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FORESTRY





(Photo by courtesy U. S. Forest Service.)

CŒUR D'ALENE NATIONAL FOREST.

Mature white pine timber ready for cutting under forest management. Another crop will be harvested on this land in about seventy-five years.

FORESTRY

A STUDY OF ITS ORIGIN
APPLICATION AND SIGNIFICANCE
IN THE UNITED STATES

By

ARTHUR B. RECKNAGEL, B. A., M. F.

Professor of Forest Management and
Utilization, Cornell University

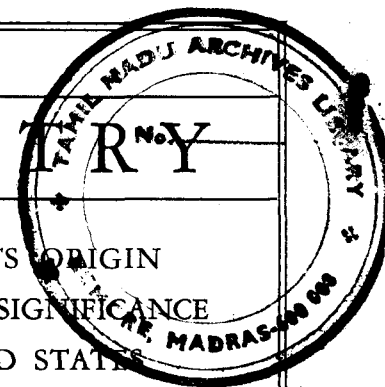
and

SAMUEL N. SPRING, B. A., M. F.

Professor of Silviculture,
Cornell University



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FORESTRY

ARTHUR BERNARD RECKNAGEL

and

SAMUEL NEWTON SPRING

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TO

M. T. M. R. AND A. E. S.

MANUFACTURED IN THE UNITED STATES OF AMERICA

PREFACE

For some time the authors have held the intention of formulating a book dealing with the present-day economic problems of forestry in the United States, as Dr. B. E. Fernow did so inimitably well in his *Economics of Forestry* of twenty-five years ago.¹ They were encouraged in this undertaking by the tremendous interest which many people have taken in the country's forestry problem, and by the need of orienting the public, particularly the younger generation in schools and colleges, in the important economic aspects of this problem.

The present book makes no pretense of being a compendium of forestry information. In no sense, moreover, is it a manual of methods. The five branches of forestry — Silviculture, Management, Protection, Utilization, and Policy — are not dealt with categorically, nor are the various forest regions of the United States described in detail with respect to component species, characteristics, possible forms of management, etc. This has been done satisfactorily in other books.

The purpose of the book, as the subtitle suggests, is to present a study of the origin, application, and significance of

¹ B. E. Fernow, *Economics of Forestry*. T. Y. Crowell & Co., New York, 2nd edition, 1902.

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forestry in the United States. The approach is historical, economic, and objective, designed to give the reader a general grasp of the forestry problem.

The opening chapter on "How Forestry Came Into Being" analyzes the formative period. The early forestry movement paralleled the immense economic development of the forest industries, as sketched in the second chapter. The merging of the two movements into one great undertaking—timber production by forestry methods, with all of the attendant social benefits of essential wood supplies and adequate recreational opportunities—furnishes the theme of several of the succeeding chapters.

The development of a public policy regarding forestry (Chapter VI) is shown as the result of historical, social, and economic forces the full effects of which are just now becoming manifest.

The second half of the book treats first of the application of the methods and principles of forestry to actual forests in various parts of the United States. The case method is here used. Examples of applied forestry—on federal, state, and private forests—demonstrate the essential points of forestry practice. Then follows a chapter on reconstruction—the rehabilitation of forest land. This, naturally, leads to a consideration of research and of education in forestry, the two powerful means of promoting both the technical and the popular aspects of forestry in this country.

The book concludes with a consideration of how forestry

is being accomplished—that is, of the real status of forestry in the United States from the standpoint of economic progress, rather than from a technical standpoint of progress in silviculture, management, or the like.

The appendices have been purposely limited to materials which contribute directly to a clearer and fuller understanding of the foregoing chapters. No encyclopedic data of standing timber estimates, volume, growth, yield, etc., have been included, since such material is abundantly available in technical publications.

If this book fulfills the hopes of its authors, it will be received not only as an introductory text book on forestry, but also as a volume of interesting and useful information for the general public. In its preparation, this wider use has been constantly kept in mind.

We make grateful acknowledgment to our colleagues at Cornell University and elsewhere who have generously coöperated in the preparation of this book. May their reward, as ours, be the sense of having contributed their bit toward a better understanding of our greatest natural resource: the forest.

A. B. RECKNAGEL

S. N. SPRING

Ithaca, N. Y.

May, 1929.

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F O R E S T R Y

HOW FORESTRY CAME INTO BEING

Forestry in the United States traces its real beginning to a legislative modification of the public land policy. In a bill laid before the fifty-first Congress, dealing with a much demanded revision of the public land laws, a new section was introduced very late in the second session, when the bill was in conference, authorizing the President to set aside forest reserves from the public domain. This bill was quickly enacted and was approved on March 3, 1891. The then Secretary of the Interior, John W. Noble, influenced by such men as Dr. B. E. Fernow and Mr. E. A. Bowers, was responsible for the persuasive insistence which induced the conference committee to introduce this new section into the Act of 1891, thus establishing in one little paragraph a policy of setting aside and reserving public lands wholly or partly bearing forests. Although the idea of forestry had been growing, as yet there had been no uniformity or unanimity of policy — or any effective action. In a chaos of diverse laws and of conflicting interests in public lands an embryonic policy thus emerged, which in the long run was destined to accomplish the fact of federal forest management,

now the chief inspiration of state and private forestry in this country.

This elementary provision and a subsequent act in 1897, which provided definitely for the administration and management of the public forest reserves, are the outstanding events in the forestry movement of the nineteenth century in the United States. The one inconspicuous section of the Act of 1891 inaugurated the policy; the other made certain its enforcement at a time when the very existence of the forest reserves was threatened through lack of understanding and of effective means of management.

Notably different were the beginnings of forestry in its birthplace in Central Europe. There, several hundred years ago, it was the actual need of communities for fuel wood and other materials in the face of undeveloped transportation facilities and prior to the discovery of coal that gave rise to measures leading to modern forestry. High regard for forests and their skillful working, due to sheer necessity, was a heritage transmitted from father to son. Many other political, social, and economic elements brought about the present stabilized conditions of labor, market, and forest production in Europe, and made possible an intensive practice of forestry.

Only in late colonial days is a transient phase of like nature to be found in this country before the period of its great development. Restrictive laws regarding forests were enacted by the colonies, apparently to provide for a local

need, real or expected, or to correct a local abuse. With the expansion of the nation these laws passed quickly into disuse and obscurity. In the same class may be put the offer of prizes in 1804 for successful forest plantations—a plan intended by the Massachusetts Society for the Promotion of Agriculture to stimulate the production of needed material for local use. While this scarcely constitutes the beginning of American forestry, it is nevertheless astonishing in consideration of the nation's vast forest resources then unknown.

Similarly, in the first quarter of the nineteenth century, federal protection and reservation of public land bearing southern live oak and cedar, were instituted solely to meet the requirements of building wooden ships for the navy. Active interest ceased, however, with the passing of wooden battleships. As fundamental acts, these federal measures set a useful precedent and provided basic law, but no active national forestry can be said to have originated at that time.

After this period came the phenomenal expansion of the United States as a nation, involving great increases in population, westward migration, rapid clearing of forest land for farms, and other factors. As railroad building and the settlement of the open prairie and plains region progressed, an enormous lumber business was developed to supply the needs of this population, especially after the middle of the century. Continual encroachments on our forest area for agriculture and for supplying the growing needs of city,

town, and country formed the first direct influence leading to forestry.

This influence is reflected particularly in the reports of the Commissioner of Agriculture for 1865 and 1875 and in the census of 1870, which classified unimproved farm land into two groups, forest and non-forest, so as to gain more knowledge concerning forest area.

Rev. F. Starr's article in the report of 1865 seems to have been written chiefly from a farmer's point of view. It emphasized rapid consumption, predicted a timber famine or decided scarcity of wood within thirty years, and urged care and reproduction of woods by the farmer and experimental planting by the government as ameliorative measures. It was extravagant and academic in much that it presented, but it doubtless aroused considerable discussion. In contrast with this, the report of 1875 accords fully with its purpose stated at the opening: "To collate the records of this and other Departments of the Government upon forest statistics, with current experimental data from other sources, to supply the want of investigators for the main facts of forest growing." It contains a mass of statistical data gathered from questionnaires and also an interesting analysis of the forest resources by Professor W. H. Brewer of Yale University, largely descriptive of the kind of forest, location, and species.

Reports of individuals concerning European forest conditions undoubtedly influenced public opinion in America.

In this connection, Dr. Fernow mentions two important contributions: Dr. John A. Warder's official report on *Forests and Forestry of Germany*, prepared when he was Commissioner to the World's Fair in Vienna in 1873, and George P. Marsh's book, *The Earth as Modified by Human Action*, which dealt ably with the evil effects of forest destruction.

Other writings of like character might be cited, but those mentioned are representative of the period, and together with current articles they disseminated knowledge of forests and forestry — a necessary precursor of constructive action.

An early expression of interest was in the form of legislative action taken by the states and by Congress relative to tree planting. Between 1865 and 1875 numerous state legislatures passed laws to encourage tree planting, usually providing for tax exemption on land successfully planted under required conditions; in some states a cash bounty was offered. These measures failed to achieve their purpose. In 1873 Congress enacted the so-called "timber culture laws," providing that a claimant, as a prerequisite to gaining title to a prescribed area, should plant a certain portion of it with trees. Intended originally as a homestead act to encourage tree planting, it became, however, a source of many fraudulent practices in acquiring lands, and was subsequently amended and finally repealed.

In these state and federal acts is to be seen the beginning of much subsequent accomplishment in private planting

of shelterbelts and windbreaks, insofar as our forestless regions are concerned, but they do not constitute the real beginning of American forestry. They reflect political interest in the agricultural element of the population, an erroneous idea of the possibility of timber-growing in the prairie and plains region and its supposed influence on general climate, and also the notion that planting was the solution of the timber depletion problem. This last idea, perhaps accentuated by the inauguration of Arbor Day, has persisted to the present, and has done much to hinder the progress of rational management of existing forests.

Inquiry and action by the states did, however, bear witness to public interest in forests. Far more significant was the provision by Congress in 1876 for a Commissioner of Forestry in the Department of Agriculture; this assured a center of official investigations, gave continued support to the forestry movement, and subsequently grew into the present highly developed Forest Service of that Department. It was through a memorial of the American Association for the Advancement of Science in 1873, together with personal persuasion by members of its forestry committee, that Congress after three years thus gave official recognition to our forest problem. The best point of view of that period is expressed by the wording of this act, requiring that the Commissioner of Agriculture

appoint a man of approved attainments and practically well acquainted with the methods of statistical inquiry . . .

with a view of ascertaining the annual amount of consumption, importation and exportation of timber and other forest products; the probable supply for future wants, the means best adapted to the preservation and renewal of forests, the influence of forests on climate, and the measures that have been successfully applied in foreign countries or that may be deemed applicable in this country for the preservation and restoration or planting of forests, and to report the same to the Commissioner of Agriculture to be by him in a separate report transmitted to Congress.

This government agency and the American Forestry Association, founded at this time and developed into an active organization soon afterward, were the two most powerful forces behind the public forestry movement. Local and state forestry associations, likewise founded during this period, were also influential within their limits in educating the public mind.

The greatest landowner of that day was the United States, which even as late as 1869 still possessed three-quarters of the public domain. It is easy today to ask why the nation did not then inaugurate a rational policy for forest lands and thus safeguard the forest resources permanently. The basis for an answer, if such a question can be answered, lies in an examination of some of the chief facts in the history of our public land policy during the last century.

There were statesmen who held broad views concerning the disposal of public land for purposes of settlement, but the enormous extent of the area, its apparently inexhaustible

resources, and the pressing, immediate problems of its use obscured the vision of a future when the United States would be a settled country. It was an age of exploitation, and the expediency of the moment very largely controlled legislation for a century.

Aside from the primary objective of securing immediate revenue for an impoverished government following the foundation of our republic, the dominating idea was to provide for the settlement and development of the public domain. The underlying motive was "to establish a permanent democratic civilization secured by diffusion of proprietary rights in the soil."

Congress labored faithfully with the problem of agricultural settlement, and finally evolved the Homestead Act of 1862. Previous legislative acts, especially the Preemption Act, had, by sale of public land, provided for settlement of the humid East where practically all land was considered agricultural and had generally to be cleared of the timber on it, then of little or no use, to make way for crops. The Homestead Act provided that settlers might acquire farms of 160 acres, gratis, except for a fee on filing their entry; and, to insure permanency of settlement, the further provision was made that the individual must live on the land for a stated length of time, although this period might be commuted. Under this act the central humid prairie region of the United States was settled. Within this region it operated successfully, but it was not well adapted to condi-

tions of the arid West. The Desert Land Acts aimed to meet these conditions.

To afford markets and means of communication for these settlers as they spread out over the western farmlands, Congress, during the period from 1850 to 1871, made large grants of public land, amounting to nearly two hundred million acres, chiefly for railroads, but also for other internal improvements. They were located mostly in non-timbered country but some of these grants encroached largely on the timbered regions of the public domain, alienating some land which might later have been included in the reserves and making possible the acquisition of certain large private holdings.

The Swamp Land Act, passed in 1850, was primarily intended to further agricultural settlement of public lands which required reclamation. Under this act the United States granted swamp lands to the various states, on condition that the latter would drain and reclaim them. Much of the land so granted bore timber and very little of it was reclaimed for agriculture, but was sold or otherwise assigned to private individuals and companies.

In conjunction with the fundamental acts for agricultural settlement, it was necessary to make provision for the miners, another class of pioneers. After 1849 prospecting and mining rapidly increased and Congress by the Mining Act of 1866 threw the mineral lands of the public domain open to exploration and occupancy, and provided that title might

be had to a mineral lode if the claimant had previously occupied it according to local mining rules and had expended on it as much as \$1000 for labor and improvements. Individually these persons required wood in working their claims, and the requirements for fuel and timber became great around mining settlements as more and more of them came into existence.

A third class for which the government might have been expected to make some provision from timbered public lands consisted of the lumbermen. Not until 1878 was legislation enacted to permit use of timber on public lands or to provide for the sale of timbered lands of the public domain. How, then, was the great demand of settlers met prior to this time? Unrestricted individual initiative, which may perhaps be termed the slogan of the century, found a way. The existing Preëemption and Commutation Homestead Acts served as vehicles for acquiring title to large consolidated areas of timberland, although these laws were never intended to have this effect. Such timber tracts were obtainable also by direct purchase with military and agricultural college scrip — warrants issued for military bounty and for advancement of education. Furthermore, since there were no legal means of securing timber from public lands, thievery reached enormous proportions. To be sure, provision had been made as early as 1831 for guardianship of timber on the public domain, but the inadequate provisions by Congress for enforcement made protection ineffective.

Acceding to an almost unanimous public opinion, Congress passed two acts in 1878, following insistent and just demands of settlers and miners for timber from the public land, as also repeated recommendations of government officials for legalized sale of timberlands as the remedy for depredations.

The Timber Cutting Act was designed to provide residents of the Rocky Mountain states with free timber from mineral lands of the public domain, such timber to be used for building, agriculture, mining, or other domestic purposes. Even as late as 1891, the very year in which the reserve policy was adopted, it was extended to cover use for manufacturing, that is, manufacture of lumber.

The second act, known as the Timber and Stone Act, provided for the sale at not less than \$2.50 an acre of public lands in California, Oregon, Nevada, and Washington Territory, valuable chiefly for timber and stone. It applied to lands not procurable under the agricultural acts, in quantities not to exceed 160 acres per person. The intent was to provide timber or stone "for personal use and not for speculation or for another person," if one is to judge by the sworn statement required of the individual purchaser. The act was extended in 1892 to all public land states.

Space does not permit a discussion of the events leading up to these laws and of the way in which they were executed. This has been ably presented by Dr. J. Ise in his

History of the United States Forest Policy and concisely stated by Dr. B. H. Hibbard in his *History of Public Land Policies*. Suffice it to say here that both of these acts made possible the fraudulent acquisition of timber and of large concentrated timber holdings, and alienated at a low price tremendous areas of the best timber land of the public domain. They failed, moreover, to help directly the persons for whom they were intended. The single purpose of Congress to provide liberally for settlers, the inability of the government to protect public land and to prevent fraud, the insatiate desire of individuals for private gain from natural resources, which each considered his own, all dominated the situation.

Knowledge of the economic conditions concerning timber supply was by no means lacking. Government officials repeatedly drew attention in one way or another to the need for conservation. Rapid removal by cutting and enormous losses by fire were early recognized. Reports of the Commissioner of the Land Office and the Commissioner of Agriculture during the period from 1865 to 1890 are of interest in this connection, because of the variety of solutions of the problem which they suggest. As early as 1867 there was enunciated by the Commissioner of the Land Office the suggestion that lands producing timber should be retained in each section of the country for local use and protection (see Appendix, p. 218).

Reserving the land from ordinary disposal, appraisal of

timber on it, and sale under sealed bids was another proposal. The idea of establishing forest reserves, as later enacted, came slowly. Franklin B. Hough, the first Commissioner of Forestry, advocated the Canadian plan of selling stumpage and retaining the land, yet in 1880 he says: "It can scarcely be expected that either the states or the general government will for many years, if ever, undertake forest management for market supply as is done in most countries of Europe." N. H. Egleston, his successor, reviewing the situation in his report of 1883, made an excellent epigram: "Spendthrift treatment must be stopped." Referring to the public land policy of the United States, he wrote: "The general welfare, not only for the present, but for a long time to come, as affected by the forests, is of more account and deserves more attention on the part of the government than the convenience or the gain of individual settlers." Dr. Fernow assumed charge of the Division of Forestry in 1886, and Mr. Bowers shortly thereafter entered the General Land Office; they constituted two powerful forces in subsequent years.

It was from 1885 to 1890 that the most active moves were made for a modification of the public land policy in respect to forests. Commissioner Sparks' report of 1885, approved by Secretary Lamar, dealt scathingly with the way in which the land laws had been abused. He fully appreciated the importance and necessity of maintaining our remaining public forests and definitely recommended

the immediate withdrawal from appropriation, sale or disposal of all public forests and of lands valuable chiefly for timber, subject to future legislation, for the permanent reservation of designated areas and a more economically governed disposal of such timber as it may not be necessary indefinitely to reserve.

It is needless to recount here the various bills on this subject that were presented in Congress between 1876 and 1891. They were the result, chiefly, of untiring work on the part of government officials and representatives of forestry associations. The policy became an initial fact in the law of 1891, first mentioned in this chapter—an omnibus act of changes in the public land laws. Tardily Congress passed an act for administration of the great areas soon set aside by the presidents following the year 1891, and here the forest land policy of the government is clearly defined. It was the consummation of the desire of those who for years had labored to further the forestry movement and was well expressed by Dr. Fernow's confident assertions in his report of 1886:

The remaining public timber domain would not be best disposed of by sale, nor is it needed for settlement. It is principally more valuable for the timber on it than for agricultural purposes. It is likewise more valuable, by its position on mountain slopes and crests, for other objects than for its material. Its retention and administration, under Government control, is demanded by the best interests of the adjoining territories as well as of the country at large.

Dr. Hibbard has well said: "The most commendable act on the part of the government during the past half-century was the reservation of so much forest land from private entry."

