices. They carry forestry books approved by the library committee at Washington, the publications of the forest service and such periodicals as "The Forest Quarterly," "Proceedings of the Society of American Foresters," "Botanical Gazette," etc.

A collection of photographs illustrating forest conditions and administrative methods on the national forests and elsewhere is maintained in these libraries.

Forest service publications are supplied also to rangers, and to all officers for their office files and personal use.

The United States of America Forest Service publishes a large number of bulletins on forestry matters generally, both for propagandist purposes and as scientific records.

Suggestions of subjects on which publications might be prepared are welcomed from all members of the forest service.

"If the subject relates to investigative work or involves the compilation of data, it will be referred to the district investigative committee; if to administrative work, authorisation may be sought from the forester to prepare it."

An endeavour is made to solve the difficulties of properly assigning credits for articles. The following is a general statement of the policy adopted:—

- (1.) Publications embody primarily the work of the Forest Service, not of individuals.
- (2.) Results which have been gathered by individuals belong not to the individual, but to the Forest Service.
- (3.) The Forester has a right to expect all members of the service to contribute willingly and to any extent towards making any and all publications as good as possible.
- (4.) The giving of proper credits is a stimulus to good work.
- (5.) The man who has actually put most into the publication should have principal credit for it.
- (6.) Supervision of work, though it may actually make suitable for publication the completed report, does not entitle the one supervising the work to assume credit as the author.
- (7.) When a man undertakes a publication concerning work of which he has charge, the necessity of acknowledgments is a matter of administrative judgment.
- (8.) It is desirable to give credit for original work without detracting from the value of the publication through minute or excessive acknowledgments or interruptions of the continuity of presentation.

CHAPTER XIV.

FOREST INVESTIGATIONS.

The inapplicability of European forest data to American conditions made it inevitable that the United States of America Forest Service should undertake quite early a comprehensive study of American forest problems.

Research and progress, in both forestry and forest industry, march hand in hand. It was realised that the only possible basis for a successful development was an accurate and detailed knowledge of the facts. Empirical practice was a delusion and a snare.

The "National Forest Manual" affirmed that:

"Forest investigations of systematic character, and conducted with scientific accuracy, form an important part of the work of the Forest Service, both as a means of building up the science of forestry in the United States of America, and of assisting and improving the administration of the national forests."

Every member of the Forest Service was expected to co-operate in the common task of forest study, and all opportunity and encouragement were afforded officers to carry out investigations side by side with their ordinary routine duties.

The investigations were to cover every branch of forestry, "especially silviculture, including reforestation, tree and shrub distribution, volume and yield measurements, forest influences, protection from fire, insects and disease, lumbering methods and costs, stumpage appraisals, dendrology, grazing, and utilisation of forest products."

The attached list is a compilation of the studies now being carried out by the United States of America Forest Service. It is of interest because of the fact that almost precisely the same range of research must inevitably be undertaken by Australian Departments of Forestry, as a basis for their scientific development.

UNITED STATES OF AMERICA FOREST STUDIES—A COMPILATION.

FOREST UTILISATION.

1. Studies of existing industries, covering methods and costs of manufacture; grading rules; collection of market prices; mill-scale studies to determine grades and over-run; investigation of kiln-drying methods.
2. Market prejudices against particular species or classes of material and means of overcoming them through special studies or publicity.
3. General questions of timber supply and demand, markets, and freight rates; stumpage appraisals and royalties.
4. Advice and assistance in the construction of State forest improvements, particularly in the use of wood preservatives.
5. Advice and assistance to persons in the respective districts, outside of the Forest Service, or any of the foregoing or related questions.
6. Preparation of publications on any subjects covered by the foregoing investigations which have marked practical or scientific value.
7. Demonstration of methods or processes developed by the Forest Service for the benefit of local industries.

INDUSTRIAL.

8. Collection and compilation of statistics on the production and consumption of forest products, prevailing market and stumpage prices, imports and exports, and transportation rates.
9. Compilation and study of specifications of rough and manufactured forest products.
10. Studies of timber manufacture and wood-using industries as to methods, forms of material, waste, costs, equipment, substitution of one species for another, and improvements through more conservative use of raw material.
11. Advice and assistance through co-operative agreements and otherwise to other departments, industries, and individuals concerned with such lines of work.

SILVICULTURAL.

12. Silvics and dendrology; silvical descriptions of forest types and species.

13. Forest management—utilisation, cuttings, thinnings, and natural and artificial reproduction.

14. Reforestation—general problems.

15. Forest influences—forests and climate, stream flow and erosion.

16. Forest mensuration—critical analysis of forest measurements, and publications dealing with fundamental laws of the growth, comparative growth of different species, methods of working up field measurements.

17. Wood structure and identification.

18. Forest distribution.

19. Cut over areas—study of.

GRAZING.

20. Improvement of range by seeding to cultivated forage plants.

21. Improvement of range by natural reseeding—rotations.

22. Studies of forage plants.

23. Methods of handling stock—and other phases of the live stock industry related to efficient management of grazing lands on national forests.

24. Range development—water and tracks, fences, and other improvements.

25. Influences *in re* reproduction, floods and erosion, forest fires, and water supply.

GENERAL.

26. Forest manuals—preparation of instructions governing the administration of the forests and the various branches of technical work involved.

27. Scientific management in forest practice—time studies—elimination of lost motion—efficiency engineering.

FOREST PRODUCTS.

28. Mechanical, physical, and chemical properties of wood.

29. Air-seasoning and artificial drying of wood.

30. Agencies destructive to wood.

31. Wood preservation.

32. Wood distillation.

33. Production of pulp, paper, gums, oils, dyes, and other chemical products of wood.

34. New uses for indigenous species through wood preservation.

35. Waste—and closer utilisation through improved methods.

36. Introduction of industries which will result in closer or more profitable utilisation, *e.g.*, pulp and paper, wood distillation, turpentine, and the manufacture of secondary wood products.

Many of these studies, of course, are being covered in a general way by the Forest Service as a whole, concurrently with its administrative work, and the activities of its specialised branches.

In the Office of Silviculture, for instance, the expert officers have undertaken a large amount of research work with regard to growths and yields, reforestation, and tree studies generally; while observations are being maintained on cut-over areas to determine the best methods of cutting and slash disposal for each type.

Forest supervisors, again, are required to bring under notice matters affecting the broad administration of their forests, such as "the presence of large quantities of unmarketable species, of dead timber, or of material not used in current sales, local manufacturing and marketing problems, market prejudices, etc.; and experts in forest products are attached to each District Office to deal with these matters and investigate the general utilisation and market problems of the district.

The Office of Industrial Investigations also conducts statistical and industrial inquiries as to wood uses and manufacture.

In other specialising branches of administration, similar general investigations are being carried out.

Such investigations, however, were largely of a transitory nature, bounded by the beginning and end of field seasons, and subordinated to the administrative activities upon which officers were really engaged. Something more was required if well-ordered and substantial progress was to be made. In addition to general investigation, the need for intensive research on a permanent basis was realised.

Intensive studies were classed under the four heads of Dendrology, Grazing, Silviculture, and Products.

An Office of Dendrology was constituted at Washington to carry on the dendrological studies of the Forest Service, and field officers were required to co-operate with it by collecting specimens.

An Office of Grazing Studies also was established, with experiment stations of its own on several of the national forests.

The strictly technical research on forest products was centralised at the well-equipped Madison Forest Laboratory attached to the University of Wisconsin.

Intensive study with regard to silvicultural problems was allotted to forest experiment stations, similar to those of Germany and India, three of which were established in the central and southern Rockies, one in the Sierras, one in North-Western Idaho, and one at the University of Minnesota.

Finally, with the accumulation of data on every hand, and the extension of investigative activities throughout the Forest Service, the necessity of co-ordination was felt, and the organisation of the forest research work was completed by the appointment of investigative committees in each district with a controlling central investigative committee at Washington. The duty of the district committees was to prepare an annual programme of forest studies for the respective districts. These programmes were to be submitted to the central committee, whose function was to correlate, plan, and direct the entire research work of the Forest Service, and publish the results periodically in a review of investigations.

Forest studies are just as essential to the development of Australian forestry as they were to the building up of the American science. But our investigative resources are more limited. We have not organisations highly specialised like that of the United States of America Forest Service, nor have we even a staff of scientists or experts in the various branches of forestry. It is true that something can be done in a general way by the present supervisory and assessment staff in the shape of accumulating extensive data, but much more is necessary. Certainly, Mr. R. T. Baker, at the Technological Museum, and Professor Warren, at the Engineering School of Sydney University, and others, have contributed greatly to our knowledge with regard to forest products, while Mr. J. H. Maiden, at the National Herbarium, has

recorded in his "Forest Flora" all the dendrological data at present available. But silvicultural, industrial, grazing, utilisation, and management problems are not covered in any way, despite their supreme importance in every day administration.

Moreover, there is a lack of co-ordination, without which a well-ordered development is impossible.

There should be a mobilisation of our limited and scattered investigative resources, and an organisation of a comprehensive system of forest studies.

My proposals are—

1. Forestry and forest industry investigations should be centralised at a State Institute of Forest Research to be attached to the proposed schools of forestry; provided that:
 - (a) That section of research relating to forest products be allocated under a suitable agreement to such institutions as technological museums and the engineering schools.
 - (b) That section of research relating to botany and general dendrology be left in the hands of the Government Botanists, as heretofore.
2. That a permanent forest investigation committee consisting of the representatives of the institutions concerned be established to co-ordinate the research work to be undertaken.

The proposed combination of teaching and investigative work at the forest schools would make for the greatest possible economy and efficiency, especially with regard to the school itself, since a stronger faculty and wider facilities would be available to the students. An important precedent for the proposal is a similar combination in the case of the Imperial Forest Research Institute and College at Dehra Dun, India. The same idea has been adopted largely in Germany.

CHAPTER XV.

FOREST IMPROVEMENTS.

ORGANISATION FIRST.

A natural forest is a mere wildwood.

The introduction of business management implies the provision of means for the fullest possible protection and utilisation of its resources.

The first consideration is organisation, and the primary requirements, therefore, are means of transportation, control, and communication.

These needs were especially felt in the American case owing to the overshadowing danger of fire ravage.

That danger provided the great spur to American forest development. To its existence was mainly due the improvement of the national forests up to the present pitch. The Fire Protection Plan called for roads and tracks to make all parts of the forests accessible for look-out stations and forest officers' headquarters for purposes of control; and for telephone communication with settlements for mobilisation needs.

The provision of means of travel and transportation was the prime essential in organisation. The standard was accessibility to saddle horses. The aim was to develop a system of roads which would place every part of a forest within seven miles of a wagon road—that is, a day's return journey for a pack horse.

In open forests there was no immediate necessity for "trail" construction; operations, therefore, were concentrated in the heavily timbered areas most in need of protection and management.

The topographic map again affords the basis for organisation. An improvements map is prepared from it, showing existing and proposed routes.

The "ultimately necessary" road system is decided upon, and those roads which unquestionably must be built are located first. The supervisor prepares data and recommendations with regard to extensions and submits them to the district forester, who determines the needs, and the order of construction.

The "Manual of Trail Construction" establishes a uniform classification of roads and "trails," and sets out standard specifications for each class; it describes approved methods of location, construction and maintenance, and furnishes reference data useful in preparing estimates and in actual construction work.

The "trails" were designed as the forerunners of the roads of the forest and their classification is based upon the uses to which the "trails" may be put. Those following main valleys, and likely to constitute the framework of the permanent road system are located with a maximum grade of 6 per cent., so that they may be convertible into first-class wagon roads. Those following ridges or tributary streams are classed as B or C. Class B "trails" have a maximum grade of 12 per cent. and are convertible into safe mountain roads. Class C "trails" are intended only for pack horse routes and may have a grade up to 18 per cent.

Trail construction includes the building of all necessary bridges.

Where waterways exist, boats, launches, or ferries are used; and where railways or logging railroads are available, speeders and hand-cars are requisitioned. Motor cars similarly are utilised.

Furthermore, if it is possible to effect a saving thereby, these means of travel, as well as pack horses, teams, wagon scrapers, road grades, stump pullers, and other road-building equipment are purchased rather than hired.

The construction of logging roads, chutes, and flumes solely for the purpose of extracting timber is undertaken by the Forest Service only in exceptional cases. As a general rule, this phase of improvement is left to the operator.

For purposes of control by the forest personnel, a survey is made of all the administrative sites required, and a special map showing topography cover, soil, and improvements, is prepared on a 20-chain scale.

On these sites, such requisite buildings as ranger's headquarters and offices, lookout stations, summer camps, barns, sheds and pounds are constructed and paddocks laid out for the use of the forest staff.

Standard Forest Service plans and specifications have been prepared for all buildings and work in these classes. The maximum amount which may be spent in this work is limited by enactment to £130 per building. This sum has proved inadequate in the case of ranger headquarters.

Forest officers are permitted to cultivate forest land "for the economical production of forage crops," and build fences to provide requisite pasturage for live stock used in the work of the Forest Service.

The construction of dams, tanks, and fences for the development of the forage resources generally, is carried out as a rule by the livestock associations using the forest, under co-operative agreements entered into with the Forest Service. In exceptional cases, funds may be allotted, however, for this purpose.

The linking up of lookouts, ranger stations, supervisor's headquarters, and district forestry offices by telephone communication is looked upon as an essential for effective fire protection and economical administration. Where possible, commercial lines are utilised, and commercial companies and settlers are encouraged to build lines on or near the forests. The Act of 4th March, 1913, permits the free use of timber for the construction of such lines as are necessary for fire protection purposes.

The Forest Service, however, maintains a telephone department of its own, which undertakes the bulk of the telephone installation and maintenance work upon the National Forests. It is a department which is assuming large dimensions, controlling, even at this early stage of its existence, some thousands of miles of line.

It, too, has produced a manual of its own, aiming at standardisation and uniform efficiency in the whole work of planning, building, and maintaining the entire telephone system upon the Forest Service holdings.

Tree line construction generally is adopted on account of its simplicity and low cost. The Forest Service standard is a grounded No. 9 wire. The lines are built along the course of trails. The average cost is about £8 per mile.

A wonderful little portable telephone eminently useful in Forest Service work has been evolved recently by R. B. Adams, in charge of the telephone section in District No. 1.

Miners, settlers, logging foremen, and other persons needed in the fire plan, may be appointed "per diem" patrolmen, and allowed telephone service free under co-operative agreements.

The whole improvement work upon the National Forests of the United States of America is carried out by the Forest Service itself by day labour.

The success achieved is due to the fact that the complete organisation and thorough system which have been built up have afforded the necessary framework upon which to hang all details. By no other means could it be obtained.

The work is carried out by the branch of operations, which includes the offices of geography and quarters, trail and telephone construction, all of which it is proposed to incorporate into a new and single branch of forest engineering.

These offices design the work to be undertaken and draw up plans and specifications. The actual construction and maintenance are carried out by the forest personnel, the district ranger (our proposed resident forester or forest overseer) being placed in direct charge of improvement crews.

Every managing officer is given practically a free executive hand. His limitations are those only of policy and funds.

Improvement allotments to forests are made by the district forester in conformity with the improvement plan as to constitution and on the basis of the supervisor's annual estimates as to maintenance.

A classified cost record is kept in every case, as it serves as a measure of efficiency and as a guide in future work.

The "National Forest Manual" sets forth that:—

"The construction and maintenance of improvements require the most rigid economy consistent with the fulfilment of their purposes, particularly as they afford greater opportunity for inefficiency and extravagance than any other line of work. Because of these facts all plans for improvement demand the most careful consideration both as to preparation and execution."

Little, if anything, in the nature of secondary improvement has been undertaken, all energies having been directed to the work of organisation.

Some silvicultural improvements were initiated in the early days when European ideals dominated the departmental attitude. They have been abandoned for the present before the greater needs of transportation, communication, and control. Conditions of timber sale agreements now are made to provide a foundation for further development along the lines of forest tending.

CHAPTER XVI.

FOREST PESTS.