That nineteenth century opened with the possession by this country of vast forest resources; it closed with the possession of still great forest resources, although ownership had passed in large part to private hands. The rapid use of the original forests was inevitable; it contributed tremendously to the development of the nation. The speculation and fraud that were involved and the enormous losses through waste and destruction by fire are deplorable. The fact remains, however, that before 1900 the nation had adopted a policy of care and management of its remaining public lands bearing forest or suitable for forest—a truly great act in that it modified our land policy and initiated forestry where it was of prime necessity as a part of the national economy.

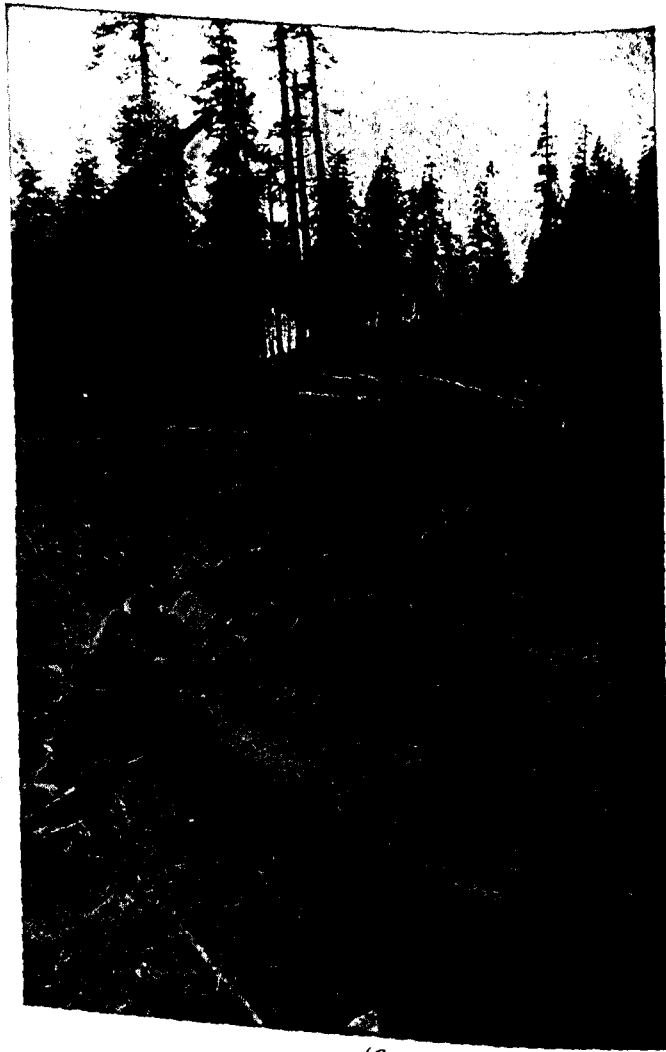
This beginning was on a higher plane of civilized endeavor than a mere act to avoid an impending timber shortage. The nation, having set in order its own household, could then seek to promote forestry within the states and on lands held in private ownership. }}

lumberman was the chief figure in industrial development of the commonwealth.

After the Civil War came a period of retardation, followed by a tremendous upswing about 1870, which pushed the center of lumber production into the Great Lakes states of Michigan, Wisconsin, and Minnesota. Here, indeed, the lumberman flourished in the heyday of his prosperity. Never was there such timber to cut and haul as the virgin white pine abounding in these great forests. It seemed endless to the pioneer lumberman, who came there from the East and set up larger and more modern mills to manufacture a product that soon was celebrated throughout the world. Michigan pine — a name to conjure with! Romance of logging camps, of river drives, of incredible hardships cheerfully borne! Stewart Edward White has well caught the spirit of it in his *The Blazed Trail*.

By 1890 the lumber industry of the Great Lakes states was at the height of its glory. The demand for its product was insistent as the agricultural region of the Middle West opened up with the onrush of settlement. The excellent and cheap lumber of the Great Lakes region made possible the comfortable farmhouses and high plane of living which now characterizes the corn belt. This is the greatest contribution which the lumber industry of the Great Lakes states has made to industrial prosperity of the nation.

By the turn of the century a change had begun to take place. The South, slighted since the calamitous Civil War,



(Courtesy Caterpillar Tractor Co.)

FIG. 1. SKIDDING LOGS.

Difficult logging conditions successfully met in the Sierras of California on land owned by the Red River Lumber Company.

CHAPTER II

THE DEVELOPMENT OF AMERICAN
FOREST INDUSTRY

Forestry was initiated as an industry in America when the first settlers landed at Jamestown and felled trees for the rude stockade that protected the precarious settlement from hostile Indians. The products of our forests have always been one of the principal contributions to our national wealth, as the forest industry has been the most typical of American industrial developments.

From meager beginnings in the colonial period the forest industry has advanced by giant strides, crossing the continent in seven league boots, until now, scarcely three centuries after its inception, it stands with its back to the Pacific in the last great stronghold of American forest wealth, the vast timberlands of the western slope. Further it cannot go; for as Dr. Wilson Compton, Secretary of the National Lumber Manufacturers' Association, points out, "there are no forests on or under the waters of the Pacific; here it must stand and live or die."¹

The sweep of the American forest industry across the

continent of North America is a dramatic epic. It begins with the primacy of New England in the days following the establishment of the United States. Maine—bearer of the proud title "Pine Tree State"—was the leader for the first fifty years of the nineteenth century, closely followed by her sister states of Massachusetts, New Hampshire, and Vermont. Those were the days when men toiled on their farms in the summer and in the woods in the winter. They were pioneer days when agriculture and lumbering were mutually dependent. The rivers of New England were the highways that bore the annual harvest of logs to the waiting sawmills. White pine was the principal product, spruce and hemlock were of secondary importance, and hardwoods, since they could not be floated, were of no economic consequence.

By 1850 the picture had begun to change. New York stood first in lumber production and contributed a fifth of the nation's timber crop. It is strange to think of those days when sawmill and gristmill (often combined) were pushing into the wilderness of western New York. Many men now living can recall the time when the primeval forests of New York were opened up to logging, closely followed by permanent settlements for farming.

Ten years after New York's brief supremacy, Pennsylvania took the lead in lumber production. Pennsylvania's forests have always been the pride of the state, and to this day there remain evidences of that great period when the

¹ *Journal of Forestry*, XXVI, 2, February, 1928, pp. 156-162.

attracted the lumberman, who saw his holdings in the North undergoing rapid depletion. Great resources of yellow pine, cypress, and hardwoods beckoned him. By 1900 the southward trend was well under way, by 1910 the South was firmly in the saddle, and today it is but slowly yielding to the Pacific Northwest its leadership of the lumber industry.

The "last stand" of the industry in Washington and Oregon is of comparatively recent date. Before the World War the developments were comparatively small. The great boom of 1920 led many operators who were nearing the end of their southern timber supply to move westward. The past decade has witnessed the astonishing upswing of the industry on the west coast, until now the single species known as Douglas fir produces nearly a quarter of the entire lumber output of the country.

In 1926 the total lumber production of the United States was nearly thirty-seven billion board feet (as contrasted with forty-four billion in the peak year, 1909), made up of 82 per cent softwoods and 18 per cent hardwoods.² The western species (Pacific Coast) now aggregate 57 per cent of the total softwood cut. In thirty-two states the cut of both softwood and hardwood lumber is less than the consumption.

Exports of lumber in 1926 represent 8 per cent of the

² Preliminary figures for 1927 show a total cut of thirty-four and one-half billion feet, a decrease of six and one-half per cent since 1926. A further decrease of 15 per cent is expected for the year 1928.

total cut, and 88 per cent of the exports are of softwoods. Douglas fir leads with 54 per cent of the exports, followed by southern yellow pines with 30 per cent. The principal foreign markets for western species are the countries bordering on the Pacific; for eastern and southern woods, the rest of America and the countries of Europe and Asia.

The consumption figures do not include imports of lumber (two billion feet in 1926). Thus, the present per capita consumption of lumber in the United States, production plus importation, amounts to 305 board feet. This shows a decrease since 1925 and sharply contrasts with the peak of 484 board feet reached at the height of lumber production in 1909.

The ox team and river driver have definitely disappeared. It is an era of power logging, with man's mechanical ingenuity taxed to the utmost to bring from seemingly impregnable mountain fastnesses the giant trees of the western forests.

Today the lumber industry stands first in number of wage-earners in eleven states: Washington, Louisiana, Mississippi, Oregon, Arkansas, Idaho, Florida, Virginia, Alabama, California, and Texas, in the order named.

However, the actual operation of cutting timber and converting it into rough lumber, despite its importance to these and other states, is only part of the forest products industry. The remanufacture and conversion of this rough product into material to supply the varied needs of the

ultimate consumer is a much larger, though less spectacular, phase of the industry. While the lumberman has moved across the continent to tap new timber supplies, the real center of activity has remained in the manufacturing states near the eastern markets.

This is illustrated by the map on page 25 (Fig. 2), which shows the percentage of the total forest products industry of the nation contributed by each state (see Appendix, p. 221). It is significant that nearly one-fifth of the industry is located in the two states of New York and Michigan.

The following figures for lumber and allied products show the magnitude of the industry:³

Total value of products	\$3,688,552,647
Basic industries	\$1,468,427,334
Wood reworking industries	778,050,860
Wooden container industries	249,612,107
Furniture and related industries	950,595,981
Miscellaneous industries	241,866,365

It is evident that we are dealing here with an industrial activity of the first magnitude. The forest industry now represents approximately one-tenth of the total industrial

³ The latest available figures for 1925, taken from the biennial census of manufactures compiled in 1926 by the United States Department of Commerce.

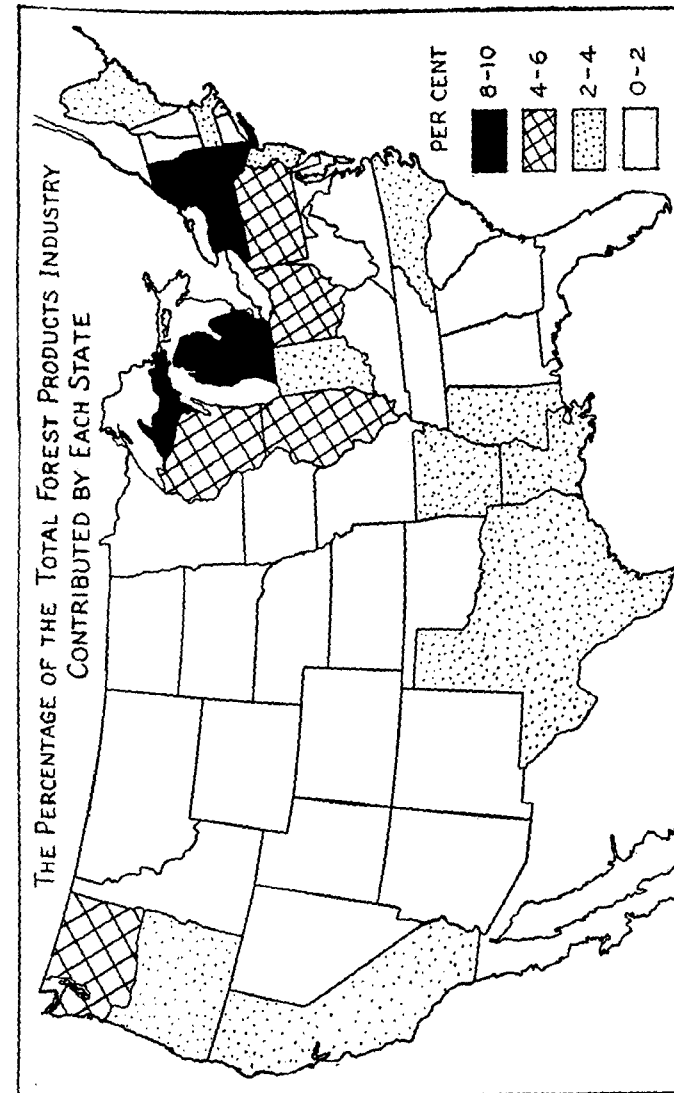


FIG. 2.

development of the United States. In number of wage earners it is exceeded only by the textile industry. In value of products it stands eighth in the list of major industries.

While lumber and its remanufactured products have played a leading rôle in the forest industry, it is in effect only a third of the total cut of our forests, as is illustrated by the table on page 27.

The use of our forests for products other than lumber, as this table reveals, reaches astonishing proportions. Nor is this all. There are many minor forest-dependent industries, some using wood direct as raw material, others elaborating it for derived products such as wood alcohol, acetic acid, and the like. There is the so-called "Naval Stores Industry" which taps the southern pines for turpentine and resin, the maple sugar industry, and many others—all finding in the forest the raw material without which they cannot operate.

Outstanding among the minor industries—if indeed it can be called minor—is the pulp and paper industry. This industry is incapable of using the wood direct, but requires that it be macerated into fibres, either mechanically by grinding or chemically by digesting with acids; the resulting sheet of paper is made by adding various other ingredients. The paper industry has advanced by leaps and bounds, and today, while it consumes only 3 per cent of the wood cut in this country, it is, next to the lumber industry itself, potentially the most important of the forest

The Development of American Forest Industry 27

TIMBER REMOVED EACH YEAR FROM FORESTS OF THE
UNITED STATES¹

Form of Material	Equivalent in standing timber	Possible lumber production from same material
	<i>Cubic feet</i>	<i>Board feet</i>
Fuel wood	9,500,000,000	5,000,000,000
Lumber, dimension material, and sawed ties ..	8,256,300,000	37,700,000,000
Fencing	1,800,000,000	825,000,000
Ties, hewed	840,000,000	2,100,000,000
Pulp wood	585,000,000	2,340,000,000
Mine timbers	395,550,000	879,000,000
Cooperage	314,820,000	1,426,500,000
Veneer logs	105,980,000	691,200,000
Vehicle stock, handles, woodenware, furniture, etc.	45,800,000	200,000,000
Shingles	198,000,000	900,000,000
All other classes	364,050,000	882,000,000
<i>Total</i>	22,405,500,000	52,943,700,000
Destroyed by fire, insects, disease, and windfall ..	2,380,000,000	7,250,000,000
<i>Grand Total</i>	24,785,500,000	60,193,700,000
The cut may be grouped as:	<i>Cubic feet</i>	<i>Percentage</i>
Fuel wood	9,500,000,000	42.4
Sawed lumber	8,256,300,000	36.8
Other forest products ..	4,649,200,000	20.8
	22,405,500,000	100.0

¹ From the *Yearbook* of the United States Department of Agriculture for 1922. One thousand feet of seasoned, unplanned lumber has been considered the equivalent of 219 cubic feet of standing timber, including stumps and tops, but excluding branches. For other items different ratios, depending upon the character of the material, have been used.

industries. The rapid increase of paper consumption is shown by the fact that 6,256,000 tons were consumed in 1917 as compared with 11,807,000 tons in 1926 — a gain of more than 94 per cent in nine years. Unfortunately, most of this increase was supplied by foreign countries (chiefly Canada) in the form of pulpwood, wood pulp, and paper itself. Domestic wood contributed an increase of less than one million tons of paper, primarily due to the lack of adequate supplies of raw material near the industry's milling units.

The pulp and paper industry is located chiefly in the Great Lakes states and in the Northeast, because these are or have been the most favorable regions. In the face of an enormous and rapidly increasing demand, however, the existence of many units of the industry is threatened by the exhaustion of supplies in the regions where they are located.

Why, then, does not the paper industry pick up and move as its predecessor, the lumbermill, has done? In answering the question, Mr. George G. Wheat paraphrases the language of Will Rogers: "Because they couldn't just get up on their hind legs and leg it back into the woods like the sawmill fellers done for the last hundred years and more; they got too much baggage and maybe they got more sense."⁵

⁵ Wheat, George G., "Growing a Spruce Crop in 30 Years," *Editor and Publisher*, June 9, 1928, p. 14.

The industry is so constituted that it cannot readily change its location, and shift as its sources of supplies shift, without making great sacrifices. Had the industry possessed sufficient flexibility to move from one location to another at low cost, units formerly would have done so only at the risk of placing themselves under a great handicap, because not all of the industry's pulping units would have shifted at once. Some companies would have remained in their original location by reason of their having been more fortunately situated regarding supplies of raw materials, while others, by reason of the proximity of Canadian supplies of pulpwood, would have imported from Canada to produce paper at a cost slightly under what it would have cost an emigrating company to produce paper and put it on the market. Such an arrangement might conceivably last as long as Canadian supplies hold out. Hence the material rigidity of the industry and the prevailing economic conditions have held it largely to its original location. Enough has been said, perhaps, to give a general idea of the magnitude of the industry, its present location and the causes thereof, and its situation regarding demand and supply.

The future of the forest industry promises an increasing emphasis on wood as a raw material, not for lumber alone, but for innumerable products — now in large part classed as by-products, but soon, perhaps, to be of primary importance. A conspicuous example is the development of

"rayon" — artificial silk — based largely on sulphite pulp derived from spruce. Who could have foretold, a few years ago, that milady of 1929 would be clothed in wood?

Howard Weiss, former Director of the United States Forest Products Laboratory at Madison, Wisconsin, sensed this change in an address which he delivered before the Wisconsin Commercial Forestry Conference: "We must," he said, "more closely adhere to the view of looking at the tree as a national product, which develops a wood substance, or to put it in a more technical phrase, a plant which grows cellulose. . . . Some day we may change the forester's title to cellulose propagator!" (See Appendix, pp. 225 to 226 for entire address.)

Dean Franklin Moon of the New York State College of Forestry brings back from his European studies a similar idea. He reports the Heidelberg City Forester as saying to him that "within seventy-five years the American consuming public will thank God for wood cellulose in any form in which they can purchase it."

All this points to the integration of the American forest industry. Starting as a pioneer industry concerned entirely with lumber production, it is becoming a forest products industry, in which lumber is still a chief factor, but no longer the sole dependence for commercial prosperity. Instead, like the meat packing industry, which uses "everything

⁶ *Forestry in Wisconsin*, Ashworth, H. L., Milwaukee, 1928, p. 137.
⁷ *The News Letter*, New York State College of Forestry at Syracuse University, July, 1927, p. 2, col. 1.

but the squeal," it will exploit its resources to the utmost. This means permanence of production requiring permanent assurance of raw material. Industrial coördination is the key to profitable utilization, and this, in turn, is essential to the marketing of the raw material — wood.

The forest industry of America is becoming conscious of its obligations and of its dependence upon forestry for its existence. The past year has seen a development of great importance in the forest industry of this country. It is the *rapprochement* — the getting together — of lumbermen and foresters in realization of their common aims and interests. This attitude of coöperation supplants one of mutual distrust, when foresters were prone to brand lumbermen as "malefactors" and "forest destroyers," while lumbermen reciprocated with an attitude of disdain toward the impractical theories of the technician.

It has, indeed, now reached the point where the forest industry is taking the lead in forestry practice on private lands and is actually more enthusiastic, with greater vision of accomplishments, than foresters whom years of "hope deferred" have made less optimistic.

Obviously the leadership in the improved management of private timberlands belongs to the owners of those lands. According to W. B. Greeley,⁸ of the 470,200,000 acres of forest land in the continental United States, the federal

⁸ *Present Needs in National and State Forestry*, U. S. Department of Agriculture, Forest Service, 1927.

government owns 89,000,000, the states 10,500,000, municipalities and counties 700,000, *large* private owners 220,000,000, and *small* private owners 150,000,000.