The annual forest loss in Australia owing to the activities of forest pests is incalculably large.

Probably 80 per cent. of our hardwoods show some degree of hollowness or decay due to the ravages of termites. The greatest enemy of hoop pine is the borer. The mantis is responsible for wholesale destruction within our forests. The wombat has ringbarked enormous numbers of our bush giants. The rabbit, in drought time, has nibbled away the lives of multitudes of our western shrubs and trees.

Not alone insects and animals, but prickly-pear and other forest weeds by destructive competition contribute to the tremendous waste of our limited timber resources.

The American forests are not subject to so fierce a ravage.

Nevertheless, the United States of America Forest Service has appreciated the necessity of grappling with the forest pest problem.

Realising that unless insect attacks are met in the early stages it becomes a difficult and costly task to attempt their elimination, local officers are required to keep a close check on existing infestations, and whenever and wherever possible secure the removal of infested trees by utilisation.

Whenever an infestation is too extensive to be disposed of in this way, the local officer is required to report the fact and forward specimens.

A plan of control is then prepared by the forest officer in charge of insect control. The execution of the plan is carried out by the Forest Service, but recourse is had to the Bureau of Entomology of the Department of Agriculture for assistance, and for the making of entomological investigations.

The officer in charge of the project is given considerable latitude in the execution of the plan.

Funds are allotted specially for the work.

Control areas are constantly studied by the Forest Service with a view to making control measures increasingly effective by obtaining data on methods of attack and the history of insect infestations, past and present.

In view of the limited extent of our own timber resource, and the scope of the pest ravage within the forest, I recommend the adoption of a comprehensive system of control.

I propose the appointment of a forest entomologist and zoologist to undertake a systematic investigation of the forest pests. He should be stationed at the Forest Institute where his services would be available also in a section of the teaching work. Such measures as are evolved at the institute should be applied by the field staff to their forests.

With regard to the overwhelming white ant infestations, it is possible that silvical measures may exercise far-reaching control influences. Apparently, white ants gain ingress to the tree either through a broken root or a broken branch. They follow the grain and cannot bore transversely. It is impossible for them to attack a sound tree. Consequently, it is the ancient and over-mature overwood which is most open to attack; the robust pole underwood escapes.

A close well-grown stand cut before maturity is passed would probably be entirely free from white ant infestation.

CHAPTER XVII.

THE FOREST WATER RESOURCE.

It is true the water resource of our forests is infinitesimal in comparison with that of the United States of America, but that fact should warrant the application of much more intensive control.

"The United States of America Forest Service Manual" provides for the development of a definite water protection plan:—

"In order to follow a definite and consistent policy with respect to the restriction of the use of the forest resources for the purpose of protecting the water supplies, complete information must be collected as to the sources, the amount, and use of water arising in the National Forests, the present condition of the vegetative cover on the watersheds, as to its influences or run-off and the special measures necessary to maintain the protective value of the cover.

"This information will be presented in the form of a definite water protection plan. This will include an administrative map and report."

The administrative map shows the—

"watersheds which supply water for municipal and domestic use, for irrigation, and for the development of hydro-electric power. It includes the location of ditches, corrals, flumes, dams, power plants, and other works; also the streams subject to disastrous floods and the settlements, mines, railroads, or other works in need of protection from snowslides."

The report covers—

“the amount of water, the purpose for and extent to which it is used at the present time, the probable future use, the condition of the cover, and the special protective measures which are at present in force, with definite recommendations of measures which will be needed to meet future demands.”

The protective measures applied include “restriction of grazing, special uses and settlement, possible modifications of lumbering, reafforestation, and range improvement; the appointment of extra patrolmen, and the construction of works for the prevention of fires, floods, snowslides, and the contamination of the water.”

It is the duty of officers before issuing licenses or permits to consider the possible effect on the water supply and when necessary to attach conditions affording necessary protection.

Streams are to be protected from pollution.

I advocate the stocktaking of the water resources of our forests and the preparation of a water protection section of the working plan of each forest. This duty should constitute part of the general forest reconnaissance work. It is a function of the branch of forest engineering.

CHAPTER XVIII.

FOREST SERVICE BOOK-KEEPING.

A review of the orderly modern system of accounts of the United States of America Forest Service is of great suggestive value.

Two main features distinguish the method of dealing with receipts.

One is that payment in advance is a requirement in respect to all fees and royalties due to the Forest Service.

No tree may be felled, no exploitation may begin, until the sale has been confirmed in cash. Deposits must be made in advance of cutting. The timber sales account for any operator must always show a credit balance.

The other is that forest officers are not collectors of forest revenue, and are not permitted to receive any monies due to the department—the policy also of Queensland.

At all district office headquarters a bank is selected and designated as a Government depository for the district, and debtors are required to pay directly into that depository, to the credit of the Forest Service, all National Forest revenue due by them.

The receipt and disbursement of funds and the execution of all formal papers affecting the grade, assignment, or salary of members of the Forest Service are vested entirely in the chief of accounts at Washington. This officer has a representative at each district office, who is styled the district fiscal agent, and is charged with the entire execution of the accounts system for his district.

A letter of transmittal is the vehicle employed in making payments. It is in the following form :—

LETTER OF TRANSMITTAL.

..191

Western Montana National Bank,
United States Depository,
Missoula, Mont.

There is enclosed herewith a { Money Order } for
 Draft

Dollars

drawn payable to your order, to be placed to the credit of the Treasurer of the U.S.A.

This deposit is _____

(First, second, or third payment ; payment in full ; deposit)

on account of

(Timber Sale, settlement for trespass, &c.)

...National Forest.

(Signed) _____

Payer, of _____

Sgd. *****

Forest Officer.

(Complete case designation)

Coupon—Do not detach.

(Name)

Deposit on account of.....

National Forest.....

Three separate styles of letters of transmittal are adopted, viz., one for special use permits (coloured blue); one for grazing fees (coloured yellow); and one for timber royalties, &c. (coloured white).

Forest officers are required to furnish these forms to the persons making the payments. The latter must lodge postal or money orders for the amount at the depository accompanied by the letter of transmittal. (Cheques are not accepted unless certified by the bank).

A daily abstract of receipts is prepared in duplicate from these letters by the depository, and both abstracts and letters are forwarded to the district fiscal agent, who stamps the letters "paid," and after detaching the coupons therefrom, forwards them to the forest supervisor.

The latter, after making the necessary records in his office, informs the ranger concerned, and forwards the letters to the respective payers as receipts.

At the district fiscal agent's office the detached coupons are totalled by classes and the totals entered on one of the abstracts. The coupons are then filed by forests and classes in a current file.

At the end of each month the coupons for the month are totalled by classes and forests and the totals recorded on forest receipt cards, the totals to date brought down, and the totals for each class on all forests in the district summarised on a card of the same form. The totals by classes are verified by comparing them with the entries on the retained copies of the bank's abstracts.

Refunds for excess collections are dealt with similarly, but the totals are entered in red ink on separate cards which are filed immediately behind the receipt cards.

Monthly and annual statements of receipts are forwarded to the chief of accounts.

The system is a model of directness, simplicity and labour-saving and its adoption by the Australian Forest Services is worthy of serious consideration.

The basis of the disbursement plan is a series of specific appropriations from which allotments are made by the forester to the district forester, and from the district forester to the forest supervisor, and from the forest supervisor to the forest ranger.

The allotments are in accordance with annual estimates prepared by officers in respect to their districts or forests. Estimates are made on the basis of the bedrock cost of protecting the forests and carrying on the current business under average normal conditions; and for completing such improvements as are most urgently needed to supplement ordinary protection and meet the immediate needs of administration.

The annual preparation of allotment estimates is a work of some magnitude, and the principles, factors and procedure in regard thereto have been made the subject of a special manual of instructions.

A standard list of accounts has been prepared under the following heads :—

HEAD OFFICE.	DISTRICT OFFICES.	SUPERVISOR'S OFFICES.
Forester	District Forester	Salaries
Editor	Property Auditor	Operation
Law	Supply Dépôt	Protection
Accounts	Law	Improvements
Operation	Accounts	Silviculture
Lands	Operation	Lands
Silviculture	Lands	Grazing
Research	Silviculture	
Grazing	Grazing	
Acquisition	Products	

There are innumerable subheads, and additional subdivisions are authorised, to any extent found useful in the application of the system.