Furthermore, it is fitting that American business, in accord with its recognized genius, should take the lead in matters of public welfare, and that under the new dispensation the government should seek to aid rather than obstruct it in these processes.

President Hoover, when he was Secretary of Commerce, said:

This group in the wood industries is pioneering amongst our American industries several years in advance of most of the others. I do not think we have another industry that is so intimately and actively organized, as the wood-using industries are today, for the common problems of promoting greater efficiency and greater stability and a full regard for the public responsibilities of the industry.⁹

The Conference on Commercial Forestry, held in Chicago in November, 1927, crystallized the views of leaders of the forest industry and greatly stimulated the progress of forestry on private timberlands. This conference, called by the Chamber of Commerce of the United States, adopted the striking resolution¹⁰ "that, recognizing their responsibility, forest land owners assume, as a civic duty, the leader-

⁹ *National Committee on Wood Utilization*, U. S. Department of Commerce Proceedings, Third Annual Meeting, May 4-5, 1928 (Mimeogr.).

¹⁰ *Report of the Conference on Commercial Forestry*, Chamber of Commerce of the United States, Washington, 1927, p. 195.

ship in this great national business enterprise [of timber growing] already well begun."

What, it may be asked, has impelled the forest industry to turn thus toward forestry, to which it was formerly indifferent or even hostile? The answer is found in the increasing depletion of raw material—timber. Dismissing fears of an imminent timber famine as the propaganda of alarmists, there remains the indubitable fact that the timber resources of this country are rapidly dwindling and that they can not hold out forever. There is only one way to replenish our timber stores, and that is the practice of forestry. Furthermore, the industry itself recognizes that increasing timber depletion is not favorable to its interests but quite the reverse! Says Carl Wernicke, the well-known authority on southern pine:¹¹

That a shortage of timber will be of genuine advantage to the lumber industry is a fallacy. Raw materials which are dwindling in supply experience a hastened reduction of demand, because manufacturers who depend on such materials tend to seek substitutes which can be relied on to maintain a reasonable market. While there is no danger that the lumber industry will face a genuine over-production in the future, there is some possibility that it may suffer from competition of substitutes because of under-production. This would mean it may find itself struggling to maintain markets in a struggle for profits in spite of high prices. . . . The best insurance the (lumber) industry can have is a large area of land growing enough

¹¹ Pine Institute of America, General Bulletin, April 25, 1927.

timber so that lumber using industries can rely on lumber as a permanent available raw material, and so that competitive demand will not raise prices beyond the point of general usefulness.

Thus lumbering has come to have a new meaning. No longer does it signify denudation without thought of regrowth. Forestry and lumbering are meeting on the middle ground of timber production, which the public welfare demands. The beginnings are necessarily small, but what is encouraging is the fact that the private timber owner is giving careful thought to his problem.

Typical among pioneer industries in this country, the forest industry of America has passed rapidly through the stages of exploitation which carried it from the Atlantic to the Pacific Ocean. Now, in the face of growing timber depletion and the inroads of substitute materials, it faces a new era: the growing of its raw material — wood. It is not only the privilege but the duty of every forester to further this enterprise.



(Photo by A. G. Varela, Courtesy U. S. Forest Service.)

FIG. 3. PLUMAS NATIONAL FOREST.

Felling a mature pine on a National Forest sale area in California. Younger trees are allowed to stand and are safeguarded during the progress of logging.

CHAPTER III

FORESTRY—ITS OBJECTIVES

The United States just now is in a transitional stage. Virgin timber, stored up by nature, is still available in the West and will constitute an important source of supply for several decades. It represents the last of our great fortune in original timber. The next stage, and that in which the country is already finding immediate interest, is the production of all raw wood material on land definitely devoted to forestry. The present transition is not fully comparable with developments in the forest history of older countries. Political, economic, and social conditions are controlling factors, but they are conditions of the twentieth century, not of feudal or intervening times. The problem is one of an advanced industrial period; the transition is from a temporary to a permanent forest industry.

With due regard to economic conditions, production of timber on permanent areas should be hastened in every practicable way, in order to furnish an abundance of useful and cheap raw material. It has to do with the application of forestry to areas now classifiable as forest, whether young, middle-aged, or old, and with the reestablishment of forests

on land unsuited for other purposes and yet useful for wood crops. ||

This is not so easy as it may seem, for there must be an adequate amount of land for the purpose, plus economic conditions that make the venture profitable and encourage the willingness to practice forestry. The manner in which the intricate problems of forestry are being met will be set forth further on. Of first consideration is the land available for forestry, its extent, its quality, and its location. If it were wholly a matter of selecting areas for permanent timber production without reference to other land uses, the problem would be comparatively simple. However, since an expected increase of population calls for a greater production of food supplies as well as of wood materials, a larger area is needed for agriculture and pasture, or increased production per unit area, or both. In the *Yearbook of Agriculture for 1923* Dr. J. D. Gray and his associates discuss in detail the utilization of our lands for agricultural purposes. They point out that land, from the standpoint of its physical character, may be used for crops, for pasture, and for forest. In the regions of adequate rainfall these three uses are competitive. Arid and semi-arid land can not be used for forest, but is valuable chiefly for grazing; and under favorable conditions, natural or artificial, portions of it can be used for crops. There are also complementary uses of land, such as combined forest and grazing, as found in controlled grazing within our western coniferous forests.

On the other hand, in our eastern broadleaf deciduous forests, this same practice serves neither interest advantageously from the standpoint of production, but is nevertheless quite common. Another complementary use is pasture and crops, the former as one stage in crop rotation, and the latter as an alternative source of feed for grazing animals.

The picture of the present state of land utilization is shown approximately by the estimates which Dr. Gray has compiled on the basis of governmental data and official estimates of the Department of Agriculture. Expressed in percentage of the total land area of the United States (1903 million acres), crops of 1919 covered 19 per cent, pasture 43 per cent, and forest and cut-over land 25 per cent, while the balance of 13 per cent was divided, about one half being idle or waste areas on farms and the other half non-agricultural areas, such as urban land, absolute desert, rocky areas, and land used for highways and railroads. The period of plentiful land resources came to an end at the beginning of this century. The present division was reached without unified or systematic direction of settlement. During the past hundred years the federal government has turned more and more toward classification of public land on the basis of use, but generally its aim has been to reserve certain classes of land for disposal to private ownership under conditions different from those established under preceding policy, or for permanent reservation and use.

There is still the possibility of expansion for agricultural purposes, although the best of our land is now in use. Changed economic conditions have given rise to extensive abandonment of agricultural land, because it became submarginal for profitable use for that purpose. Adjustments of this sort continue, and land so abandoned often lies idle without natural seeding by valuable species, or is reverting to forest, or has completely returned to more or less productive, useful forest. On the other hand, the clearing of forest land for agricultural purposes still plays a part, though not a great one, and crops have encroached upon pasture. There is a yearly accretion of cut-over forest land not destined immediately to be maintained for production of forest crops. These cut-over lands as a whole are not economically useful for crops and pasture, the cost of clearing them and quality of their soil being major determining factors. They are not being rapidly taken up. There has been much misdirection in the settlement of such land through the policies and practices of selling agencies. The United States Department of Agriculture made a study of land settlement and colonization in the Great Lakes states in 1925, acting in coöperation with these states. Dr. J. D. Black and Dr. L. C. Gray, in their exhaustive report, bring out one point of major importance to our discussion: that there should be a careful selection of the land to be settled. Such selection requires an economic survey as an essential means of determining land use. Such surveys are in progress

in Michigan, and a summary of results for one county is given in the Appendix. These surveys, wherever made, should serve as a basis both for state policy and for practice, and in respect to forest crop production they reveal the areas that should be devoted to this use. We are on the threshold of systematic land classification in this country.

The problem of forestry is to produce on land available for forest use supplies adequate to meet the future needs of the country as it grows. Without exact knowledge derived from economic surveys, action must be based on estimates. Government economists say that for the next fifty years our present forest area, including cut-over lands that are not restocking, will not be greatly reduced by other agricultural uses, since these will be met by expansion over non-forest lands, by adjustments in use, and by increased yield per acre. Greater pressure for available land will surely follow. The immediate problem is to handle this forest area wisely. Three-quarters of our forest land lies in the East, but the greater portion of our present standing timber is in the West, more or less distant from the centers of large consumption. Much has been written about a timber famine which is not yet evident, but it behooves both public and private owners to take increasingly active steps to maintain the production of wood crops in harmony with economic possibilities.

Of the three agricultural uses of land, the public is intimately acquainted only with crops and pasture. But whereas

most people are fully appreciative of well-tilled fields of cotton, of great cornfields, of waving stretches of grain, of well-managed fruit orchards, of fat sheep browsing on rich, fenced-in pastures, of sleek cattle roaming on farms, mesas, and mountain meadows, and of the green oases formed by irrigated farms in the semi-arid region, they are virtually ignorant of the permanent use of land for forests. Planting of trees on idle land seems concrete enough to be as readily understood as planting of corn or wheat; but that natural forests are renewable through the agency of cutting mature timber, and that growing forests are capable of improvement by thinning, are facts the importance and nature of which are seemingly but dimly perceived by the public.

The broadest purpose of forestry is to make permanently useful lands now bearing forest or capable of bearing forest, areas sub-marginal for other agricultural uses. Such lands comprise mountain plateaus and slopes, rough hilly country, areas of light sandy soils, at least some heavy soils, and wet lands not practically redeemable for crops or pasture. Current economic conditions determine at any period the division of land for the three agricultural uses, and they further determine the degree to which forestry can be applied in any given region.

This economic point of view is fundamentally important. It must be kept in mind, however, that the economic welfare of the people as a whole is expressed in the welfare

of individuals. The first direct objective of forestry, therefore, is to maintain the forest industry, a source of wealth and a means of furnishing permanently, and at a reasonable cost, a supply of useful wood products that everybody needs. To maintain the industry we must maintain the timber crops.

Land adequate in quantity and quality to meet our needs seems assured. Exact figures indicating the extent of our forest area are lacking, but available estimates serve to give some idea of the situation. Expressed in percentage of the whole (470,000,000 acres),¹ virgin forest constitutes approximately 29 per cent; second growth, that has come up naturally after cutting or fires, 53 per cent; the balance, consisting of land on which no satisfactory natural stocking has taken place, 18 per cent. In the case of virgin areas, forestry is concerned with economical harvesting of mature and over-mature timber, with due provision for leaving the areas in such condition that future valuable forest crops may be assured. Protection of timberland and cut-over lands from fire is of paramount importance. Second growth areas, largely to be found in the eastern part of the United States, present numerous problems, varying with differences in location, soil, forest conditions, logging requirements, and market. Slightly less than half of such second growth is estimated to be of saw timber size, the

¹ "Timber: Mine or Crop?" United States Department of Agriculture Yearbook, 1922.

rest consisting of growing stands in the various younger stages of development. Many of these forests have suffered from fire and are inferior in composition. Here the objective is to improve the forest by protection, by wise cutting, and by utilization of the products as they are grown—an application of rational treatment looking toward permanently improved production, both as to quantity and as to quality.

The public should be most interested in the accomplishment of this objective of permanent timber cropping because, with the reduction of accessible virgin timber supplies our needs, within half a century, must be met in increasing degree from these second-growth lands. A permanent outflow of products from our forest land means permanent local industries, with their accompanying economic values attendant on distribution of manufactured products either locally or more widely, as the case may be.

Much has been written about the economic evils of temporary industries, mute evidences of which remain in "ghost towns" of former rich mineral locations and villages virtually deserted since the end of first-growth timber logging. That page of our forest history can be turned over, for the application of forestry is beginning to inscribe permanent characters on a new page, as reflected in the changing point of view of the industry. Ex-President Calvin Coolidge well said: "It is my belief that no other of our internal problems is of greater moment than the rehabilitation of our forests, now so hopefully begun, but

needing the strong support of our collective will and intelligence."²

Lands not restocking naturally with forest comprise a great area at present idle. They are the cripples of economic strife, subjects now for reconstruction operations. A burdensome menace to individuals, localities, and states, they may in great part be brought into productiveness by planting during this century and will aid in meeting timber needs within a period of fifty to seventy-five years. Subsequent chapters of this book deal with the manner in which the desired objectives are being attained with respect both to reforestation and forest management.

Thus far, emphasis has been laid on the primary economic purpose of building up a permanent forest industry, because it affects directly or indirectly every inhabitant of this country. The accomplishment of this purpose need in no way preclude the maintenance of other benefits arising from the presence of forest, provided federal and state forest policies are helpful and constructive to this end. Well-managed forests with this objective of permanent productiveness are more effective in the protection of stream flow and the prevention of soil erosion than are unmanaged, burned, decadent, and unsanitary wild woods. Skillful, controlled cutting not only yields valuable revenue, but brings the whole forest area thus managed into the highest state of efficiency. This has been well illustrated in the

² Message for American Forest Week, 1927.

management of our national forests by the Forest Service, which provides for the most complete use of the forest, with due regard to production of timber, conservation of water for irrigation, power, and potable supply, provision for recreational use, and for other uses to the highest degree.

The broad purpose of forestry to provide a continuous flow of products from forest land and to maintain other benefits finds interpretation according to the object of the owner, whether it be the federal government, a state, or a private individual, any one of whom may emphasize one phase more than another. Unenlightened interpretation of forestry has given rise to many and varied ideas, often at directly opposite poles. Thus, preservation without use, recreational use only, timber production only, protection only, and so on, have led to confusion and obscurity of the main objective.

Broad analysis is helpful but not sufficient. Clearly, forestry deals with forests and forest industry, and with the acquisition of maximum returns, both direct and indirect. Economic conditions have decided where it shall be practiced; that is, they have established the division of land for the purpose. Its specific objectives are determined by ownership and by the conditions of the particular area to be placed under management. To arrive accurately at the specific objectives, fundamental economic study is necessary in each case. Such studies give a basis for the policy to be pursued and make possible a completeness of use and

returns commensurate with the value and usefulness of the particular resource. The term "selfish interest" might well be replaced by the phrase "enlightened self-interest" and that is equally applicable to public or private holdings — federal and state forests, private preserves, or timberland holdings. Only by a careful analysis in each case can misuse be avoided. Disuse and use which is foolishly limited constitute grave errors.

The keynote of the age is production and the rational use of our natural resources. Increased yield from our forest areas and continued use are vitally essential.)

CHAPTER IV

FORESTRY—AN ESSENTIAL OF SOCIAL WELFARE

I. NECESSITIES

It is indeed true, as Owen Meredith says in *Lucile*, that "Civilized man cannot live without *wood*." Wood is one of the essential raw materials of the world, and the commodities derived from it are well-nigh numberless. From cradle to coffin, both made of wood, no other material affects each one of us in so many ways in this age of progress. Without wood our civilization would be impossible.

The source of wood is the forest, and our attitude toward the forest is a fair index to the degree of our civilization. In the early days of settlement of this country the forest was regarded as man's enemy. It was something to be avoided, to be cleared off the land and kept off by means of fire and axe. Seemingly, there was no end to it. As settlers pushed their way slowly westward from the Atlantic seaboard they found endless ranks of trees obstructing their way. These trees were, of course, objects of supreme beauty, but not so to the early settler, who regarded them chiefly as obstacles to be overcome. Even in New York

State an instance of the kind is related by one of the pioneers of Niagara County:

The Erie Canal opened up a market for lumber. Ship lumber! No wonder the settlers leaped with joy. They had large tracts of land. They had wood for fuel. They might, indeed, now and then obtain a few English shillings by making "black salts" in the swamps, by selling a few pounds of maple sugar, a dish of wild honey, or the carcass of a wild deer. But there was no market for these. But now the timber, the miserable worthless trees, could be sold for money. A tree, a single tree, of the millions that abounded would buy a gown for the wife, toys for the children, and a jerkin for the farmer.

Today all this is changed. The forest, once man's enemy, is now recognized as his necessary friend. This is so, not only because it furnishes that all-important raw material—wood but because of its contributing influences in modifying climate, in retaining snow and rain water, and in regulating stream flow. Most of all, perhaps, the forest is prized because of its value for recreation. These latter aspects will be dealt with in the next section; this one deals only with forests as sources of necessary materials and commodities.

Contrary to popular opinion, the chief valuable properties of wood are shared by nearly all woods. This means, not that certain woods are not better suited for certain purposes, but that nearly all woods possess in common the fundamentally useful properties of wood.

In the first place, wood is one of the few substances which are coherent without treatment. Rock, of course, is another.

In the second place, wood is insoluble. The significance of this quality in the use of wood for shelter is apparent. In a rainless climate, like that of Egypt, the use of unbaked clay or "adobe" is satisfactory for houses, but a climate like that of America requires the employment of some material that will not melt.

Wood is found in convenient sizes, large and small. In many regions it is the only available material of this sort. Throughout history, man has found wood his most serviceable building material, and to a very considerable extent he still finds it so.

Next, wood is soft and light. This property is, of course, relative. Some woods are comparatively heavy and hard, but in general wood is so light that it can be fashioned into a tool that can be handled. Furthermore, wood floats on water, and it not only floats but carries a load when floating.

Wood is flexible. The making of bows and arrows, for instance, depends on this inherent quality.

Wood is durable. Happily is this so! Suppose it were not durable. Suppose it decayed like an apple or fermented like wheat. Without durability it would be valueless for many of the purposes for which we now use it. Moreover, it is practically insect and animal proof.

It is combustible—perhaps the most valuable quality

of all, for wood has cooked man's food and warmed his body for ages.

Wood is cleavable, also fibrous—it can be taken apart. The Indian used this quality in making baskets; the white man uses it in making paper.

Wood is beautiful, wood is abundant, and, best of all, wood is replaceable. A hundred years ago, even among the most civilized peoples, nearly all implements, buildings, vehicles, and other commodities were wooden. Plows were nearly all of wood, spades were of wood, knife-handles were of wood, wagons were all of wood except for the tires and a few bolts—and most of the bolts were wood! Wooden knives, forks, and spoons were used at the table. Even today, in some European countries, wooden shoes are more common than are those of leather. A century ago little metal was used. Ships were wooden, held together with wooden pins. Locust tree nails were as important as bread and more common than sugar! The first railroad train steaming up the Hudson River ran on a wooden track covered on top with a sheet of strap iron. Most people today use wooden, rather than steel, tools—because most people do not live in the United States. This is how near we come to being primitives! In short, wood has been one of the most important factors in the cultural development of man, and is essential to his continued social welfare and progress.

Manufacturers of substitutes for wood have propagated and capitalized the idea that diminishing the demand for

wood relieves the drain upon our forests, and that it is, therefore, a virtuous public service to use substitutes for wood. The truth, however, is far otherwise. Col. W. B. Greeley, until recently Chief Forester, points out in an open letter to the Director of the National Committee on Wood Utilization:¹

National interests will benefit far more by vigorous encouragement of timber growing than by hoarding the timber we now have . . . a liberal use of wood is essential to our industrial and construction requirements and to high standards of living.

Timber growing . . . is primarily an economic process. If it does not pay, forests cannot be widely and generally produced. To make it pay there must be an adequate market for forest products. . . . The constructive solution of the whole problem lies in timber use and timber culture, each backing and sustaining the other.