The procedure in regard to disbursements includes a comprehensive system of cost-keeping, which has been designed to secure economy and efficiency in Forest Service business by the comparison of costs with results ; and to provide statistical data for the information of the supervisor, district forester, forester, secretary of agriculture, and the United States Congress, showing in detail and by units of organisations the specific purposes for which the annual appropriations have been expended and at the same time furnishing a basis for future estimates and allotments and for general appropriations for the service.

The card-system of book-keeping is adopted throughout.

The principal cards are—

- (1.) Major control and suballotment cards ;
- (2.) Salary cards ;
- (3.) Project cards ;
- (4.) Quarters cards ;
- (5.) Leases cards ;
- (6.) Transportation cards ;
- (7.) Voucher register cards ;
- (8.) Cost cards ; and
- (9.) Distribution cards to accompany each voucher to indicate the appropriations to which each item is to be charged.

The forest supervisor's accounts system consists of card records showing :—

- (1.) District forester's allotment to the forest from various appropriations ;
 - (a) Statutory salaries ;
 - (b) General expenses of the forest ;
 - (c) Improvements ;
 - (d) Roads and trails ;
 - (e) Fire fighting ; and
 - (f) Special appropriations.
- (2.) The supervisor's cost records by activities, lines of work or projects.

The cards are filed in accordance with the following system:—

- (1.) Allotment register;
- (2.) Voucher register;
- (3.) Statutory salary summary. Individual salary cards alphabetically arranged;
- (4.) General expense summary;
- (5.) Improvement summary. Individual salary cards, if any;
- (6.) Road and trail summary. Individual salary cards, if any;
- (7.) Fire and special appropriation summaries follow, with individual salary cards, if any, behind them;
- (8.) Cost cards—
 - (a) Supervision;
 - (b) Geography—Atlas;
 - (c) Status;
 - (d) Boundary surveys, &c.

The accounts record is closed on 25th of each month.

The necessary entries are made on the voucher register, salary and cost cards, and a distribution of charges form is prepared for each voucher, showing the distribution of the items by funds and classes of expenditure according to projects and lines of work.

Vouchers covering the disbursements to be made for the month are prepared in duplicate, the originals being forwarded on the 5th of each succeeding month to the fiscal agent, accompanied by a distribution form for each, and an abstract.

After being certified by the chiefs of offices, they are dated, numbered, and examined by the district fiscal agent, who assembles them by appropriations, makes the necessary book and card entries, and issues cheques.

All cheques are typewritten, with a special perforating machine, a carbon duplicate being prepared at the same time.

The carbon copies of cheques constitute the cash book.

Opposite the last cheque drawn are shown the total charges against each appropriation, the total disbursements for the day, and the balance to the disbursing credit.

The appropriation charges are posted daily to the disbursement ledger, which is kept separately on sheets, and shows deposits and disbursements for each supervisor.

The district fiscal agent files the vouchers numerically until the end of the quarter, when they are forwarded with the account current to the chief of accounts. A register of all vouchers received is kept on cards.

The distribution form is marked "paid" and returned to the supervisor, who enters on the current record any changes made by the fiscal agent.

The copy of the voucher retained at the supervisor's office is filed with all papers relating to it attached.

The supervisor forwards to the fiscal agent a monthly statement as to the total expenditure for the month, as shown on the project cards, by classes.

The district fiscal agent in his turn forwards to the chief of accounts a similar statement for the district.

An annual summary of expenditure is prepared similarly.

At Washington, the monthly statements or receipts and expenditure are consolidated for administrative and departmental uses. The annual statements are summarised by districts, States, &c., as a basis for reports to congress.

The district fiscal agent keeps an account with each appropriation and subappropriation from which allotments are made.

At Washington, separate accounts are kept of each district's allotments from each appropriation and subappropriation.

General accounts are kept with each appropriation and subappropriation.

Under the cost-keeping system, each officer is required to prepare a monthly service report from his diary, showing the distribution of his time to the various projects and activities of forestry work. Every man is his own timekeeper. Detailed instructions covering every possible point of forest cost-keeping are provided for the officer's information in preparing those reports.

The fiscal agent's office undertakes the cost-keeping records systems.

Calculating machines are used extensively.

An Australian Study
of
American Forestry.

Australian Recommendations.

AUSTRALIAN RECOMMENDATIONS.

The four corner stones of Australian Forestry development are:—

- (a) The immediate provision of a scheme of forestry training.
- (b) The building-up of a forest science by research.
- (c) The establishment of an organisation.
- (d) The construction of a system.

FORESTRY TRAINING.

1. There should be attached to each State Forest Service, for the purpose of staff training, a School of Forestry.

2. That School of Forestry should be neither a professional nor a trade institution like those of Europe, but a vocational one bearing the same relation to forestry and the timber industry that a School of Mines bears to mining and the mine industries.

3. Both a three (or four) years' undergraduate course for a junior staff in training, and a three months' short course for officers already employed should be provided.

4. An appropriate syllabus is suggested on pages 35-39 of this memoir.

5. The school should be so located as to be of ready access to the forest and its administrative headquarters, the timber industries' operations, a District Forestry Office, a railway, and a town.

6. The students should be selected carefully, and appointed on an apprenticeship basis, with board and residence, and a living allowance of, say, 10s. per week.

7. An appropriation of approximately £3,500 should be allotted to defray capital cost, with a like amount annually for upkeep.

8. The course should include work in the forest, experience in forest assessment camps, forest nurseries and experiment stations, demonstration forests, and forest offices.

DEVELOPMENT OF FOREST SCIENCE.

Education and research go hand in hand, and considerable advantages flow from the combination. The work of the Forestry School should be not alone instructive, but investigative and experimental also. In some measure, the school should be a clearing house for new ideas—analogous to some extent to the planning and training department of scientific management.

Many problems must be solved before Australian forest practice can be established soundly. Due preparation and planning make for economy of administration in the long run. The field of forest research is very wide. The task should be commenced forthwith in a comprehensive way.

9. The important work of forest investigation might be centred with advantage at a Forestry School, which would be styled: "The State School of Forestry and Institute of Forest Research."

Provided that—

- (a) The section relating to Forest Products might be allocated under suitable agreement to institutions such as the Technological Museum of Sydney, and Engineering Schools of Universities.
- (b) The section relating to Dendrology and Botany might be shared with State Botanists.
- (c) The work of silvical research should be divided amongst Experimental and Demonstration areas, Forest Nurseries and Forest Stations, and general forest investigations.

10. The State Forestry Museum might be attached to the Forest Institute.

11. The services and records of Forest Officers generally and of Forest Assessors particularly should be available to the Institute in the collection and compilation of data.

12. All specialist and investigative officers might be concentrated with advantage at the Forest Institute until such time as extension of departmental administration justifies the establishment of distinct specialising branches.

13. The research work undertaken at the Forest Institute should include the study of forest and timber industries and markets, with a view to developing improved methods and extended uses for native timbers, and furnishing advice and assistance generally to the public and the Forest Service in all its operations.

14. The research work should include also the systematic investigation of the forest pests, including white ants, borers, mantis, &c., with a view to reducing the tremendous losses due thereto.

15. The research work should include also the study and planning of administrative methods and the application of Scientific Management principles.

16. The functions of the Forest Institute might include the preparation of manuals, circulars, text-books, reviews, and measures of publicity.

17. Generally, the Forest Institute would be used by the Director of Forests as an agency wherewith to mould the new forestry. Therefore, it would come under his immediate control.

ORGANISATION OF PERSONNEL.

Personnel stock-taking is the first measure in organising an administration.

It has been estimated that 75 per cent. of workers are in the wrong avocations.

"The ideal for every employee is that he should be employed in that position which he is best fitted to fill, doing work which by natural aptitude, training, and experience, he is best qualified to do."

18. A preliminary measure should be vocational analysis under the Blackford Employment Plan, of each officer, present and prospective, of the Forest Service, with a view to the scientific determination of his especial bent, and his allotment to that line of projected duty in which he is best fitted to engage.