Abstention from the use of timber will not help the cause of forest perpetuation. Furthermore, like any other crop, timber becomes a partial or total loss if not utilized when mature. . . .

Closer utilization of timber will make forest crops more valuable and hence encourage their production. . . . While this is largely an industrial problem, its solution can be materially aided by the research of public agencies and by the promotion of more effective utilization through such admirable work as that of the National Committee on Wood Utilization.²

¹ Under date of January 25, 1928. See Appendix, pp. 244-250.

² This committee, organized after the National Conference on Utilization of Forest Products, in November, 1924, is composed of leading citizens in the forest industries. Axel H. Oxholm, of the United States Department of Commerce, is the Director.

Much has been said and written about an impending timber famine. To judge by the prophecies of earlier writers, the shortage should have been upon us before this. We continue, however, to have a super-abundance of wood products on the market, while there exists a simultaneous and undeniable depletion of our raw material.

The timber removed each year from the forests of the United States (see Chapter II) aggregates more than twenty-two billion cubic feet. If we add to this the amount destroyed by fire, insects, disease, and windfall, we find that the gross annual depletion is increased to nearly twenty-five billion cubic feet. The annual growth of nearly six billion cubic feet makes the net depletion nearly nineteen billion cubic feet.³

The standing timber of the United States is estimated at nearly eight hundred billion cubic feet.⁴ By division one arrives at the apparent conclusion that in forty years it will all be gone. But this, as R. S. Kellogg says, is "unprovable and quite likely not true."

About 45 per cent of our lumber cut is consumed east of the Mississippi and north of the Ohio and Potomac, but some 60 per cent of the standing timber is west of the Great Plains. Depletion of the southern pine forests is rapidly increasing the proportion of western lumber coming into the eastern markets.

³ Table 11, Forest Statistics of the United States—1927.

⁴ Table 8, Forest Statistics of the United States—1927.

Between 1914 and 1924 the average rail haul on lumber doubled.⁵ The average freight charge per thousand feet of domestic lumber consumed is \$9.06. The annual freight bill on domestic lumber amounts to \$27,257,444 for Illinois; to \$32,489,318 for New York; to \$23,847,230 for Pennsylvania; to \$19,157,053 for Michigan; and to \$15,076,444 for New England. For the entire country the lumber freight bill is \$292,672,340 per annum.

The situation is such that the country today is suffering from a misplacement of wood supplies. There is enough wood to go around, but it is wrongly located with respect to centers of consumption.

As a matter of fact, conditions of utilization are changing so rapidly that no one can confidently predict what the future will be. Whereas the per capita consumption of lumber is rapidly diminishing, the total use of wood is not. As fast as one use of wood drops out, new uses, undreamed of a generation ago, rise to take its place; consequently, where ten years ago but two thousand uses of wood could be enumerated, a census this year disclosed over four thousand five hundred ways in which wood was employed.

An example of the unpredictable is the expansion of the radio industry. Radio cabinets, within the past two years,

⁵ Estimates for 1924 placed it at 725 miles, whereas a 1914 estimate put it at only 360 miles. From the northwest lumber travels an average of 4155 miles to the Northeastern States. Besides this, large amounts of lumber are shipped from the Pacific Northwest to the Atlantic Coast via the Panama Canal.

in certain territories, have required more lumber than house-building.

The future uses of wood stagger the imagination. Fig. 4 shows the Pulp and Chemical Products derived from wood. How many people know that moving picture films are derived from the cellulose of wood? Or that without wood we would not have dynamite, or smokeless powder? Even the casing of the humble "hot dog" sausage is made of wood.

It is evident that almost every new industrial development brings out new uses for wood. It is one of the great basic raw materials—truly an essential of social welfare.

The principal uses of the annual harvest of wood are shown in the table on page 56:

A. *Analysis of Wood Requirements by Industries.*—
(1). *Fuel wood.* While this can scarcely be said to form an industry, nevertheless more timber is removed each year from the forests of the United States for this purpose than for any other.

The total annual cut of wood is estimated at one hundred million cords valued at four hundred seventy-five million dollars.^a In cubic feet (at 95 to the cord, a rather generous allowance) this is equivalent to nearly ten billion cubic feet, or 38 per cent of the total annual drain on our forests. This cut is composed of nearly seven billion cubic feet of

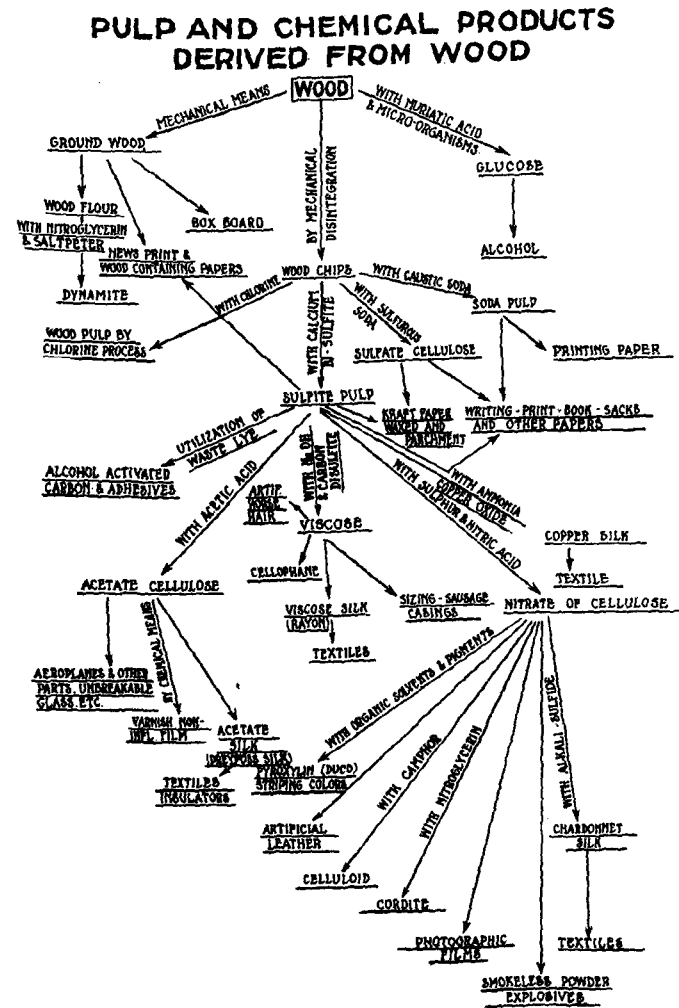


FIG. 4.

^a Yearbook of the United States Department of Agriculture, 1923, Sec. 629, p. 1079.

PRINCIPAL USES OF WOOD CUT

		<i>Equivalent in Cubic Feet</i>
Fuel wood	<i>cords</i> 100,000,000	9,500,000,000
Lumber, dimension material and sawed ties	<i>feet b.m.</i> 37,700,000,000	8,256,300,000
Fencing	<i>posts</i> 900,000,000	1,800,000,000
Ties, hewed	<i>ties</i> 70,000,000	840,000,000
Pulpwood	<i>cords</i> 5,000,000	585,000,000
Mine timbers	<i>cu. feet</i> 293,000,000	395,550,000
Tight staves	<i>staves</i> 350,000,000	116,550,000
Tight heading	<i>sets</i> 24,000,000	39,000,000
Slack staves	<i>staves</i> 1,200,000,000	79,200,000
Slack heading	<i>sets</i> 90,000,000	72,990,000
Hoops	<i>hoops</i> 120,000,000	7,080,000
Vehicle stock, handles, woodenware, furniture, etc.	<i>bd. ft.</i> 200,000,000	45,800,000
Shingles	<i>shingles</i> 9,000,000,000	198,000,000
Distillation	<i>cords</i> 1,400,000	133,000,000
Tanning extract	<i>cords</i> 1,000,000	95,000,000
Veneer logs	<i>bd. ft.</i> 576,000,000	105,980,000
Poles	<i>poles</i> 4,250,000	55,250,000
Export logs and hewn timbers	<i>bd. ft.</i> 100,000,000	18,400,000
Lath	<i>lath</i> 2,000,000,000	
Excelsior	<i>cords</i> 200,000	23,400,000
Piling	<i>pieces</i> 1,500,000	39,000,000
Total		22,405,500,000

hardwoods and nearly three billion cubic feet of softwoods. Saw timber should not be utilized for fuel, yet for this purpose we cut annually an equivalent of more than three billion board feet of hardwoods and more than a billion board feet of softwoods, or a total of five billion board feet which should be utilized for lumber.

(2). *Lumber, dimension material, and sawed ties.* These products of our sawmills total about thirty-eight billion board feet annually and are valued at nearly one and one-half million dollars. In cubic feet (at 219 per 1000) this is equivalent to more than eight billion cubic feet, or 33 per cent of the total annual drain on our forests. This cut is composed of more than two billion cubic feet of hardwoods and more than six billion cubic feet of softwoods. Lumber must come from saw timber, but substantial economies could be effected in the woods and at the mill so as to diminish the drain of nearly forty billion feet of timber annually from our forests.

(3). *Fencing.* The total annual cut of fence posts is estimated at nine hundred millions, valued at a quarter of a billion dollars. This is equivalent to 1,800,000,000 cubic feet or 7.26 per cent of the total annual drain on our forests. This cut is composed of three hundred and sixty million cubic feet of hardwoods and almost a billion and a half cubic feet of softwoods. Fence posts need not be cut from timber sufficiently large for making lumber, yet for this purpose we cut annually an equivalent of one hundred and

sixty-five million board feet of hardwoods and six hundred and sixty million board feet of softwoods, or a total of eight hundred and twenty-five million board feet which should be saved for lumber. Preservative treatment of fence posts would help to lessen this drain.

(4). *Hewn ties*. Annually there are hewn in our woods seventy million railroad ties, valued at nearly seventy-five million dollars. This is equivalent to eight hundred and forty million cubic feet, or $3\frac{1}{2}$ per cent of the total annual drain on our forests. This cut is composed of nearly seven hundred million cubic feet of hardwoods and one hundred and sixty-eight million cubic feet of softwoods. Hewing ties is a wasteful practice; in fact, the equivalent in lumber is one billion, six hundred and eighty million board feet of hardwoods and four hundred and twenty million board feet of softwoods, or a total of more than two billion board feet which could be more economically handled at a saw-mill. Preservative treatment of ties would, if more generally practiced, serve greatly to reduce the need for replacement.

(5). *Pulpwood*. We consume each year 6,000,000 cords of pulp wood, valued at nearly one hundred million dollars. This is estimated to equal seven hundred million cubic feet or 3 per cent of the total annual drain on our forests. Ninety per cent of this cut is composed of softwoods. Contrary to the usual practice at present, pulpwood should not be taken from saw timber. By this change alone, a saving could be effected of two hundred million board feet of

hardwoods and of more than two million board feet of softwoods, among trees now cut for pulpwood which are of sufficient size for saw timber. There is room here for substantial economies.

(6). *Miscellaneous*. Without going into details, we may cite numerous other uses of wood which now utilize saw timber whereas smaller material would serve the purpose equally well. These various requirements account for nearly 6 per cent of the total annual drain on our forests. Many of them could be met from material other than saw timber.

(7). *Totals*. Our total annual wood requirement is nearly twenty-three billion cubic feet, valued at more than two million dollars. This cut is composed of nearly eleven billion cubic feet of hardwoods and twelve billion cubic feet of softwoods. The equivalent in lumber which might have been sawed from the same trees amounts to nearly eighteen billion board feet of hardwoods and approximately thirty-five billion board feet of softwoods, or a total of some fifty-three billion board feet. By reasonable economies this drain could be reduced to forty-five billion board feet yearly.⁷

B. *The Closer Utilization of Timber*.—One hears the question asked: "What becomes of the wood in a forest?"

⁷ United States Department of Agriculture *Yearbook* for 1922, p. 135. For further details see *Report of the National Conference on Utilization of Forest Products*, Washington, D. C., November, 1924, United States Department of Agriculture, Miscellaneous Circular 37, 1925, particularly "Wood Waste Prevention," pp. 83-100.

The answer is that about one-fourth of the forest is left on the ground after logging is completed. This may be called "woods waste," but properly it is "woods refuse," since, under present economic conditions, much of this waste could not possibly be used to advantage. If one ask: "What becomes of the wood in a tree?" the answer is that about one-sixth of it is left on the ground after logging is completed.

If we trace the process to the mill, we find that the mill waste is 40 per cent of the wood in a forest, 44 per cent of the wood in a tree, and 53 per cent of the wood in a log. Take, for example, the wood in a log—when it is sawed up the bark constitutes 13 per cent of the volume of the log, the sawdust cut by the saw (known as saw kerf) is 13 per cent (with circular saws it often runs as high as 20 per cent), and the slabs equal 12 per cent. Then there is the waste through edging (the process which makes the sides of boards parallel) and through trimming (the process which makes the boards of even length and the ends parallel). Edgings and trimmings together take 12 per cent of the volume of a log. Finally, careless manufacture and miscellaneous losses account for 3 per cent, bringing the total waste to 53 per cent.

Even after the log is cut into lumber this waste continues; for in the process of seasoning there is a waste of 6.7 per cent, which brings the total to nearly 60 per cent of the wood in a log. There remains, then, 40 per cent in the

CHART SHOWING UTILIZATION as practiced and as potentially possible for the average Forest Tree

Data from the National Association of Wood-using Industries
Published in Lumber World Review of October 10, 1921.

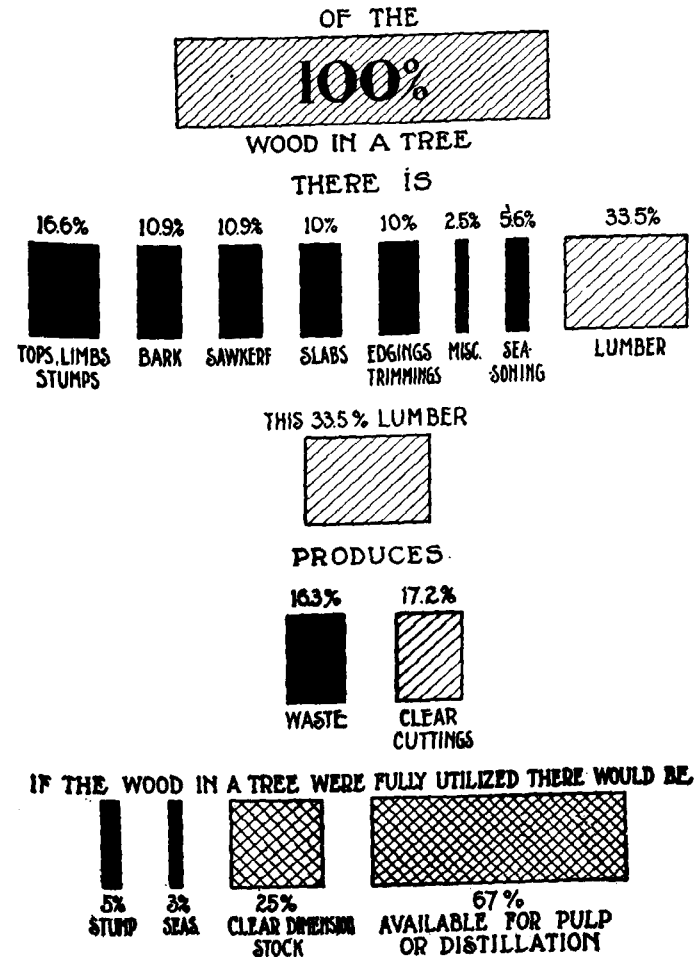


FIG. 5.

form of seasoned, unplanned lumber. Even this lumber, however, is not used without considerable waste in the process of final manufacture. The building trades, for example, use 85 per cent and waste 15 per cent.

As pointed out, much of this waste from woods to consumer is at present unavoidable. Scientific research is gradually finding use for waste products, either in the manufacture of small wooden articles, or in chemical products. Further, it has been shown in actual practice that the amount of waste can be reduced by more careful methods of logging; by taking to the mill more of the defective and inferior kinds of trees; by using band saws, whenever possible, instead of circular saws, which cut a wider kerf; by not cutting lumber to standard sizes alone;⁸ by using round-edge lumber; by adopting proper methods of seasoning; by exercising greater care in manufacture and in the use of lumber; by working up the "refuse" into small articles; and by converting chemically (by distillation, extraction of resin, and manufacture of pulp) what would otherwise be wasted.

⁸ While 20 per cent of the lumber used in the average American house is of lengths less than 8 feet, only $1\frac{1}{2}$ per cent of such short length material is bought from the lumber mills in short lengths, the balance being cut from longer lengths on the job. The National Committee on Wood Utilization, Washington, D. C., has issued a bulletin, *The Marketing of Short Length Lumber*, and the United States Department of Agriculture published in July, 1926, Circular 383, *Industrial Outlets for Short Length Softwood Yard Lumber*. Similarly, the Association of Wood Using Industries in Chicago published in 1923 *Production and Use of Small Dimension Stock in the Chair Industry*.

N. C. Brown gives the following figures on annual wastage in the production of our principal wood products:⁹

<i>Products</i>	<i>Wastage</i> (million cu. ft.)	<i>Total Cut</i>
Lumber	6,000	8,256 ¹⁰
Fuel wood	100	9,500
Fence posts	50	1,800
Railroad ties	350	840
Pulpwood	60	585
Round mine timbers	30	396
Shingles	100	198
Tannins (wood and bark)	33	95
Distillation wood	12	133
Veneers	60	106
Slack Cooperage	70	152
Tight Cooperage	90	156
Poles and piling	20	94
Lath	10	18
Excelsior	1	23
Total	6,876	22,352

On the basis of a total consumption of these products of nearly twenty-three million cubic feet, the average wastage is 30.8 per cent.

⁹ Brown, N. C., *The American Lumber Industry*, New York, John Wiley & Sons, 1923, pp. 54-57.

¹⁰ United States Department of Agriculture *Yearbook* for 1922, p. 109; *idem*, for 1923, p. 1079.

C. *Wood Waste Prevention*.¹¹—The greatest hope for immediate aid in the alleviation of the timber shortage lies in more effective methods of manufacturing and utilizing forest products. Improvements can be made immediately on the basis of knowledge already available. Present wastes and losses are enormous. Present average practice in the manufacture and use of forest products is so far below the best present practice that tremendous savings can be made at once.

If present best practice and knowledge were put into effect to the fullest extent economically feasible, it is estimated that a saving of approximately two-ninths of the present drain on the forests could be accomplished.

The reader should note carefully that the estimated saving of two-ninths of the annual drain is based entirely upon economies already proved to be feasible. Further economies of at least equal magnitude will almost certainly be developed through research, making possible a total saving of four-ninths of the annual drain and a corresponding extension of the existing timber supply. It thus appears that better utilization will be of material assistance in bridging the gap between the exhaustion of virgin stumpage and the availability of new forests.

On the basis of present wastes and losses, the status of

¹¹ Based upon material presented by the United States Forest Service at the National Conference on Utilization of Forest Products on November 19 and 20, 1924.