Most of the confusion in the world is due to the incorrect placing of the individual. Utopia cannot arrive until the right man

is in the right place, whether as leader or follower, " and working under conditions of natural environment—tools, rates of pay, hours of labour, and periods of rest, superintendence and management, future prospects and education that will develop and make useful to himself and his employer his best and finest latent abilities and capacities."

The militaristic and red-tape types of personnel control which involve the "mechanical enforcement of rigid rules," are provocative of antagonism and unrest, and cannot much longer survive the advance of the broader ideals of democracy.

The aim should be to develop throughout the Forest Service an atmosphere of mutual trust and co-operative enthusiasm. Officers should be afforded generous encouragement and all opportunity to improve their capabilities of usefulness in the Departments. Credit, as well as blame, should be concentrated on the individual, and, within the broad limitations of policy, officers should be given every possible latitude in initiative and management.

These things are of greater consequence to the average human being even than salary increments. There must be room for growth.

19. There should be a scientific study of the needs of the staff, leading to the development of a comprehensive system of credits, and the devising of a procedure calculated to produce a co-operative enthusiasm in work, and provide ample opportunity and encouragement.

20. As far as possible under the administrative policy, officers should be allotted individual spheres of initiative in which to work out their especial tasks and their own departmental destiny.

This supreme human need cannot be overlooked. Personal distinction and pride in work constitute the strength of life. Specialists are always hobbyists.

21. Personnel control is a matter for scientists.

I recommend the creation in the new Departments, of Personnel and System Bureaux on the lines of the Blackford Employment and Emerson Scientific Management Plans, to undertake the special work of vocational analysis, personnel employment and management, and the planning of systems.

In any case, the vocational analysis of cadets and officers who pass through the schools should be undertaken, and, if necessary, the proposed bureaux could be planned at and launched from those institutions.

22. A system of detailing officers to the Forest Institute, District and Head Offices, and other districts should be worked out. Reading courses should also be allotted.

23. District and inter-district conferences should be held periodically—the latter at the Forest Institute.

ORGANISATION OF ADMINISTRATION.

The reconstitution and extension of the forest staff must be preliminary to the reconstitution and extension of the Forest Service. A business can develop only as far and as quickly as its personnel can carry it.

Forest management by contract is impossible. The essential peg upon which to hang the execution of forest work is a resident forest staff.

My proposals are—

24. That the new position of resident overseer of a State Forest, analogous to that of District Ranger of the United States of America, be created; and that a forest overseer be appointed to each important State Forest, to take immediate charge of all operations thereon, from supervision of timbergetting and grazing to foremanship of forest improvement and fire protection crews.

25. That returned soldiers of suitable bent be given preference in such appointments.

26. That each appointee be given a short course of training at the Forest School before taking up duty.

27. That qualified forest officers be charged with the direct management of groups of State forests under the style of Forest Supervisors, and be given immediate control of the work of the forest overseers.

28. That each State be divided ultimately into forestry districts controlled by district foresters in accordance with the policy and general direction of the Director of Forestry.

29. That as the business of the Department grows sufficiently, the Director of Forests have the services of inspectors to assist him. As far as possible, decentralisation should be aimed at.

30. That the Forest Assessment staff be extended by the appointment of a party in each Forestry District.

31. That forest surveyors be appointed to carry out the secondary control survey work of the State.

32. That the nucleus of a branch of forest engineering be established, whose duty shall be to direct the work of forest survey (but not assessment), road-planning and building, quarters construction, water supply, &c., &c.

33. That similarly the nucleus be established of a Working Plans Branch, charged with the duty of timber sale, assessment, silvicultural experiment, and working plans, &c. It would work in collaboration with the Forest Institute.

34. That a forest badge be designed and issued to and worn by Forest Officers as an emblem of their authority as such.

ORGANISATION OF THE STATE FORESTS.

Organisation of the State forests themselves must follow closely on the organisation of the administration.

35. The first measures must be the carrying-out of detailed and accurate topographic forest surveys, and the preparation of forest maps to form a Forest Atlas.

36. The State forests must be subdivided into convenient units of management and operation, and the timber estimates prepared in accordance with those subdivisions.

37. Administrative sites should be selected on each State forest for the establishment of Forest Stations.

38. Road and track systems must be planned, and construction proceeded with in order of urgency. All areas under operation should be made thoroughly accessible in order to cheapen transport and increase stumpage values.

39. Tanks, dams, bores, or other forms of water supply must be provided at Forest Stations and throughout the forests where required for purposes of effective administration and exploitation of the timber and forage resources.

40. Under the unavoidable conditions of bullock team logging of Australian forests, the provision of grass paddocks, &c., is of primary importance. Apart from reasons of necessity, the forest revenue may be increased considerably by the provision.

41. On the forest stations must be built as required—Overseer's headquarters and offices, nurseries and experiment areas, camps, paddocks and pounds, and look-outs, &c. Standard specifications should be drawn up by the Branch of Forest Engineering.

42. Logging railroads and chutes should be laid out into bodies of otherwise inaccessible timber.

43. Telephone lines may have to be built in some instances, to connect forest stations to settlements.

All this work is within the especial province of the proposed branch of Forest Engineering.

Its execution should be under the direction of the forest supervisor and the foremanship of the forest overseer. Under this organisation, day labour should be most appropriate and effective in forest work.

BUILDING A SYSTEM.

The goal of a Forest Service in every aspect of its work should be "100 per cent. Efficiency."

That goal can never be attained by the adoption of a "muddling through" policy. There must be a persistent scientific attack upon the problems to be solved. The importance of detail must be recognised. The principles of efficiency engineering should be incorporated into departmental routine.

There should be an early stocktaking of existing methods—a setting down in writing of the accumulated "head" knowledge and experience of all officers, an inventory of laws, regulations, precedents and procedure. There must be a sorting out and a standardisation. A provisional system must be adopted as a basis for progressive revision.

I suggest—

44. The preparation of a State Forest Manual parallel to that of the United States of America Forest Service; to be bound on the loose leaf principle so as to allow of revision by the substitution of new pages for old.

45. The delegation of a special officer to undertake its compilation and progressive revision.

In the meantime, the following suggestions are offered by the United States of America experience with respect to the development of a system for each branch of forestry work.

(1.) Forest Classification.

Timber is an elementary necessity of State. Forest demarcation is a vital issue.

There must be an early and complete stocktaking of the timber resources of each State, with a view to determining what areas should be reserved permanently, what temporarily, and what made available for settlement. Australia is a comparatively timberless country, and its limited forest areas are particularly precious. But the forests generally are situated in the regions of greatest rainfall and accessibility, where settlement congregates. Their possession consequently has been contested fiercely by the opposing interests.

The theory of setting apart the poorer lands for forestry holds to an infinitely less degree here than even in Europe or America, since the climate, configuration, and location are such as to make in Australia even comparatively poor lands desirable in the eyes of the settler and the land speculator.

46. There must be a sufficient forest reservation to supply the material needs of prospective populations and to afford safeguards against possible climatic and waterflow changes.

47. A per capita basis cannot be adopted because the Australian community is a mere nucleus of what it is destined to become.

48. Since most forest lands are more or less suitable for some form of settlement, and the theory of relegation to poor soils will not hold in Australia, an arbitrary forest ratio must be established for each State in framing the forest policy.

49. As far as is at all practicable the Australian ratio should be fixed at not less than 5 per cent. of the total State area. In Europe the proportion of 20 per cent. to 30 per cent. still holds, in despite of teeming populations and intense demand for land, and forest redemption is still taking place. Mr. D. E. Hutchins in his "Discussion of Australian Forestry" proposes 15 per cent.

50. Preliminary forest exploration work should be pushed as far and as quickly as practicable. A cursory examination should be enough to secure a temporary reservation of likely lands pending final demarcation. The Departments of Lands should co-operate in the project.

51. Final demarcation up to the limits of the prescription for the State should be the exclusive function of the Forest Services, and should be undertaken in the course of forest survey and assessment.