In *Journal of Forestry*, Vol. XXVI, No. 5, May, 1928, p. 716.

research in forest products, and present economic conditions, the Forest Service has made a detailed estimate of the savings which could be made in the drain on the forests if our best present knowledge were applied to all of the various steps in the manufacture and use of forest products wherever such procedure is commercially and economically feasible. This total estimated saving amounts to nearly six billion cubic feet per annum. This amount is more than two-ninths of the present annual forest drain and nearly equals the total present growth of timber over our entire forest area.

Conservative estimates show that, by methods now known and available, we can reduce the drain upon the forests by more than two-ninths without reducing the amount of use or service rendered, and without adopting any methods or practices which are not now commercially feasible or economical.

What does the future hold in the way of still better methods?

Scientific research and better organization of industry are each year disclosing new economies in wood, and we may safely predict that they will continue to do so, even beyond the now feasible economies of two-ninths of the annual drain. As timber grows scarcer we may expect, for instance, a trend toward the use of the slow but efficient methods of lumber manufacture employed in Europe. In spite of the wonderful mechanical development of the

American type of sawmill machinery, and the severe punishment which it successfully withstands under high-speed and grueling service, it is recognized as being far more wasteful of lumber than European apparatus, and it has not found favor in Europe because of this fact. It will never be possible to attain to complete and perfect utilization, for we cannot eliminate entirely such items as slabs and edgings, sawdust and planer shavings, allowances for variations in sawing, and allowances for variations in shrinkage of the wood as it dries. It seems probable, however, that the additional savings which may be expected in the future will be as great as those now feasible, in which event the ultimate possible savings would be 19,000,000,000 cubic feet per annum, or four-ninths of the present drain.

It is evident from what has been said, that only by increased production of wood crops can we hope to meet the continued drain on our forest resources. The practice of forestry alone can assure an adequate wood supply for the years to come. Whatever the future may hold, wood will have its place, and a foremost place, in the national economy.

In the fall of 1927 the National Lumber Manufacturers' Association promoted a campaign for the increased use of wood. Substantial prizes were offered for the best "slogans" submitted. Of some 370,000 slogans the one chosen, "*Certified by Centuries of Service*," emphasizes the tried and true dependability of wood. The second prize slogan, "*Wood: Use it; Nature Renews it*," emphasizes the fact

that the use of wood is coupled with the unique attribute of renewability — an attribute which is the foundation of forestry.

There is danger of excessive zeal in the enthusiasm of promoting wood uses. Professor E. Fritz of the University of California has urged that "Use wood wherever it will serve the purpose" should be the slogan of every forester. Proponents of this viewpoint would insist on using wood irrespective of the superior merits of competing materials.

Preferable is the viewpoint of R. S. Kellogg:¹²

Wooden sidewalks went out of fashion long ago; wooden buildings and shingle roofs are not permitted in restricted sections of cities; boxes of paper and fibre are used in place of boxes formerly made of boards; steel passenger and freight cars and concrete culverts and bridges are common; while structures of concrete, brick, or tile are found on the farms. . . . Wood has been so cheap and abundant in the United States that it has been used for a multitude of temporary purposes, and often for purposes for which other products are better suited.

Another stage of economic development has now been reached. Wood is taking its place as one of the finer materials, and the coarser uses are being given over to coarser products. This makes it possible to have a relatively larger supply of wood for the purposes for which it is unquestionably the most suitable material. No doubt, also, some of the present use of substitutes is a temporary fad, and public favor will eventually return sensibly to the earlier material.

¹² *Lumber and its Uses* (3rd edit.), New York, U. P. C. Book Co., 1924, p. 353.

Professor Fritz' slogan for foresters should read: "Use wood wherever it will serve the purpose — best."

Wood is quite capable of standing on its own merits. Indeed, we are on the threshold of important modifications in wood structure and wood production through the cross-breeding of important timber species. Experiments by the late Luther Burbank in crossing the English walnut with its California cousin showed a marked increase in wood production. An experiment in crossing English walnut with the black walnut of the eastern United States shows a similar increase of growth in the hybrids and a tendency to combine the wood characteristics of the parent species.

Studies are being made in interbreeding poplars for pulp-wood. There lies in the future a vast field of possibilities whereby the skill of the forester may produce special kinds of wood material for special purposes, and may, in addition, shorten the time required to grow the timber crop, thus making it serve better the wood requirements of modern society.

With uses multiplying fast,
As modern man takes up new ways,
Who says the day of wood is past?
The forest's gift forever stays.
(Arthur M. Bullock, Greenville, N.C.)

2. RECREATION

Constructive recreation has long been recognized to be of as great significance to the social welfare of our nation

as is efficient labor. In fact the two go hand in hand, and with the increasing leisure time at the disposal of almost every class of worker the manner in which such time is spent makes either for high efficiency or for deterioration.

The extent of outdoor recreation has been greatly increased because of the remarkable development of transportation facilities since the opening of this century. It is local, regional, and transcontinental, by train, by boat, and especially by motor car. This movement is unbelievably great; it is already ahead of provision to meet its necessities in many states and will undoubtedly increase. Outdoor recreation is the safety valve for the tremendous pressure of life under our present civilization and is a much-needed diversion from the drab monotony of work in many lines. C. J. Hamlin, chairman of the National Conference on Outdoor Recreation, has well pointed out that the objective in providing adequate facilities for outdoor recreation is for the purpose of affording, not the luxuries, but rather the essentials, of living. It is significant that more than a hundred associations are directly or indirectly concerned with furthering sane outdoor recreation.

Forestry makes an important contribution to our social welfare by giving an appropriate place to the recreational use of our forest resources. This rests on the concept that all of our natural resources should be used to the highest degree but without nullifying their major economic use.

The advantages and delights of the forest as a place of

recreation need no commentary, but it is desirable to make clear distinctions concerning the use of the land in this respect. A brief glance at the field of recreational development will show its various phases, as well as the nature and the economic significance of each.

The greatest competition for use of land is in congested centers. Nevertheless, much headway has been made in providing playgrounds, playfields, parked streets, and parks within the respective limits of cities and towns. In this movement the competition is between the use of land for business and residential purposes, on the one hand, and for furthering social welfare through recreation, on the other. A suitable, proportionate use must be assured. It is a part of broad city planning for present needs and future expansion.

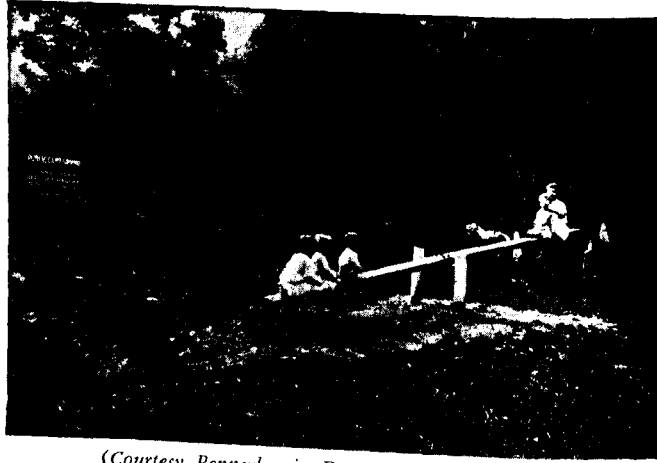
In 1880 municipal park areas, except perhaps in a dozen large cities, were negligible, but between 1890 and 1905 there was a general awakening to the recreational needs of city dwellers and a great increase in the amount of land set apart for this purpose. By 1926, according to statistics of the United States Department of Labor, the total area of parks in towns and cities of 2500 inhabitants and upwards was nearly 250,000 acres. In 1895 the county park came into being and since 1900 has been adopted in numerous places. This is evidence of the widening range of recreation, and it seems that the movement is likely to increase as a means of affording recreational opportunities for large numbers, admirably

supplementing city park systems, and often forming an extension of these.

Where parks within cities or on nearby areas are in forest, the primary or sole purpose is recreation. Forestry, except for maintaining such areas as are wooded in a healthy condition, has no place in this program, since recreation, not material production, is the higher use.

Town, city, and county forests, for the most part established by planting in recent years, but in some instances comprising forest land, have the fundamental economic purpose of producing useful materials. This does not preclude their use for recreational purposes to any great extent, such use being clearly within the province of intelligent forest management. The quality and particular character of these lands should be such that other use is economically unprofitable, forest being the natural as well as the principal use and recreation secondary or complementary to that. Where such forests safeguard potable water supplies, public health must be safeguarded in such recreational use as is permitted.

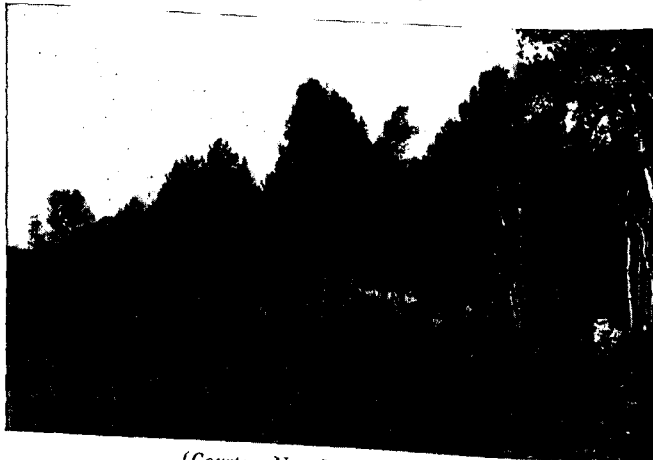
While it is true that open areas within congested cities and their environs are of vast importance in furnishing facilities for recreation, it is likewise true that people today go much farther afield for pleasure — evening trips, weekend parties, and vacation periods. Hunting and fishing have always carried sportsmen far and wide, juvenile organizations are stimulating outdoor life, and motorists



(Courtesy Pennsylvania Department of Forests and Waters.)

FIG. 6A. RECREATION.

An important use of the Pennsylvania forests.



(Courtesy New York State Conservation Department.)

FIG. 6B. PUBLIC CAMP SITE.

The Fish Creek Ponds, between Saranac Lake and Tupper Lake in the Adirondacks.

travel widely to enjoy the scenic beauties of the countryside, to camp, and to pursue other outdoor diversions. As a result, various agencies, chiefly within two decades, have elaborated various more or less well-defined plans for acquiring land to meet their needs, but as yet they lack full coördination and careful arrangements based on economic surveys to the end of maintaining the proper proportions for each use. There is grave danger that enthusiasm and zeal in developing any one particular use may result in loss of other values of equal or greater economic importance. A stable policy consistently followed, together with single or well coördinated administrative control, is a vital necessity.

Land requirements for crops, pasture, and forest have already been defined and discussed. Timber production is to be accomplished on existing lands now in forest and on idle lands which find their highest use in wood crops. Thus we have national forests, state forests, and private forests dedicated to production of raw wood products, useful also for the conservation of water and the prevention of soil erosion in mountainous and hilly regions. These are capable of affording places of recreation, but such use should be made with due regard to the main purpose of forest production.

National parks, state parks, game refuges, and public shooting-grounds constitute a land requirement to provide primarily for recreation and also, indeed, for no small measure of education. National parks are in a class by

themselves, unique in grandeur and natural beauty. Dr. J. C. Merriam, president of the Carnegie Institution of Washington, spoke of them aptly at the National Conference on Outdoor Recreation in 1925:

While the national parks serve in an important sense as recreation areas, their primary uses extend far into that fundamental education which concerns real appreciation of nature. Here beauty in its truest sense receives expression and exerts its influence along with recreation and formal education. To me the parks are not merely places to rest and exercise and learn. They are regions where one looks through the veil to meet the realities of nature and of the unfathomable power behind it.

One of the most commendable movements of the last two decades has resulted in the establishment of numerous state parks. One can truly say that they have added greatly to the happiness of millions of people. They have preserved for permanent public enjoyment bathing beaches, lakes, streams, beautiful scenic spots, and places of historic and peculiar state interest. Their purpose is primarily to furnish ample, well-distributed, accessible places of outdoor recreation; their product is character, built up by wholesome social enjoyment, stimulating to mind and body alike. Forestry can contribute to the management of these forest parks, to their protection from damaging agents, to the maintenance of conditions that will naturally perpetuate their beauty and recreational usefulness. Although incidental products from sanitary cutting and other forest im-

provement work may be utilized in such state parks, a flow of wood products is not the aim. Every condition favorable to plant and animal life and its natural balance should be maintained, and the laws of nature should be followed closely in the treatment of these areas.

In contradistinction to national parks and state parks are national forests and state forests, the primary purpose of which is the continuous production of wood crops. If properly coördinated with economic use and confined within suitable limits, as need may be, both national forests and state forests can be used for hunting, fishing, camping, and other activities. American tourists return from Europe full of enthusiasm for the Black Forest, the forests of the Harz Mountains, the spruce and fir forests of the high Alps, and magnificent beech forests, not always realizing that these are the result of painstaking forestry practice. One asks why they are so interesting, and the answer is that they are more attractive because they are well-managed and subject to skillful cutting. The American public still thinks of utilization as the wholesale exploitation of all of the trees on large logging areas, yet there are now in this country notable examples of forests under management that are furnishing useful products, duly maintaining the protective value of forest cover and at the same time giving place to forest recreation. These things are not incompatible, but complementary. Another important use of land is for game preserves set apart for protecting and increasing game and

other forms of wild life. These areas of refuge have been separately acquired and reserved for this purpose, and they have been set aside within national forests and state forests. Wild life is protected within national parks. In line with such refuges is the plea for reservation of natural areas of limited size, especially those with virgin vegetation, as places for basic research and study of conditions uninfluenced by man's action. A further land need is found in the acquirement of public shooting-grounds in various states, the use of which is obvious and increasingly important as the available area becomes scarcer by reason of denser settlement.

Beyond all these demands is the clearly expressed desire of some people for the wilderness type of retreat where they can get as far as possible from the restraints of civilization and live in primitive fashion. No one is likely to question the importance of all these demands for different uses of land, competitive or complementary, as the case may be, but to get the right proportion for each really requires state planning much after the manner of city planning. The approach to this solution by Michigan, made possible through economic surveys, is the soundest procedure. Michigan's policy is admirably stated in the biennial report of the Department of Conservation for 1925-1926, as follows:

Our prosperity is dependent in large measure on the continued utility of our natural resources and we need now, and in the future, to give careful thought and serious

attention to the policies by which their utility can be maintained and increased. Agricultural improvement and betterment, forest protection and production, wild life conservation and propagation, preservation of natural water and woodland areas for the recreational use of the citizens — these and other matters of state and local interests have a place in our conservation policy. But policies which will adequately, justly, and intelligently deal with the use and perpetuation of these resources cannot be built out of thin air, personal opinion, or prejudice. They must be built on a foundation of facts which have been obtained by a careful inventory of the present character, condition, and use of the resources with which they deal and a competent appraisal of the extent and nature of their future utility.

Michigan is representative of a number of states that have made excellent progress in providing for recreation, and which possess well-distributed state parks, game refuges, and shooting preserves. Its state forests, when increased to an area commensurate with the needs of the state, will further provide largely for recreation.

States possessing large areas of forest land and many streams and lakes are peculiarly fortunate, since they may advantageously plan and provide for well-distributed parks, preserves, and forests. So great is present-day motor travel that, in such states, reserved areas will be used not only by its citizens but, as experience has shown, by people from nearly every state in the Union. States with large city populations have been very active in providing for recreation.

New York, New Jersey, Pennsylvania, the New England states, and the Great Lakes states fall particularly within this category. National forests in the White Mountains and southern Appalachian region will admirably supplement the recreational facilities of state parks and state forests in the East. The newly created Great Smoky Mountain National Park and the Shenandoah National Park still further extend the field of recreation in the eastern states.

Western states have wonderful facilities in the national parks and national forests, magnificent in extent, extraordinary in features of interest and in opportunity for outdoor life. The full possibilities of the public domain are yet to be realized. The report of the Joint Committee on Recreational Survey of Federal Lands of the American Forestry Association and the National Parks Association to the National Conference on Outdoor Recreation in 1928 indicates admirably the present facilities and their great future possibilities.

It is typical of the United States to enter impetuously on any plan having so wide an appeal and for which the demand is already very great. The whole movement owes its progress chiefly to the extraordinary material prosperity and economic development of the country, but it is fostered by many organizations of far-seeing and public-spirited citizens who will keep it within reasonable bounds. It is a concomitant part of the many movements now in progress looking toward the health and social welfare of the

people. Perhaps more than any one other single factor it will tend to give a true appreciation, not only of the recreational value of our forests, but of their usefulness in providing us with products in an ever-flowing stream.

The development of recreation places is linked with the planning and establishment of well-defined road systems making accessible state parks and other areas. In this matter consideration should be given to the possibilities of other features having educational advantages and attracting the traveler. One finds publications which deal separately with state parks, with state forests, with historic places, and with mountain and seaside resorts. There is need of linking these together both by well-planned road systems and by state publications offering information in regard to the location and character of each of these and showing cartographically suitable tours that may be made to them. Distribution of recreationists is important to avoid intense congestion and to give the greatest enjoyment and instruction to the traveler.

CHAPTER V

PUBLIC POLICY REGARDING
FORESTS

The settlement and development of this country from the colonial period to the end of the nineteenth century rested successively on the use of new resources, whether soil, water, mineral, or forest. It is true that ideas about use have been refined in the course of our progress, so that expressions such as "conservative use" and "wise use" have appeared, but use has been and still is the dominating, decisive force. We wish to use without stint.

Settlers on the land in colonial times wished to use the soil, not the forest. To be sure, the forest furnished fuel, material for shelter, and, near shipping points, products to load into vessels for return cargo to Europe, but otherwise it was of no use. It gave place to agricultural fields and pastures; as a useless barrier it was pushed out of the way with great labor.

The nation, when it came into being after the Revolutionary War, had early to formulate a land policy. No one then was particularly concerned with forest use, except to safeguard supplies for the navy—a matter of national de-

fense, not of forestry. The use of productive soil, not forest, was important to new settlers. Subsequently, during the nineteenth century, the forest came into great use, an economic aid to settlers as they spread beyond the limits of the great eastern forest region. There existed a very real concern over the extensive clearing of forest land for agricultural use and over the rapid exploitation of virgin timber resources with the accompanying destruction by fire.

Forestless, windswept prairies seemed to call for planting; disappearing forests called for renewal. No one seemed to realize, in the 'seventies, that control and prevention of forest fires alone could aid natural renewal of the forest. The public policy, both national and state, of attempting to encourage tree planting as an ameliorative measure was a feeble and ineffective gesture, sincere but lacking a sound foundation of knowledge. Real recognition of the forest problem was given by the creation of an agency of information and investigation in the Department of Agriculture in 1876, which became the *Division of Forestry* in 1881 and a Bureau in 1901. The simultaneous appointment in the states of commissions of inquiry and the recognition of the place of forestry in state governmental organization similarly laid the foundation for subsequent forest policies; unfortunately, some of these efforts of the states fell by the wayside.

During this period the federal government continued to dispose freely of public land for agricultural use, and the

settlement of new areas reached its maximum. At the same time, greater and greater exploitation of forest resources took place, and federal lands suffered from fire and theft. These lands seemed doomed to go to waste if allowed to pass to private ownership.