52. State Forests should be located as closely as possible to present and prospective markets, because of the heaviness and bulk of the material to be transported therefrom.

53. They should be of sufficient extent to make possible and profitable their management as separate areas. Forest lands are most valuable when handled in large unbroken units.

54. Primarily, they should furnish a soil and climate adapted to the production of marketable timber. If they carry seed trees of the right species, so much to the good; if a mature stand exists, still better; if an abundant young growth, best of all. If the cover furnishes watershed protection, reservation may be justified even in default of other factors. Ruggedness is an argument in favour of retention. Preference should be extended to mountain forests.

55. Areas necessary for administrative purposes should be retained.

56. Administrative purposes include forest stations, plantations and nurseries, mill and camp sites, log depôts, logging roads and chutes, and means of access, look-out points, telephone lines, firebreaks, and every other area needed in the work of the forester, and such areas as are requisite for public camping grounds, health or pleasure resorts, or other purposes for the use of the public.

57. Since Australian forest exploitation depends primarily upon bullock teams, the provision of water supply and pasture, paddocks, pounds, stock driveways and holding grounds, is of especial importance, apart from the question of general forest grazing management.

58. Patches of agricultural or other non-forest land which might otherwise be eliminated, but are so intimately an integral part of the forest that they cannot be segregated without destroying a forest unit, should be retained. A State forest should not be shredded by alienation to a point making protection, general administration, or application of forest management unpractical.

59. Agricultural land which might otherwise be cut out, but carries a heavy stand of timber of such value that the timber speculator in place of the bona fide selector would seek to acquire title, should not be made available until the timber has been removed completely.

60. When a considerable area of forest is clearly of great economic value to the State and an attempt to transform it into an agricultural country might result in irreparable disaster by disturbing a well-established climatic or economic equilibrium, it should be retained. Such an area is the Pilliga Forest of New South Wales.

(2.) Forest Survey and Assessment.

Forest assessment is an operation which must be repeated periodically. Forest survey, however, must be undertaken once and for all. The two projects are inseparable at this stage, and, combined, they represent an undertaking of paramount importance, since it furnishes a foundation upon which must be erected the whole edifice of forest management. A comprehensive scheme of forest survey and assessment should be conceived at the start. It will give the greatest return in the long run.

61. There should be a broad, but elastic, division of the two component parts of (1) survey: and (2) assessment; the first to be directed by the proposed branch of forest engineering, the second by the proposed working plans branch in collaboration.

62. Forest survey should cover primary and secondary control, the objects of which are to provide an accurate surround, and a framework of more or less parallel lines and profiles not over two miles apart.

63. Primary and secondary control may be deemed to be the especial province of the proposed forest surveyors.

64. Tertiary control and assessment would cover the method of strip survey, with the aim to clothe the secondary control framework with topographic detail and to gather working plan data.

65. Assessment work, including the collection of working plan data, is a matter for the exclusive attention of experts acting under the direction of the Working Plans Branch.

66. Small separate camps are uneconomical, and considerable advantages flow from a combined organisation such as that consisting of a forest surveyor and two assessment parties (a forest assessor and his assistant) working together. Camp transport work is reduced, and one cook suffices for all; camp life is made more congenial and the work is expedited generally.

67. Secondary control lines should be blazed, and marks should be set up as the starting and closing points for horizontal and vertical strip surveys.

68. A camp map should be prepared, on which should be plotted the surround and framework, and all existing surveys.

69. A preliminary subdivision of the area should be worked out on the camp map for purposes of convenient estimating and compiling. The United States of America Forest Service uses the 40-acre lot as a basis.

70. The projected strips should be laid out in pencil on the camp map. The distance between strips should be ten or twenty chains. Circumstances, however, may alter cases.

71. A scale of 20 chains per inch and contours of 25 feet interval should be adopted as standards for the detailed base maps resulting from strip surveys.

72. I recommend the use of the new Bonner Reflecting Abney level and trailer-tape system of tertiary control. The United States of America Forest Service sketching-sheet and transparent duplicate with separate tally sheet may also be employed with advantage. The tally man should book tallies instead of calling out to the assessor. Perfect synchronisation is requisite if speed is to be attained.

73. The survey season should be fixed to suit local climatic conditions as far as possible; ordinarily, it should be in the autumn to spring months. The severe summer months might be devoted to office work or to details of study and investigation at the Forest Institute and Experiment Stations, or holidays.

74. For the proper assembling of data, four standard maps should be adopted, viz., (1) The base map, showing topography and "culture"; (2) the silvical map, showing forest types and age classes; (3) the timber map, showing timber stands and assessment estimates; and (4) the forest organisation map, showing present and projected improvements and subdivisions.

75. A State forest atlas of a standard size (say, 18 inches by 21 inches) should be established at head offices, with district forest atlases at each district office. In these atlases should be assembled systematically the prepared maps and collected figures resulting from strip survey. An index map on a scale of 80 chains to the inch should be included.

For map-filing purposes, the adoption of the Beck vertical map file and envelopes is recommended.

76. The American alpha-numeric symbolisation scheme to denote mixed stands should be adapted for Australian use.

(3.) Silviculture and Forest Management.

Silviculture is the handling of woodlands in accordance with the various silvicultural characteristics and requirements of the contained species; in other words, the incorporation into forest treatment of the results of the forest research to be carried out at the forest institute, experiment stations, and demonstration forests, and by forest officers generally. Its objective is the attainment of the normal or perfect forest.

Necessarily, it cannot come in its fulness forthwith; the unfolding will be gradual. But its application begins with exploitation, which, silviculturally speaking, is only a means to an end, that of normal regeneration.

77. The welfare of the stand must be the chief consideration in permitting cutting operations, which should be conducted so as to afford the maximum opportunity for natural regeneration.

78. There must be an insistence upon conservative methods of timber-getting (low stumps, high tops, sawing instead of axeing, &c.), not only upon grounds of economy, but in order to reduce the accumulation of debris and improve the chances for reproduction; where necessary, slash must be stacked and burnt, or scattered; dead, defective, and damaged trees must be removed; young growth must be safeguarded against injury.

79. Markets must be canvassed in order to develop a sale for the lesser species which crowd the forest and stand in the way of profitable regeneration and improvement.

80. The areas most in need of cutting should be located accurately and operations diverted thereto.

81. Present timber-getting operations should be limited, by the prescription of a high minimum girth, to the skimming from the forest of the overmature and deteriorating trees.

82. Secondary fellings should be in the nature of a seeding cutting, and should be conducted, when practicable, by the forest service itself. Otherwise, the forest service should mark the trees to be removed.

83. Marking rules should be developed in the light of the silvicultural lessons learnt. The work of marking should be regarded as of the first importance, and be under the direct superintendence of expert officers, who should establish sample markings on each cutting area.

84. A systematic study of cut-over areas should be maintained, and the results recorded at the Forest Institute for use in developing silvicultural practice.

85. The processes of natural regeneration should be observed closely in the forest, and worked out on experimental areas and in forest nurseries. The time of seedfall should be recorded for each species. Sample plots of seedlings should be marked for observation. The influences of firing, light regulation, shelter, soil-working, &c.—and their costs—should be analysed.

86. Forest improvement in the sense of silvicultural tending should be carried on, for the present, only experimentally, and as such should be studied closely as a part of research.

Undoubtedly, it is desirable that areas already cut over under the unrestricted conditions of the past should be set in order. But it is a tremendous and costly task, and general forest organisation should be regarded as of prior urgency, more especially as sound silvicultural practice has yet to be developed, and to a large extent also is dependent upon a widening of the Australian market.

87. A demonstration area should be set apart on each forest for direct exploitation and regeneration by the Forest Service, to serve both as an example of conservative utilisation and an experiment in applied silviculture.

88. In opening up roads within the forest, the Forest Service should itself convert and dispose of the trees to be removed.

89. Thinning work should be undertaken only where a market for thinnings exists or can be established. As a rule, there is little need for it in Australian forest practice, unless in the way of improvement fellings in the overwood. Congested pole crops are of infrequent occurrence.

90. A maximum periodic cut approximating to the sustained yield should be fixed for each forest.

91. Increment plots for the purpose of recording the rate of growth for different species, and accurately determining the rotation, should be established on each forest and for each site quality.

92. As the forest approaches normality, it will be possible to increase the periodic cut. The present annual sustained yield for the Brooloo Forest (Q.) of 40,000 acres has been fixed at 4,000,000 feet. When fully stocked, it is estimated that it will produce from 20 to 40 million superficial feet of hoop pine per annum.

93. Pending their organisation, State forests should be withheld from immediate exploitation, whenever it is practicable to divert cutting to timber reserves, ordinary Crown lands, leaseholds, or private property. I regard this policy as of paramount importance to Australian forestry. The timber resources carried by those lands must be utilised to the uttermost. Every stick destroyed in clearing for settlement means equivalent loss to the permanent reservations.

94. A silvicultural advance may be initiated by the attachment to timber sale agreements or licenses of essential provisos. Compensation for any added labour cost should be arranged in fixing royalties.

95. The correct appraisal of stumpage values is fundamental to the institution of forest management. An intensive study of labour, freight, and market conditions is essential to its solution.

96. A natural market value, rather than an artificial royalty, should be adopted as the basis of timber sale. The uniform royalty expedient must go.

97. Stumpage values must be based on market prices, less the cost of cutting, extraction, and transport to the market.

98. The Forest Service, however, should fix minimum selling prices for each forest, which represent the point at which it is believed to be a wise public policy to withhold timber from sale rather than sell it at the market value then obtainable. There are cases, however, where it would pay better to give trees away rather than leave them to cumber the forest, and the Forest Service should not hamper its management by the prescription by Regulation of high State minimums. Upsets for each sale provide adequate safeguards. Maximums depend upon imports and tariffs.

99. Direct government exploitation may be reached through development of the methods of stumpage appraisals.

100. The destructive systems of competitive exploitation occasioned by the indiscriminate granting of licenses for the same area must be abolished if silvicultural success, or even ordinary business system, is to be achieved.

101. Every operator should be confined to a definite timber lot, for the operations on which he should be held responsible. He should be required to work in accordance with the terms of an agreement drawn up by the managing forester.

102. The agreement should specify a maximum quantity for the period and a minimum per month. Its conditions should provide for conservative timber-getting and necessary silvicultural measures.

103. The term should be short, generally not exceeding one year. The quantities should be based, generally, upon what a single operator can extract in the time. The sale of the agreement should be at public competition, after due advertisement. Upset prices per 100 square feet should be fixed accurately on natural market values, less the cost of cutting, snigging, and hauling.

104. Sales for each forest should be yearly or half-yearly, and should be limited to the prescribed yield for the area.

105. A reasonable operating life for established plants may best be guaranteed by such short-term sales up to the limits of the maximum periodic cut. Unrestricted sales at low prices tend to produce a host of small, temporary plants on the "boom and bust" principle.

(4.) Working Plans.

Working plans are nothing more than orderly records of information, and the deduced ideas of the manager with regard to the future working of the forest.

Working plans develop as the organisation grows.

The confusion of thought which exists with regard to working plans is due to the fact that our only model—the European form—too often reflects the complexity of the organisation of which it is the instrument.

In the American experiment, the attempt was made to apply to the management of the primaeval forest the working plan of the gardened one.

Organisation and working plans started off at opposite poles.

Time has elaborated the former and simplified the latter until both are now practically co-incident and co-ordinate.

The American lesson for Australia is that development must start from the rock bottom of established facts.

The vehicles are policy, forest organisation, silvicultural research, and annual working plans.

106. Each Forest Service needs urgently legislative enactment vesting in it:—(1) An adequate forest estate; (2) wide powers of technical management; (3) authority to reinvest forest revenue in the forest business.

107. The reports and maps resulting from forest survey should be employed as the basis of the working plan. Division of the area is fundamental, and a tentative arrangement into convenient units of estimation, management, and operation, with complete road systems, should be worked out on the map. To the report should be attached a short prescription fixing the maximum periodic cut, and outlining the general timber sale policy to be applied.

108. Silvicultural methods, based upon the results of research, and prepared in accordance with a standard outline, should be suggested for each species and each forest type.

109. An annual working plan report should be required for each forest under management. In that report the year's records and results should be assembled and discussed, and plans for the ensuing period sketched. This annual report would be actually the living working plan, whose normal growth would bring in course of time the final working plan, which prescribes the policy of management not for one year but for twenty.

(5.) Reforestation and Afforestation.

110. Artificial regeneration of forests in Australia by planting is justified only:—

- (a) Where natural regeneration has failed.
- (b) Where waste lands, burns, and watersheds are to be afforested.
- (c) Where cheap exotic softwoods, not replaceable by native timbers, must be produced.

In contrast to the high New Zealand expenditure of at least £7 per acre, is the American one of 25s. per acre, due to improved nursery and planting methods.

111. I recommend the introduction of scientific management into nursery and planting practice in Australia.

112. The following devices should be imported into afforestation work in Australia.

- (a) The Savenac threading board and threading table.
- (b) The transplanting rake and trenching hoe.
- (c) The Feigly tree digger for lifting plants for stock distribution.
- (d) The packing-machine and the bundle method.
- (e) The modified trenching plough.
- (f) The United States of America Forest Service planting bag and tool.

113. Planting operations should be restricted at present to the most favourable areas, with a view to developing successful methods capable of application to less-favoured sites.

114. The United States of America planting formation and methods should be adopted.

115. The ground should be prepared for planting only just so far as is absolutely necessary. In many cases there should be no preparation.

116. Detailed cost-keeping records should be kept, and there should be a close study and careful recording of results for further guidance.

117. Annual nursery and planting reports on United States of America lines should be adopted.

118. The collection of seed for afforestation purposes should constitute part of the duty of forest overseers.

(6.) Fire Protection.

The practice of silviculture must be preceded by fire protection. Bush fires in Australia have thinned the timber stands, injured or stunted the survivors, rendering them branchy, and opening the door to white ant infestations, and finally routed regeneration and impoverished the soil.

Yet to bush fires has been ascribed the alleged prolific reproduction in Australian forests. One fire at the right time may be useful; it is the recurrent firing that has wrecked the Australian timber lands.

The solution of the bush fire problem is not difficult if we give up the search for miracles.

Achievement is possible only through patient organisation.

The measures to be taken are those relating to prevention, detection, and suppression.

There must be an active promulgation among the general public and forest users of an attitude towards forest fires and forest incendiarism parallel to that felt in regard to a burning house:

I recommend:—

119. Persistent publicity, through signs and posters, books and notices, issuance of forest fire news for publication, education in the school, personal appeal.

The fire liability should be reduced as far as possible.

The forest user must do his part.

I propose—

120. The attachment, whenever advisable, of conditions to licenses, permits, and timber sale agreements, to provide for (a) lopping, stacking, and burning debris; (b) the cutting of dead trees which by their height constitute a fire menace; (c) the clearing of the right of ways of railways and logging railroads; (d) the use of spark arresters on engines; (e) the regulation of camp fire building.

121. The establishment of dépôts of fire-fighting tools at forest stations and at likely places in State forests.

122. The opening up of every part of a State forest by roads and tracks, to provide access and firebrakes.

The cost of establishing a 100 per cent. system of divisional firebreaks to control a 2 per cent. or 3 per cent. burn would be overwhelming.

The construction of firebreaks, other than roads, should not ordinarily be undertaken.

One of the main difficulties of the situation is to ascertain quickly the outbreak of a fire.

I do not advocate any such costly system of lookouts as that adopted in the United States of America. The forest overseers' stations should ordinarily be fire lookouts. Further extension of the lookout system should not usually be necessary.

123. License conditions or timber sale provisos should stipulate that all forest users must report the outbreak of bush fires, and personally assist to extinguish them.

124. Arrangements should be made beforehand with non-forest users who are resident in the locality similarly to report outbreaks and assist in suppression.

125. A fire study should be made for each State forest, and a fire plan prepared, embracing the results of this study, and the measures of fire control to be undertaken for the specific area.

126. The keystone of the fire plan is the proposed forest overseer, who should maintain a constant lookout during the fire season, and upon the occurrence of a fire should set the fire plan in motion and superintend the work of suppression.