Those interested in forestry wisely bent their efforts toward securing a national policy of retaining the remaining forested portion of the public domain in permanent reserves, and there was attained that legislative modification of the public land policy which has been explained in Chapter I. That section of the Act of 1891 expressed only the policy of reserving portions of the public domain. Previous bills introduced into Congress from time to time, and especially one drawn by the Chief of the Division of Forestry, introduced into Congress in 1888 and supported by the American Forestry Association, had, however, clearly enunciated a policy of reservation, administration, protection, and use. This was an accepted policy in the minds of those urging legislation. It was not until 1897 that the public policy was clearly defined by law and put into effect. The main objectives stated in the law were "To improve and protect the forest . . . for the purpose of maintaining favorable conditions of waterflow and to furnish a continuous supply of timber for the use and necessities of citizens of the United States." Thus, the United States government had made itself a permanent landowner with two definite objectives.

Much the best part of that law of 1897 is contained, however, in the statement of how these objectives were specifically to be attained. To quote further:

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 on the forest reservations as may be compatible with the proper utilization of the forests thereon and may sell the same. . . .

Here is clearly stated the adopted policy of applying forestry to these lands—a recognition that controlled cutting and utilization is the basis of forest improvement and the maintenance of its usefulness. Two other provisions deserve mention. It was provided that lands within reserves better adapted for agriculture or for mining might be restored to the public domain and be subject to private entry under the existing laws, and that bona fide settlers and miners might be given, under permit of the Secretary, the use of the timber and stone for domestic purposes.

One must revert here for a moment to the avowed objective of maintaining conditions of waterflow, for it bears on a further extension of federal policy. The value of water, particularly for drinking purposes and for irrigation and mining, to the arid West was early recognized. Today its importance is even greater, especially in the development of power and irrigation projects. Bare slopes favor erosion;

any vegetation is a deterrent to surface runoff of water; grass, brush, open forest, dense forest cover — each has a protective effect. It is in mountainous country that this protective influence of forest is great, and the lands set aside as forest reserves were mountainous. The cover of vegetation over the soil is controllable — controlled grazing to avoid destruction of grass cover and still maintain its influence, as for example above the timber line, in mountain meadows or in open forest; controlled cutting to improve forest growth and maintain its effective influence on stream-flow; control by protecting the forest from fire, the greatest source of harm. Climate, the kind of soil, the degree of slope, the geologic underlying foundation — all these are beyond human control.

It is easy to recognize the influence of vegetation, especially forest, on erosion if one but considers the protective barrier of crowns above, young growth beneath, fallen twigs, branches, leaf litter, and leaf mold. The water storage capacity of mellow forest soil and its overlying litter is great, although in prolonged storms water cannot sink into the soil with sufficient rapidity nor will the litter hold enough to prevent surface flow.

Generally speaking, the tendency of forest influence is to reduce extremes, permit more water to enter the soil and reach the streams by seepage, hence making more even year-long flow with reduced high levels and less extreme low stages. Even flow of water free from high silt content is

the desired end, especially of streams with rapid fall suitable for power development and needed for irrigation. Much has been written on this subject to substantiate the protective value of forests. The carrying of sediment by streams and rivers is vitally important in connection with floods, of which there have been several disastrous instances in recent years. E. A. Sherman¹ in his excellent report on *Protection Forests of the Mississippi Watershed* has shown the importance of the forested portion in solving the flood problem and has indicated the necessity of public ownership and management of strategic areas.

On the basis of control of streamflow and protection of navigable streams, there was initiated a movement early in the present century to inaugurate a policy of acquiring national forests at the headwaters of important streams, especially with reference to the eastern mountainous regions. A coördinate object, but one less strongly emphasized at the time, was the maintenance of production of valuable hardwoods.

In 1905 the forest reserves, renamed national forests to indicate use but not reservation, had been transferred from administration under the Department of the Interior to the Department of Agriculture. It was a highly desirable move, since the problem of growing timber crops could be solved to the best advantage in a department devoted to crop

¹ E. A. Sherman, Associate Forester of the Forest Service, United States Department of Agriculture.

production and already containing divisions able to supply necessary technical knowledge. The technical Bureau of Forestry, then expanded into the Forest Service, took charge of the national forests. The subsequent growing knowledge of, and confidence in, the national forest policy was basic to the next important change in federal policy.

Under the government land policy of one hundred years previous, practically all of the unreserved public lands in the states east of the Mississippi had been taken up. Under the Weeks Law passed in 1911, nearly ten years after the enunciation of the first proposal of this policy, provision was made by Congress for the purchase from private owners of land for national forests on watersheds of navigable streams. Acquirement began shortly in the White Mountains of New England and in the Southern Appalachians after enabling acts had been passed by the respective states to this end. As fast as areas were approved by the National Forest Reservation Commission, a body created by the Weeks Law, and bought by the government, the forests were placed under management with the same objectives as obtained in the national forests previously created in the public domain.

It has been the aim of the Department of Agriculture and the Forest Service to make the national forests of the greatest possible use. The original law had in view clearly the interests of the settler, and from the beginning administration has taken special account of the man of small

means, the local farmer, and the settler. The timber, water, grazing, recreational opportunities and other resources have been made available for use, but the policy has been to protect these resources so that they will be maintained for continuous use.

Rapid growth of the national forests and the firm establishment of the policy are noteworthy accomplishments within a quarter of a century. The first big increase in area, comprising thirteen additional reserves, was brought about in 1897, and this more than doubled the acreage already set aside. Notable names are associated with this movement, for the committee of the National Academy of Sciences appointed by president Wolcott Gibbs, at the request of the then Secretary of the Interior, Hoke Smith, to outline a forest policy for the forested lands of the United States consisted of Professor Charles S. Sargent of Harvard; General Henry L. Abbott of the United States Engineer Corps; Professor William H. Brewer of Yale; Mr. Arnold Hague of the United States Geological Survey; Mr. Alexander Agassiz, and Mr. Gifford Pinchot, who became head of the Bureau of Forestry the following year. This committee's report not only recommended these additional reserves, but outlined the plan of administration that became a law shortly thereafter.

The second great increase, amounting to more than one hundred million acres between 1905 and 1909, was due to the vigorous conservation policy of President Roosevelt and

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¹ E. A. Sherman, Associate Forester of the Forest Service, United States Department of Agriculture.

the untiring zeal of Gifford Pinchot. In placing the national forests under administration and technical management, Mr. Pinchot accomplished a very great work, difficult in the extreme because of the many interests involved. Under Mr. Pinchot's efficient administration and during Col. H. S. Graves' subsequent incumbency, adjustments in boundaries and the classification and segregation of agricultural lands determined the final areas for which efficient plans of management should be made. Col. Graves bent a fine technical mind to the problems of administration and management of the national forests and effectively furthered national forest policy. His successor, Col. Greeley, continued this efficient management and developed an *entente cordiale* with the forest industries through his clear understanding of their problems and by broad encouragement.

The national forest policy is firmly established and accepted by the nation. It has not been without its vicissitudes, attacks, and contention with respect to administrative policy, but it stands today as the best example of a stable land policy, wisely administered not only for local needs and resultant prosperity of the states, but for the public welfare of the whole country.

The beginning of the government policy of assisting the private owner goes back to the investigative and informative function of the Division of Forestry. Dr. Fernow, realizing at the beginning that there was not much hope for a change of methods in the cutting of forest areas at that

time, wisely gave chief attention to the use of forest products and practical economy of the resource. His investigations in timber physics and wood uses did more than anything else to create respect for this new governmental division as an authoritative source of useful data. This work, continued by the Bureau of Forestry and subsequently centered in the Forest Products Laboratory at Madison, Wisconsin, by the Forest Service, has been of tremendous importance to the forest industries and a powerful factor in creating a discriminating, conservative use of forest products. This is an outstanding achievement and within the limitations of a small force and a meager appropriation the educational value of advice given and of investigations made by the Division of Forestry into silviculture and forest management was by no means inconsiderable, for it laid the groundwork of knowledge on which subsequent assistance of the forest producer could rest.

A conspicuous change in policy occurred with the advent of Gifford Pinchot as head of the Division of Forestry in the United States Department of Agriculture in 1898. The main activity of the Division was directed to field work. The new channels of work are summarized in the report for that year, as follows:

- (1) To introduce in practice better methods of handling forest lands of private owners, including both woodlots and large areas chiefly held for lumber and afterward to spread a knowledge of what has been accomplished;
- (2) to

assist the western farmer to plant better trees in better ways; (3) to reduce the loss from forest fires . . . ; (4) and, if future appropriations will permit the necessary investigations, to inform our citizens regarding the extent and value of new opportunities for forest enterprises in Alaska, Cuba and Porto Rico.

It was intended to accomplish the first two aims by coöperative agreement between the Department and the private owner for the necessary examination and the preparation of so-called working plans and planting plans, respectively. The ambitious idea of the Forester was the "introduction of practical and paying forestry among lumbermen on a large scale." In the first year there were received applications covering approximately a million and a half acres from one hundred and twenty-three owners of thirty-five states, and the demands were very great for several subsequent years. The work afforded excellent training for the men engaged in it and they amassed much detailed knowledge of forest conditions. The plans were not comparable to present day management plans, but comprised chiefly detailed forest descriptions, timber estimates, rules for conservative logging and for reduction of waste in logging. The Forester's report for 1907 makes the large claim that 75 per cent of these plans were adopted and that the owners "are now lumbering conservatively or in some other way applying practical forestry." They did not, except in few instances, result in permanent forest production, but, in the

words of an early report, they brought about "conspicuously wider and more effective and intelligent interest in forest matters in the United States."

The mighty task of managing national forests begun by the Forest Service in 1905 overshadowed assistance of the private owner for the time being. Henry S. Graves in the report of the Forester for 1911 says, "Past experience in examining woodlots and privately owned timber tracts has shown that the methods of forestry recommended are actually put into effect in far too small a percentage of cases." He notes the educational value of such work and puts his finger on the weakness of previous work by indicating the necessity of giving greater attention to the pecuniary advantages of good over poor methods of management and of studies of market conditions in order to show owners how best to dispose of the products of their woodlands. His statement of policy is significant: "Primary consideration is given to the application and needs of small owners, since they are more disposed as a rule to put the methods recommended into operation." Pinchot's ambitious plan was not possible under the economic conditions of his time in office nor was the idea of sustained production understood. In 1912 coöperative assistance of private owners was turned over by the Forest Service to those states having provision for such work. In other states lacking forestry organizations, the work of giving assistance in management to owners of small holdings was direct by the

Forest Service. In the following year there were twenty-six states caring for this work under agreements made with the Forest Service. This suggests the substantial progress made by the states in formulating forest policies and putting them into effect.

The earliest expression by the states of an interest in forests, aside from the tree planting phase, seems to have come through influence of the local and state forestry associations which were especially active about the time that the federal government first recognized the importance of the subject. Numerous commissions of inquiry were appointed and these were successful in placing forestry permanently in the organization of several states before the end of the century. The functions of such commissions or commissioners were executive or educational, or both. The policy of establishing state forest reserves was initiated during this period. But by far the most important policy enacted into law was that which recognized the duty of a state to protect forest property efficiently against fire. Through the influence of the Chief of the Division of Forestry, New York, in 1885 enacted a comprehensive forest fire law providing for organized control of fires; this was followed shortly by similar legislation in Maine, New Hampshire, Pennsylvania, Wisconsin, and Minnesota. An initial step by the states, this was a practicable measure and in itself a great educator of the public.

Forty-four of the states are now provided with forestry



(Courtesy New York State Conservation Department.)

FIG. 7. FIRE OBSERVATION TOWER.

Located on Cornell Hill, Saratoga County, in the Adirondacks.

organizations, the varying activities of which depend on sharply contrasting local conditions.² The position of the forestry organization in state government is subject to a like variation. In some cases, the forestry organization is a branch of the Conservation Department or is a separate Forestry Commission, or a State Forest Service, or it is associated with some other division of state government. The present trend is to consolidate like interests under one department of state government, and therefore forestry is frequently included with the other so-called conservation interests.

The policies adopted by the states have, on the whole, been excellent along the lines of protecting forests from fire and other damaging agents; they have been progressive in acquiring and managing state forests; and they have also been active in research and education to the end of encouraging the better management of the forest and with the view of increasing the practice of reforestation. This latter practice is still far from adequate. The stage of progress in forest policy has been governed largely by local political, social, and economic conditions; hence, it is extremely variable, and in some cases political considerations have arrested or suspended the development of state forest policy for an appreciable length of time.

Motives or influences underlying the establishment of state policies respecting forests are by no means so clear as in the development of federal policy. Early influences

² *Report of the Forester*, 1928, p. 11.

such as motivated national investigation and action have likewise aroused the states to initiate inquiries into current conditions. In the beginning the idea of conserving timber supplies may have been fundamental to the policy of state forest reserves; subsequent to the establishment of national forests it may have represented the application of the new idea of public ownership of forests. The policy of providing state demonstrations of forestry is also expressed in state legislation. Extraordinary devastation by great forest fires was an impelling motive in bringing about organized state protection. Furthermore, good laws, as does good news, travel from state to state. The initiation, form, and development of broad state policy in respect to forests were, however, most directly influenced by those sections in national legislation which provided for coöperation with the states; initial local accomplishment was due to the untiring efforts of individuals, or of associated private effort; development and progress may be traced to the earnest support of the work by members of the directive bodies in charge and to the zeal and efforts of technical foresters engaged in it.

In the early days of the Bureau of Forestry, Gifford Pinchot endeavored to spread the practice of forestry throughout the country. His field parties penetrated East and West alike. Coöperative studies of forest conditions in various states led to the formulation of state policies in the final report on these projects, to be adopted or pigeonholed by the state just as the working plans for private

owners could be adopted or filed away by the person or company for whom they were made. To these reports can be traced the beginning of policy in several states. The Conference of Governors called by President Roosevelt in March, 1908, and the report³ of the National Conservation Commission, shortly thereafter appointed by him, placed the matter of forestry squarely before the nation; this constituted another impelling influence. In 1908 Pinchot sent out letters to the Governor of each state, offering the coöperation of the Forest Service in a preliminary examination of local forest conditions. Henry S. Graves in his report in 1910 indicates that assistance in developing a forest policy had been asked by many states and that the recommendations of the Forest Service usually covered the following:

The appointment of a state forester or a forestry bureau to supervise the forest work of the state and to coöperate with private owners in assisting them to manage their forest lands properly; the enactment of laws for the protection of forest lands from fire by establishing fire warden systems, placing reasonable restrictions upon the use of fire, and providing suitable penalties for their infraction; the adjustment of taxes on forest lands so as to encourage the private owner to cut his timber conservatively and retain the land for future production; and the purchase or retention by the state of timbered or cut-over lands suitable for permanent state forests.

Something more than advice was needed and the year 1911 brought in a new policy made possible by section 2

³ 60th Cong. 2nd Sess. S. Doc. 676, 1909.

of the Weeks Law, which appropriated \$200,000 for coöperation with the states in protecting the forested watersheds of navigable streams from fire. Such coöperation was to be extended only to states that had provided for forest fire protection and that had funds appropriated for that purpose; this in itself created a motive for state policy. It required an equal contribution of funds and carried with it, by agreement, federal inspection of the operation and efficiency of the coöperative system of protection. Direct financial assistance went far beyond the previous advisory assistance in its application. Almost immediately six states entered into an agreement with the Forest Service and five more indicated their willingness to coöperate after the end of the current fiscal year. In the development of this protective work the states have far exceeded the amount contributed by the federal government and have yearly increased in the efficiency of their work, while new states have felt the urge to enter into similar agreements, with the result that organized protection from fire has now become nation-wide.

Federal, state, and private efforts have been enlisted in solving the problem of protecting forests from fire. The forest industries have aided notably through timberland owners' associations, as well as individually; the West, however, has contributed a greater proportion of financial support than has the East. All this looked rosy. This augured well for the future, and it seemed that one of the chief obstacles to the practice of forestry was about to be removed.

Several studies of the tax problem had also been made, and the uncertainty and inequity of the general property tax as commonly applied led several states to enact legislation looking toward an improvement in the method of levying on forest holdings.

On the whole a great deal of progress had been effected in state and federal forestry. When a survey was made in 1919, however, it became evident that the future need for wood could not, contrary to the popular impression, be met from current production on public lands, which constituted but a quarter of the forest area of the country, and which contributed less than that proportion in actual timber. The public rediscovered the fact that the private practice of forestry was carried on on a negligible scale.

The Forest Service then put forth new and energetic efforts to call public attention to "the grave situation," involved in the rapid depletion of forests in private hands and in the lack of effort to renew them. It was proposed to adopt a policy of enlarging the program of public acquisition of forests by the federal government, by the states, and by lesser political sub-divisions, and of protecting and perpetuating forest growths on all privately owned lands.⁴ The government was to stimulate, guide, assist and coördinate state action; the states were to assume direct responsibility for protecting and perpetuating private forest lands.

⁴ Adapted from *Report of the Forester*, 1920.

From what was said and written officially, the public gained the impression that mandatory powers were to be invoked. In fact Forester Greeley in 1920, after emphasizing the conviction that the problem of halting forest devastation is fundamentally national, gave the following opinion:

At the same time it is felt that the speediest, surest, and most equitable action can be secured through dependence on the police powers of the states for the enforcement of such reasonable requirements as should be made of private owners and on the state governments for providing organized protection of private lands against fire.

The new spirit was provocative of conferences and committee reports, and the words "devastation" and "minimum requirements" were much in evidence; on the whole, the timber industry, the public, and Congress gave serious attention to the problem.

In response to Senate Resolution 311, the Forest Service presented a report on *Timber Depletion, Timber Prices, Lumber Export and Concentration of Timber Ownership* which conveyed the information that timber was being cut more rapidly than it was being replaced through growth. The evil effects of depletion and the remedies were subsequently set forth in another publication issued in 1922 entitled *Timber: Mine or Crop?* probably the last of such warning publications officially to be put forth in this country.

In the meantime discussion continued and during the early course of the movement bills were introduced in

Congress providing for direct federal control of private forests through the taxation of forest products and for indirect federal control of private forest lands under the police powers of the several states; it being intended in the latter that the federal government should function as a coöperating and standardizing agency. Neither of the bills became law.

The police power had already been used by states in laws relative to logging slash disposal and fire patrol, as a necessity for protection of a resource of such vital importance to the welfare of the state. These fire prevention laws had been accepted by the forest industries and have since been extended and strengthened in several states. Two states, Louisiana and New Hampshire, went farther and encroached on silvicultural practice by requiring the leaving of one protected seed tree per acre on pine lands when the timber was cut. Such a policy is a doubtful expedient, and is analogous to legislation dictating the formula of commercial fertilizer for an agricultural crop or one method of growing it!

In this period, numerous economic studies were made of resources, transportation, taxation, and other subjects. There were also initiated investigations which subsequently resulted in the presentation of publications by the Forest Service on timber growing and logging practice in the several regions of the United States.

The broad, rather vague pronouncements of 1919, con-

cerning a forest policy national in scope, take more definite form in the words of Forester Greeley in 1922:⁵

Our national policy of forest conservation has been a matter of slow but sustained growth for over thirty years. It is not to be expected that its remaining chapters can all be written at once, and particularly that the extent and manner of exercising public control over private forest lands and industries can be settled in any final way until public sentiment shall have been more definitely and maturely formed on this subject. But there can be no question as to the wisdom or urgency of immediate legislative action on certain fundamental steps in any adequate Federal program of reforestation.

The immediate needs are:

1. The extension of Federal coöperation with States in forest protection on a scale commensurate with the national interests at stake and with a broader legislative basis adapted to the practical requirements of the situation. Such coöperation should not be restricted to the watersheds of navigable streams and should be contingent upon compliance by the coöperating States with standards established by the Secretary of Agriculture.

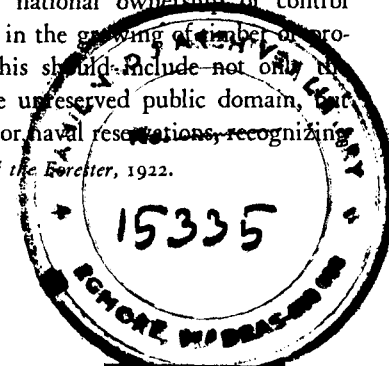
2. An enlarged scale of national forest purchases under the act of March 1, 1911, in order that the benefits of Federal forest ownership may be more widely applied in critical, or "key" areas.

3. The extension of forest protection and management to all lands now under national ownership or control whose greatest utility lies in the growing of timber or protection of watersheds. This should include not only the forested lands still in the unreserved public domain, but also those within military or naval reservations, recognizing

⁵ Report of the Forester, 1922.

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the prior service of lands of the latter class for national defense purposes.

4. Coöperation with the states in growing and distributing forest planting material, in order that this important means of reforestation may be more widely employed.

5. Provision for enlarged research in the growing and use of timber. The investigative agencies of the country are now unable to keep pace with the demands of timber growers and timber-using industries for the technical information needed to direct soundly their undertakings. The availability of accurate scientific data underlies every effort for the conservation of existing timber supplies and the growing of new timber crops.

The motion to exercise public control of private forests had evidently been tabled both with grace and good judgment. All the agitation of this period had, however, established in the public mind the need for a comprehensive national program to provide for future supplies of timber and for the maintenance of other forest benefits. A no less significant fact was emphasized in official publicity in the promulgation of the idea that forest production is an economic process, governed by economic laws, and that any requirements of the private owner must be practicable from a business standpoint.

An investigation of forest conditions in the United States made by a Senate Committee in 1923 focussed Congressional attention on reforestation. At that time, twelve of the states were maintaining nurseries for the planting of state land and the distribution of trees for purposes of reforesta-

tion to private owners. Such work had within less than a decade been gaining considerable momentum. Furthermore, a recognition of the extent of farm woodlands, estimated to comprise about one-third of the total forest area of the country, and a discovery of the extension work being done by several states in furthering the skillful handling of woodlots presented a new possibility of stimulating natural reforestation nationally.

The next year witnessed Congressional enactment of another forestry law which enlarged federal policy and marked another advance step as did its predecessor, the Weeks Law. The limitation of coöperative protection of forest lands to the watersheds of navigable streams was removed, and this provided for nation-wide action. The fire hazard was to be minimized by extended, efficient measures of prevention adopted by the states with the coöperation of the federal government with the aid of greatly increased appropriations. The new law offered tangible proof of a determination to lower this obstacle to private forest production. Another feature was the inclusion of a clause directing an investigation of forest taxation on the ground that this is also an obstacle; it is a very real one, inasmuch as present methods of levying result in the continuous taxing of timber in all its stages of growth and in the necessity for an unusually heavy investment in the forests long before a return may be expected. The forest industry, as is the case with any other industry, must be grounded on a sound economic basis and

bear its fair share of taxation, but it should not be handicapped in its long-time investment by a cumulative tax burden.

While the Clarke-McNary Law, as this act was called, confirmed and expanded the policy of establishing national forests, its chief aim was to further forest production on private land. In addition to the above-mentioned clauses directed toward removing obstacles, other clauses authorized the expenditures by the federal government in cooperating with the states (1) in the distribution of forest nursery stock for the planting of windbreaks, shelter belts and woodlots on farms, and (2) in assisting farmers in managing their forest lands on a basis of continuous production.

As we have seen, neither of those two projects had a claim to novelty, but the act made possible a valuable connection with the agricultural extension service of the government and provided financial, cooperative aid in state work. The growing and marketing of trees was thus given the status of a desirable part of farm management.

While the knowledge gained by the Senate Select Committee on Reforestation has since then been utilized in further reinforcing the policy of acquiring national forests in the East, the flood situation of 1927 was a more immediate influence. The McNary-Woodruff Law of 1928 supplements previous laws in inaugurating a program of expenditure for the purchase of areas for national forests on a much greater scale: it is proposed to spend two million dollars

to this end in 1929, three million dollars during 1930, and a like sum during 1931. The program is, of course, dependent on Congressional appropriation. The availability of these sums will make possible the purchase of three million acres of forest land in the White Mountains and Southern Appalachians, the purchase of properly distributed units in the Lake States amounting to an approximately equivalent acreage, and the acquisition of another two to three million acres in the pine-producing regions of the South. It is expected that federal acquisition of forest lands will be harmonized with state purchases within these regions. The states in the East stand in need of adopting an enlarged policy of public ownership modelled along lines on which some of these states have achieved notable progress during the past two decades. The work of reconstructing cut-over and abandoned areas in the eastern United States is a state and federal responsibility which should be met by vigorous action. As expressed in the latest report of the Forester, the policy of forest acquisition by federal, state, and municipal governments should be to secure:

- (1) the land most necessary from the standpoint of watershed protection, recreation, and like public needs; (2) land which, under management, will tend most effectively to stimulate private interest in timber growing; and (3) land necessitating such outlays for its reclamation to good timber-growing conditions that not for a long time, if ever, will private capital make use of it.

This policy does not imply the assumption of a task of providing for the future. Private ownership will probably always constitute the greater proportion, but, as outlined above, the public forests will care for the forest production of strategic areas and should exert a strong influence in the development of private practice, but without entering into competition therewith.

Economic conditions do not permit the immediate development of private forest industry on a basis of sustained production. Such practice must be put on a paying basis. It presupposes willingness and the necessary knowledge. The change from utilization of the resource to forest crop production as a permanent industry requires a large readjustment and a sound financial structure. There must above all be favorable conditions of forest, of initial investment and current costs of operation, of market, and of transportation.

One important aid to private forest production, as well as to public forest management, is to be found in research and the demonstration of usable practices. As previously stated, the government had recognized that private forest property must be defended against excessive taxation and had also recognized the necessity for the provision of an efficient system of protection against fire. In 1928 the McSweeney-McNary Act, providing for an enlarged program of research, completed the framework of our forestry structure. It capitalized the pub-

lic faith in research and directed it into the proper channels.

There remains but to touch upon the attitude of the industry itself toward permanent forest production. The development from indifference or antagonism to active interest is a long step and yet this has taken place within a generation. Active participation is dependent on local conditions. Depletion does not proceed uniformly; neither does the change to sustained production. The latter must inevitably be gradual. An indication of progress is to be found in the fact that the forest owners desire to perpetuate their industry, if possible, and have now progressed beyond the inquiry stage.

An indication of the present attitude is to be found in the Proceedings of the First Commercial Forestry Conference, called by the National Chamber of Commerce at Chicago on November 16 and 17, 1927, and planned and conducted by business men in the interest of private forest industries. Professor Fritz in reporting this meeting makes an excellent remark:

Once a timberland owner grasps the idea and spirit of forestry, and overcomes the antagonism engendered in him by propagandists, he is certain to investigate its possibilities with an open mind. The very fascination and difficulty of the problem is bound to whet his pioneering spirit.⁶

⁶ "The First Commercial Forestry Conference," Fritz, Emanuel, *Jour. of Forestry*, Vol. XXVI, p. 124.

The membership at this conference was representative of the industry; the spirit was optimistic, the attitude serious. The foreword by the general chairman⁷ expressed confidence in the existence of sufficient ability to solve the problems facing the industry provided conditions for the practice of forestry were made tolerable by a reciprocal public spirit and interest. He urged that the lumbermen and pulp men return to their homes and assume leadership in their communities, saying, "As pioneers we established this business—is it worth fighting for?" This is a typically American attitude and will prove a strong factor in forestry progress. Vice-President Butterworth of the National Chamber of Commerce voiced the attitude of the government at Washington, which has changed since Herbert Hoover's advent, that the business man, once despised, is now respected in Washington and can be depended upon to demonstrate his ability to obtain adequate forest regrowth.

The best answer to those who question private progress and the present federal and state policies with reference to private forest production is concerted building by the industry on the foundation of the recommendations of this conference. Actual achievements in timber growing will set at rest the recently renewed agitation for direct governmental control and regulation of private forest land.

⁷ Mr. E. C. Griggs, one of the leading lumbermen in the Douglas fir region.

CHAPTER VI

THE APPLICATION OF FORESTRY TO LANDS NOW IN FOREST

I. NATIONAL FORESTS

It is always difficult for one not familiar with the practice of forestry to visualize its application to tracts of timberland. Of little avail is the description of various technical procedures if the reader has no clear conception of the appearance of the forest or of the changes which may be brought about by the processes of silvicultural management. The ideal way to instruct is, of course, by actual visits to forests under management so that the picture as a whole may be impressed upon the mind of the observer. Failing this, specific cases of forestry as applied in various regions of the United States may be studied. This procedure is followed in the present chapter.

The problem is further complicated by the varied character of what is termed "forestry." It embraces, as pointed out in the chapter on forestry and its objectives, the widest spread; from purely recreational conservation without utilization of the timber, on the one hand (exemplified by the policy of New York on its forest preserve), to complete

commercial development for timber products, on the other, with but little attention to reproduction of the forest after cutting; from forestry that pays for itself by indirect benefits only, to that which depends on showing a direct profit from logging.

In selecting the examples of applied forestry, both the variety of geographic and timber conditions and the degree of technical development have been borne in mind. A choice of national forests, state forests, and private forests has likewise been made in order to picture properly the degree of forestry possible under different kinds of ownership.

First to be considered are four national forests: the Plumas in the Sierras of California (exemplifying remote markets), the Harney in the Black Hills of South Dakota (exemplifying local markets), the Pike in Colorado (exemplifying intensive utilization and streamflow protection), and the Choctawhatchee National Forest in Florida where naval stores (turpentine and rosin) rather than wood are the chief products.

The state forests chosen for study are those of Pennsylvania (where development of all forest resources, including recreation, has reached a high point) and one in Connecticut (where forests, small in area and heavily cut-over, present problems of peculiar difficulty in applying forestry).

The private timber lands chosen include the Adirondack (N. Y.) holdings of Finch, Pruyn and Company, Inc.,

those of the Goodman Lumber Company in Wisconsin, and those of the Great Southern Lumber Company in Louisiana.

Needless to say, examples might be multiplied and other regions included to advantage—such as the Douglas fir of the Pacific Coast, the western white pine and larch-fir forests of the northern Rocky Mountains, the western yellow pine of Arizona and New Mexico, and the shortleaf pine of Arkansas, but limitations of space forbid. For those interested in timber growing and logging practice in the various regions of the United States, the Forest Service of the Department of Agriculture at Washington is publishing a series of twelve regional bulletins, five of which have appeared¹ and others of which are in preparation, which set forth the measures necessary to keep forest land productive and to produce full timber crops.

A. *The Plumas National Forest in California.*—Typical of the California pine region on the slopes of the Northern Sierra Nevada is the Plumas National Forest. Western yellow pine (*Pinus ponderosa*) is the characteristic tree; with it are found sugar pine (*P. lambertiana*), Douglas fir (*Pseudotsuga taxifolia*), white fir and red fir (*Abies concolor* and *A. magnifica*), and incense cedar (*Libocedrus decurrens*). Excepting only red fir, all possible combinations of these species occur. The pines predominate in value.

The topography is varied from valleys and plateaus to

¹ Bul. 1402. California Pine. May, 1926; Bul. 1491. Central Hardwoods. May, 1927; Bul. 1493. Douglas Fir. June, 1927; Bul. 1494. Northern Rockies. Sept., 1927; Bul. 1496. Lake States. Feb., 1928.

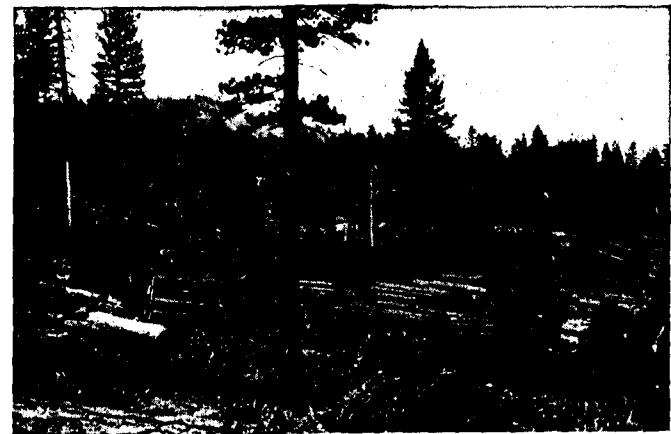
rugged mountain sides. It is a region of heavy snowfall in winter and consequently of great value in maintaining and equalizing streamflow.

Since the Plumas National Forest includes a million and a half acres, a particular part (the Meadow Valley working circle) will serve to present more comprehensively the problems of applying forestry to this region. This working circle² or unit of management (usually, though not invariably, under sustained yield, cut equaling growth in the long run) is a natural topographic unit of thirty-eight thousand acres, sufficient in size to support a lumber operation of moderate size producing material for the general market. Of the land in this circle, four-fifths is national forest and subject to the principles of public policy set forth in the preceding chapter. The remaining fifth is owned chiefly by the Spanish Peak Lumber Company.

Douglas fir and western yellow pine predominate, occupying 55 per cent of the area; sugar pine and white fir bring the total to 94 per cent of the area. There is a billion board feet on the area, and, as is usual in virgin stands, the growth is practically at a standstill.

The local population does not consume the forest products; these go to the general market which, in turn, governs the disposal of lumber from this area. Two sawmills, with a

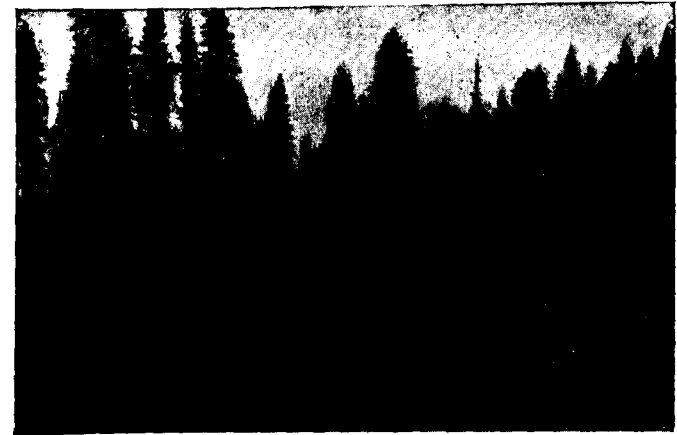
² See Appendix (pp. 297-307) of Recknagel, Bentley and Guise, *Forest Management*, New York, John Wiley & Sons, 1926. Also pp. 39-52, United States Department of Agriculture, Miscellaneous Publication No. 11, February, 1928.



(Photo by W. I. Hutchinson, Courtesy U. S. Forest Service.)

FIG. 8A. PLUMAS NATIONAL FOREST.

Application of forestry on timber sale areas in California.



(Photo by E. S. Shipp, Courtesy U. S. Forest Service.)

FIG. 8B. PLUMAS NATIONAL FOREST.

A timber sale area in California cut over under forestry methods.

daily capacity of nearly one hundred thousand board feet, ship their lumber by aerial tramway five miles to the Western Pacific Railway and thence to the lumber consuming centers of the country.

The National Forest administration has adopted the following objectives:

1. To produce saw timber for the general market.
2. To remove mature timber as rapidly as possible and to leave the area in shape for a profitable second cut.
3. To improve the condition of the forest so as to pave the way for sustained yield.

This program is fulfilled by cutting over the entire area in a fifty-year period known as a "cutting cycle." The private land is merged with the government land in this plan of cutting. All trees to be cut are marked, and these include mature and decadent trees; dead, diseased and insect-infested trees; unusually tall trees and those with very large crowns standing in locations in which they are exposed to severe winds. This will leave for the second cut, fifty years later, all thrifty trees and the most promising of the thrifty-mature trees: "those which from appearances will continue to grow until the next cutting cycle."

The result of such a cutting is a removal of about four-fifths of the volume and the retention of about one-fifth. On the privately owned land the cut will remove 95 per cent of the volume.

This policy will supply for each of the fifty years in the first cutting cycle a cut of sixteen million board feet. At the end of the cycle the mature and decadent timber has been removed, yet the government area is in shape for a second cut of some eight or nine million board feet yearly, and this is sufficient to make the operation profitable.

Forest management thus regulates the cut *in time*; it also so regulates it *in place* that the cut proceeds counter-clockwise around the basin. The industry dependent on this timber will be supplied with a continuous cut. On the private land no direct control is possible, but the owners will be urged to provide adequate fire protection while logging, and to leave at least four trees sixteen inches or over in diameter at breast height per acre.

Care in logging and in fire protection will be insisted on: specifically, care will be taken to avoid damage to existing young growth and to timber left standing, "high lead" donkey engine logging is forbidden³ and the tops of trees left after logging will be lopped and the brush piled and burned.⁴ The management plan will be revised at frequent intervals and definitely at the end of ten years of operation.

B. The Harney National Forest in South Dakota. — This national forest is typical of the Black Hills, a region made familiar to Americans by the sojourn there of President

³ For details see United States Department of Agriculture Bulletin 1402, *loc. cit.*

⁴ "The entire area is directly under the eye of the Spanish Peak Lookout, so fires should be detected when small."

Coolidge in the summer of 1927. The entire forest includes half a million acres. But of this, the so-called Custer working circle of nearly 200,000 acres typifies the problem of supplying in perpetuity, local needs for forest products. The inhabitants of this circle, once a prosperous mining community, are now dependent upon the timber business for a living. It is a local industry and virtually independent of the general timber market.

The country is characterized by high ridges with steep slopes and canyon-like valleys in between. Rock outcrops are frequent; the soil is shallow. Ranching is restricted and seldom profitable.

The principal timber tree is western yellow pine (*Pinus ponderosa*) which occurs in pure stands averaging 4,270 board feet per acre. Altogether the circle contains nearly half a billion board feet of merchantable timber. Between 1898 and 1910 much timber was "bug killed" but excellent reproduction has followed the insect depredations.

In the virgin stands growth is at a standstill, and is often more than offset by decay. After conservative cutting, however, which usually removes 70 per cent of the merchantable volume, growth is rapid, amounting to 254 per cent (of the amount left) in the thirty-five years of the adopted cutting cycle.⁵ For example:

⁵ This cutting cycle of 35 years is one-quarter of the adopted rotation (cutting age) of 140 years.

The Application of Forestry to Lands Now in Forest 117

Average stand in 1922.	5,623	bd. ft. per acre		
Amount cut	3,936	" " "	"	(70%)
Amount left	1,687	" " "	"	(30%)
Growth in 35 years	4,285	" " "	"	(254%)
Average stand in 1957..	5,972	" " "	"	

There are fifteen small sawmills operating on national forest timber within the circle. The Burlington Railroad buys railroad ties, coal and grain doors, and some bridge and structural timbers. Fuel wood is in constant demand by the population, and is granted to settlers free or at a low price stumpage in commercial sales.