(7.) Grazing.

The efficacy of fire protection policies depends very largely indeed upon the grazing policy.

But, more than that; the economic use of the large forest fodder resource of tree, shrub, and herb which occurs on the forest estate, is a subject which intimately concerns the forest administration, since it has a large bearing upon the question of utilisation of the timber supplies.

127. Forest grazing control should be vested wholly in the Forest Service.

128. I recommend the establishment of a separate branch to deal with the forest fodder business; and the appointment of a grazing expert to organise and control that business in accordance with forestry interests.

129. A scheme of grazing reconnaissance on United States of America Forest Service lines should be developed, as a vehicle for stocktaking of the forest forage resource.

130. The system of forest leasing for grazing purposes should be abolished absolutely; it should be replaced by a system of annual grazing permits on a charge per capita basis, subject to such conditions as are necessary in the forest interest, and such royalties as represent a fair and reasonable market value, and revocable at the discretion of the forest administration.

131. In the issue of such grazing permits preference should be given to forest users and adjoining residents.

132. A maximum number of stock should be fixed for each State forest, and for each permittee. Reductions should be made where the interests of the forest growth require.

133. Grazing operations should be limited to the period best suited to the forest needs.

134. Endeavour should be made to allot each class of stock to individual ranges.

135. Salting, as a measure of forest protection, should be a condition of the permit.

136. The forest overseer of the State forest should be in immediate charge of grazing operations, and exploitation of the forest forage resource. Where necessary, herdsman-forest guards might be employed to assist him.

137. The adoption of the grazing system and procedure proposed would pave the way also for direct forage exploitation by the State if such should be deemed advisable.

138. Special measures should be taken to conserve and control the valuable drought-tree forage of the inland districts. Its disposal should be regulated closely under grazing permits carrying royalties approximating as closely as possible to the real and ascertainable value of the forage.

(8.) Special Uses.

139. For the disposal of occupancies of portions of State forests for purposes other than grazing and timber sale, I recommend the adoption of the revocable annual permit, subject to such conditions and charges as are advisable in the forest interest. Leasing should be prohibited.

(9.) Forest Pest Control.

Forest pests, such as white ants, borers, mantis, wombats, &c., have been responsible for tremendous forest wastage.

140. I recommend the establishment of a section of the Forest Service to deal with forest pests.

141. I propose that a forest entomologist and zoologist should be appointed to carry out a systematic investigation with regard to the forest pests of the State. He might be stationed at the Forest Institute, so that his services would be available also for instructional purposes.

(10.) The Forest Water Resource.

142. There should be a stocktaking of the water supply resources of the State forests, with a view to their better protection and development.

143. This work should be done in the course of forest survey, and should be under the direction of the proposed branch of forest engineering.

(11.) Forest Offences.

Severity in the settlement of forest offences produces frequently the spirit of the "revanche"; systematic mildness often results in co-operation.

There has been considerable confusion of thought with regard to the policy of settling forest offences, and considerable time, trouble, and friction have been involved.

144. Apart from the penal provisions of the forest laws, there should be a standardisation of procedure for the departmental settlement of forest offences on American lines.

145. There should be separate treatment for intentional and unintentional acts of forest trespass; in the first case, the measure of damage should be the American one of the "value of the timber in its condition when and where found," plus the damage done to the forest: in the second case, the measure should be "the difference in the value of the area before and after the trespass."

146. Departmental procedure should provide for an analysis of the breach in accordance with this policy; district foresters should be authorised to settle first offence cases without recourse to legal proceedings, where the damage is below £25.

(12.) Office Methods.

147. I recommend as a measure of labour saving, the adoption at both head and district offices of the cardless vertical filing system, with a subjective classification arranged on a self-indexing basis.

148. Office work should be reduced as far as possible by the decentralisation of authority. District foresters should be given enlarged powers of district management; officers should be relieved, to the greatest degree practicable, of the burden of investigating and reporting upon appeals or complaints.

149. The carbon copy system of communication should be availed of largely.

150. The adoption of the United States of America Forest Service Promise Card Box and "follow up" system is recommended.

151. Letter-size paper should be adopted as a standard size in lieu of the ancient cumbersome and uneconomical foolscap.

152. A great deal of time, labour, and material would be saved by the elimination from all official correspondence of the department of the formal phraseology "I have the honour to be, Sir," "Your Obedient Servant," and the replacement by "Yours faithfully."

153. District forestry offices should be supplied with mimeographs for circularising purposes.

(13.) Forest Bookkeeping.

154. The payment of all royalties and charges in advance of operation is a feature of the United States of America system, which should be adopted, at all events, to the extent of requiring deposits equal to a month's timber cut.

155. The concentration of revenue collection at the district forestry offices, under the American system, would reduce bookkeeping work and the possibility of mistake or fraud. The system is recommended. It is virtually the Queensland system.

156. In establishing an accounting plan for the Forest Service the card system should be adopted as the basis.

157. A detailed cost-keeping scheme for the entire Forest Service should be drawn up and put into operation.

158. District financial management should be based on a system of appropriations and allotments consequent upon the submission of annual estimates.

(14.) Publicity and Publications.

The virtues of publicity in forestry work should be recognised. "It is desirable that all proper opportunities should be afforded the public to understand the work of the Forest Service and the principles and application of forestry."

159. District foresters should be authorised to supply forestry information for publication, with the proviso that controversy, self-advertisement, and partisan discussion of questions of policy, as well as criticisms of any other department, are to be avoided.

160. Addresses by forest officers on forestry matters should be encouraged, provided there is some administrative control thereof.

161. Forest libraries for the use of the local staff should be established at each district office; forestry works, periodicals, scientific journals, and forest photographs should be furnished to such libraries.

162. The publication of forestry information through the medium of departmental bulletins, pamphlets, reviews, and general news, should be widely extended.

(15.) Timber Conversion and Utilisation.

163. The adoption of scientific power logging should be encouraged, where the stand warrants, and where it will not be of detriment to the forest. The method of logging should be subject to Forest Service approval.

164. American sawmilling machinery and methods are commended to notice in connection with the establishment of State sawmills.

165. The establishment of State timber seasoning works is recommended, with a view to extending the utilisation of the less durable indigenous species.

166. The trial of the Holt caterpillar gasoline tractor is recommended for the exploitation of sandy forests like the Pilliga Forest of New South Wales.

167. The substitution of the white ant-resistant cypress pine for non-resistant imported softwoods should be encouraged in all Government contracts, so, also, second-class hoop pine and "tops."

168. The extended utilisation of other non-developed species should be encouraged by direct Government use, and by Forest Service publicity campaigns.

169. A small experimental sawing and seasoning plant might be attached to the Forest Institute in connection with the working of the school forest. That forest should be handled as a model area for the guidance of the timber industry.

170. The scientific grading of native timbers should be encouraged.

GENERAL.

A tremendous task lies ahead of the budding Australian forestry administrations—a task involving patient and determined organisation. It is necessary that the difficulties be faced *at once*. Not everything can be done until larger funds and powers are available, but there is much foundational and planning work that may be initiated forthwith. A general survey of the foregoing suggestions will serve to indicate what can and what cannot be commenced at the present time.

The future of Australian forestry depends very greatly on the steps that are taken to-day. *No combatant can afford to postpone measures of preparation until after the declaration of war.*

The fact that the Australian forest resource is very limited (*we have, for the equivalent area, less than one-tenth the extent of the United States of America forest*) makes it essential that we should develop that resource in the most intensive fashion, and spare no effort to improve and perpetuate it.

United States of America, with ten times the Australian forest area, spends upon its forestry scheme three times as much as the forests are returning at present in revenue.

The practice of forestry in Europe and America has shown that increased expenditure means vastly increased profits. France spends 4s. per acre per annum, and gets 7s. 3d. return. Wurtemberg spends 8s. 4d. and gets 27s. 6d.

It is necessary that we should devote for some years to come a generous part of the forest revenue to the rehabilitation of forestry in Australia and reinvestment in the forest business. And every possible means should be employed to secure the utmost return for that expenditure.

BRISBANE.

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