The management⁶ policy has adopted three chief objectives: first, to maintain a sustained yield of forest products for the use of the inhabitants; second, to furnish steady employment for local labor in woods work and in the manufacture of forest products; third, to maintain a permanent industry which will offer a market for timber as it becomes ripe for cutting.

These objectives will be furthered by cutting over the entire working circle in the first thirty-five-year cutting cycle at a rate of seven million feet yearly for the first ten years (1921-1930) with possible revision for the remaining twenty-five years (1931-1956), as additional timber estimates may indicate. This cut will maintain existing industries and provide

⁶ Cf. pp. 21-38 United States Department of Agriculture, Miscellaneous Publication No. 11.

Management Plans With Special Reference to the National Forests, Eldredge, I. F., Washington, 1928.

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Management Plans With Special Reference to the National Forests, Eldredge, I. F., Washington, 1928.

for the removal of the decadent and defective timber as quickly as possible. Carefully formulated "marking rules" are observed.

The sequence of cutting the various units of the circle is determined according to urgency, which in turn is determined by the maturity of the forest and by the presence of injurious insects. A "cutting budget" is prepared for the first ten-year "working period"; for each unit a specific year has been designated as the time for the initiation of cutting. The plan of management will be revised every ten years and again at the end of the cutting cycle. Additional data will be incorporated and used to check the application of forestry to this area.

C. *The Pike National Forest in Colorado.*—Pikes Peak imparts both its name and outstanding characteristic to the national forest named for it. Typical of the eastern rampart of the Rocky Mountains, this forest comprises more than a million acres. A representative part of the Pike National Forest is the Woodland working circle, lying from twelve to thirty-five miles to the northwest of Colorado Springs. Within this circle of one hundred and eighteen thousand acres are ninety-four thousand acres of national forests, 90 per cent of which is timbered. Here again western yellow pine (*Pinus ponderosa*) is the principal species but Douglas fir (*Pseudotsuga taxifolia*) is almost equally plentiful. Other species comprise only 10 per cent of the sixty-four million feet of national forest timber.

The application of forestry to this Colorado forest in-

volves intensive utilization and streamflow protection. Eastern Colorado is an important farming country and the streams which water it rise in the Rockies. Serious over-cutting of the forested slopes leads to irregular run-off; this is responsible for sudden floods which are followed by a dearth of water just when the need is most acute. The forest cover on watersheds where the streams rise must, therefore, be maintained at all times. Of equal importance is the fact that a large part of the Woodland circle drains to the reservoirs or intakes of the water-supply systems of Denver and of Colorado Springs.

The method of forestry practice which meets these needs best is that of selection, whereby only the mature trees are taken and the cutting cycle or interval between successive cuttings on the same area is comparatively short.

In the Pike National Forest this is achieved by setting the rotation (age of maturity of the trees) at one hundred and sixty years⁷ and dividing this into four equal cutting cycles of forty years each. During the first cutting cycle (1926-1965) the mature and over-mature stands which have no net increment will be cut. There are approximately fifty-three million board feet of this timber, and therefore one million three hundred and twenty-five thousand board feet can be cut in each year of the forty-year cycle. This does not

⁷ The age at which commercial maturity is obtained varies with species, site, and market requirements. Some stands are commercially mature at pulp-wood size, others at railroad-tie size, while still others, possibly of the same species, can be most profitably held for saw timber production.

include the amount obtained from thinning immature stands (material now unmerchantable, but which may prove salable in the future) or for volume which would now be wasted in cutting but which could be saved by the practice of closer utilization following improvement in market conditions.

Within the Woodland circle, logging is carried on by fifteen or twenty small operators: the plan of orderly and systematic cutting should stabilize and extend the timber business at Woodland Park, which is the logical center for developing such a business. For example, most of the ties for the Midland Terminal Railway are delivered at that point. Furthermore, local labor, now only partially employed, will find a desirable outlet in an increased and permanent timber business, with its consequent greater local prosperity.

In order to increase the present sporadic cut of about one million board feet annually by approximately three hundred thousand board feet, existing markets must be expanded, especially by increasing the use of local lumber in markets now supplied from other sources. A further opportunity exists in developing and meeting the demand for ornamental planting stock and for Christmas trees, which can be obtained as thinnings under proper regulation.⁸

⁸ The business of supplying Christmas trees from thinnings on National Forests located near cities has become both profitable and educational.

For the first working period (1926-1935) the areas for cutting have been selected upon the basis of accessibility and maturity: "In general, it will be the plan to begin cutting in the south and east portions of the circle and progress northerly and westerly, in counter-clockwise fashion, insofar as this is economically feasible, during the remainder of the first cutting cycle."⁹

All logging will be performed by the use of animals or motor trucks. The removal of all classes of material, including logs, railroad ties, and mine props, will be required. As already indicated, trees intended for removal will be marked in accordance with the selection system, to the end that the commercially mature and over-mature timber may be harvested and that defective, diseased, or over-crowded trees in the younger stands may be removed. Marking will usually remove from 65 to 75 per cent of the merchantable volume of the stand in trees ten inches or more in diameter at breast height.

Three additional objects of forestry practice in this Colorado forest merit special attention. These, as stated in the Management Plan for the Woodland Circle, are as follows:¹⁰

1. To coöperate with owners of private forest land, both inside and outside the present forest boundary and within the Woodland circle, in managing the forests in the manner contemplated for national forest land.

⁹ United States Department of Agriculture, Miscellaneous Publication No. 11, pp. 52-70, *loc. cit.*

¹⁰ *Ibid.*, p. 58.

2. To utilize forage resources insofar as this will not interfere with proper timber production. Grazing uses of potential timberland will be restricted or prohibited where such uses are detrimental to tree growth and natural restocking.

3. To maintain the attractiveness of important scenic and recreational areas . . . around the more important areas used, or likely to be used, extensively for recreation, the policy will be to make an improvement cutting removing dead, insect-infested, and diseased trees, and only such other trees in need of removal as can be spared without marring the beauty of the setting.

D. *The Choctawhatchee National Forest*.¹¹ — The examples so far presented of forestry applied to lands now in forest are those of national forests in the West. The area of such forests is far greater in the West than in the East or South and there has been more time for the development of their programs of management.

Typical of the less productive parts of the southern pine belt is the Choctawhatchee National Forest in western Florida. This forest presents striking contrasts with the examples of forestry already presented.

In the first place it lies, not in the mountains, but on the sandy coastal plain bordering the Gulf of Mexico. The area is almost completely level save for some huge sand dunes. The forest, an open one of longleaf pine (*Pinus palustris*), is dotted with swampy areas in which grow the bald cypress (*Taxodium distichum*) and the various hard woods — chief

¹¹ Data supplied by courtesy of Forest Supervisor A. C. Shaw.

among them oak, ash, hickory, beech, and red gum (*Liquidambar styraciflua*). The principal contrast of this southern forest and the reason for its selection as an example of applied forestry is found, however, in the fact that timber is not the chief crop: first place is held by the naval stores industry. The historic name of this industry gives little indication of its present products. In place of tar and pitch for the wooden vessels of a bygone era, this industry now produces turpentine and rosin which are essential to the manufacture of paints, varnishes, soap, paper, and many other commodities of modern life.

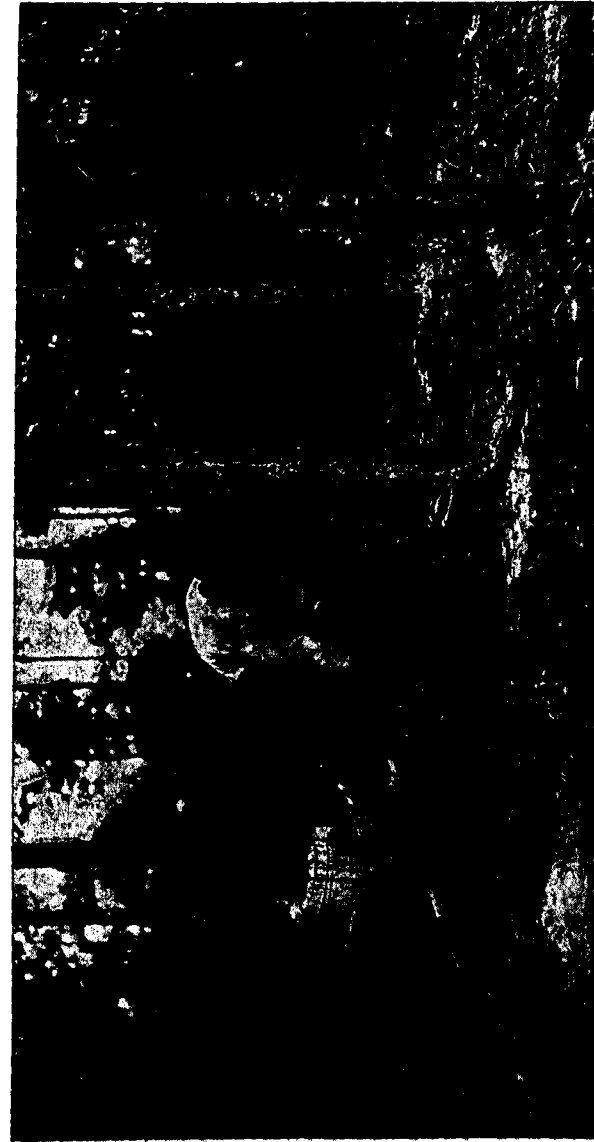
The naval stores industry originally tapped the resin from standing trees by the crude method of cutting a "box" in the base of the tree. Into this "box" the resin flowed from a series of chipped areas or "faces" which progressed weekly up the stem of the tree, until they extended beyond reach of the workman's tool. From the box the "gum" was dipped by wooden paddles into a convenient container and taken to the nearest turpentine "still" where, by crude distillation, the turpentine oil was separated from the residual rosin.

As practiced in early days, this method of "boxing" was very destructive to standing timber. This was due in part to fires which burned in the resin-soaked "boxes" and spread up the tree, in part to windfall of weakened trees, and in part to insect damage. Early in the history of the Forest Service Dr. C. H. Herty perfected a clay cup which is hung

by a nail at the apex of two galvanized iron gutters; this obviates the destructive "box" and, what is still more advantageous, increases the quality both of the resin obtained ("virgin dip") and of the resulting turpentine and rosin by the simple expedient of raising the cups above the old "face" of the previous season.

Since the time of Dr. Herty's work, further improvements have been made in the cup-and-gutter system. The McCoy cup and apron is commonly used. This is a galvanized iron or aluminum trough, resembling a bread pan in shape, which is suspended on a nail or on a wooden peg and which carries with it an apron of metal to catch the flow of the resin. More important, however, are the modifications introduced by the Forest Service in its administration of the Florida National Forest with respect to (1) the diameter limit of trees to be cupped, (2) the height, and (3) the depth of the weekly chip.

(1) It has been common commercial practice to box or cup trees of all sizes, even the smallest. This has led to the destruction of the very trees on which the future forest depends. In the Florida National Forest no trees are cupped unless at least ten inches in diameter at breast height (d.b.h.); only two cups are allowed on trees eighteen to twenty-three inches d.b.h.; while three cups is the maximum permissible on trees twenty-four inches d.b.h. or over. The working period is seven years in length and is followed by a rest period of from one to three years, during



(Photo by courtesy U. S. Forest Service.)

FIG. 9. CHOCTAWHATCHEE NATIONAL FOREST.

Longleaf pine in Florida managed for the production of resin and timber.

which the trees are allowed to recuperate. Then "back cups" are permitted between or next to the old faces for a period of seven or eight years. Trees eighteen to twenty-three inches d.b.h. are "back cupped" on one face; those twenty-four inches or over carry one and possibly two "back cups." A four-inch "life-bar" is left between the faces. This completes the working of the tree for turpentine. Expressed in years: three years virgin cups, plus four years high face cups, plus three years back cups, plus four years high face cups equals fourteen years of actual working.

(2) The height of the weekly chip or "streak" is controlled so that the working limit of height is no longer reached in three or four years; the weekly chip is now raised only one-half inch weekly (32 streaks per annum, 16 inches per year) with the result that only four feet of face are covered in three years of working.

(3) Similarly, deep chipping was found to produce not more, but less, resin, for the formation of resin ducts is best stimulated by wounding the tree lightly. These "traumatic" resin ducts form directly under the cambium, or living layer, immediately under the wood, and a deeper chip serves no useful purpose. Shallow chipping (to a depth of one-half inch) does not weaken the tree appreciably and has the added advantage of obviating the waste of valuable wood. One-half inch is, accordingly, the maximum depth of a permitted streak. The Forest Service in its turpentine con-

tracts also controls the width of the individual face, and stipulates that none shall exceed twelve inches.

A comprehension of these technical details is necessary to an understanding of the application of forestry to the longleaf pine of the Florida National Forest. The number of available "cups" or "crops"¹² are as carefully estimated as is the timber. A limited number of cups are permitted each year and the working is strictly safeguarded by the provisions set forth above, together with restrictions regarding fire (raking around the trees, fire lines, etc.) and grazing of cattle and hogs. The result on the Florida National Forest has been to make naval stores the primary source of income; timber has become a secondary consideration. No trees are cut (unless dead, diseased, or otherwise defective) until they have been completely worked for turpentine, and only trees of mature size are tapped.

It is a remarkable instance of eating one's cake and keeping it; the trees thus carefully worked for turpentine for a period of fourteen years are thereafter logged with equal care to preserve the trees of small size and the young growth. The result is a thrifty, growing forest which will, in turn, be ready for turpentine by the time the entire forest has been worked over. The forest now sustains naval stores operations to the extent of three hundred thousand cups.

This application of forestry to government land in the

¹² A "crop" is the equivalent of ten thousand cups.

southern pine belt is being extended to private land by farsighted owners. With the return of turpentine to the pineries of the Carolinas it is of special importance as safeguarding the future of these forest areas. Its adoption is an outstanding achievement of conservative management.

2. STATE AND PRIVATE FORESTS

A. *The State Forests of Pennsylvania*.¹³ — It is not possible to choose a better example of state forestry than that applied in Pennsylvania, where is combined, to an unusual degree, production of wood, control of floods, safeguarding of water supply, and the assurance of a health-giving environment with adequate outdoor recreation. As State Forester Illick says: "On this broad and purposeful basis, the State Forests of Pennsylvania were created and in accordance with these sound principles they are being administered today."

The state forests of Pennsylvania comprise somewhat more than a million acres acquired over a period of twenty-five years. Previous to that time, reports show that Pennsylvania was becoming more and more dependent upon outside sources for wood supplies. With the rapid depletion of her forests, millions of acres of idle land accumulated; for of the land area of Pennsylvania, thirteen million acres (45 per cent) are suited primarily to the growing of forest

¹³ Based on Bulletin 37 of that title, by J. S. Illick, State Forester of Pennsylvania, revised 1927, Harrisburg, Pa., p. 59.

crops. These are the lands the state is seeking to acquire with the intent of restoring idle forest land to production. As a result, the state forests are concentrated in the mountainous parts where the land is best suited to raising successive crops of forest trees.

The state forests are administered by the Department of Forests and Waters headed by the Secretary and the Deputy Secretary, the latter being State Forester. The forestry work is handled by the Forest Service functioning through the following seven bureaus: (1) Forest Protection, (2) Forest Management, (3) Forest Parks, (4) Forest Extension, (5) Lands, (6) Technical Education, and (7) Research and Information. The state is divided into twenty-four forest districts, each in charge of a technically trained District Forester; in some of the districts there is also an Assistant District Forester. These are supported by Forest Rangers and other helpers. In July, 1928, there were fifty-three technical foresters and seventy-three forest rangers. In addition, there are almost four thousand forest-fire wardens who take an active part in the prevention, detection, and suppression of forest fires. A hundred lookout towers facilitate the detection of this menace.

Unlike the forests of its sister state of New York,¹⁴ those of Pennsylvania are administered for the greatest benefit of all the citizens of the commonwealth. This results in

¹⁴ See Recknagel, A. B., *The Forests of New York State*, New York, The Macmillan Company, 1923.

bigger and better forest crops and a full measure of other benefits for the people. All that is required of the people who desire recreation only is that they use the forests and the equipment thereon wisely and in the interest of the public welfare. More than two thousand miles of roads and approximately twenty-seven hundred miles of trails have been developed. Telephone lines now reach out to practically all remote forest regions. Hunting and fishing are fostered.

Most interesting of all (in contrast to the "kept-forever-as-wild-forest-land" prescription of New York's constitution), there are more than one thousand permanent camp sites on the state forests, which are leased by citizens of the state at an annual rental of seven to fifteen dollars. More than four hundred acres are thus leased, and these produce an annual revenue of over thirteen thousand dollars. Mr. Illick estimates that nearly a quarter million people, particularly those of moderate means, used these camps last year. The duration of a camp site lease is ten years and it carries with it the privilege of renewal. In addition, there are now thirty-eight public camp sites maintained by the state; these are equipped with fireplaces, tables, benches, comfort stations, and garbage containers. The water supply is examined by state officials, and no charge is made for the camping privilege. Since most of the state forest lands are developed for wood production, areas of singular beauty and unusual interest have been set aside as state forest monuments.

Already there are nine of these, ranging in size from thirteen to three hundred and fifty acres. There are also, within the state forests, seven state forest parks.¹⁵ These are outdoor play places, and average one hundred and fifty acres in size.

Most of the forest land when purchased was devoid of tree growth; the necessity for planting a new crop of trees was apparent. The state operates one large central nursery, with a capacity of ten million trees yearly, and seven coöperative nurseries for producing stock for planting purposes. In addition, four forest tree nurseries are operated on state forest lands. Recent inventories showed almost fifty million trees in all these nurseries; from them have gone out, during the last twenty-seven years, over thirty-six million trees for planting on the state forests at an average cost of \$9.51 per acre. "As a result . . . there are now growing in the state forests," says Mr. Illick, "approximately twenty-four thousand acres of thrifty plantations of white pine, red pine, white ash, red oak, white oak, black walnut, and many other important forest trees." He adds: "These plantations are among the best and most practical object lessons in forestry."

Private forestry has not lagged behind; during the last seventeen years over fifty million trees have been planted on privately owned lands in Pennsylvania.

¹⁵ See Shoemaker, H. A., and Illick, J. S., *In Penn's Woods*, Bulletin 31 (revised edition), Harrisburg, 1925, p. 86.

There have been no fires on the forest during the past 15 or 20 years and no land has been cut clean in that period: previously much of this land was cut for cordwood used for charcoal in the iron and brass industries of the Naugatuck Valley. The major forest types are softwoods, hardwoods, mixed hardwoods, and oak ridge. Together these types cover 87 per cent of the area. Less than 10 per cent of the land has ever been farmed. The total timber content of the forest is two and one-third million board feet with twelve thousand cords additional of cordwood. Only 7 per cent of all the trees are over twelve inches d.b.h., yet over half of the wooded area has a growth between forty and sixty years of age—a growth which sprang up naturally after the clear cutting of the old charcoal days. The average annual growth per acre is nearly three-tenths of a cord. Says Mr. Hawes:

If the growth had been studied twenty years ago, before the appearance of the chestnut disease, it would undoubtedly have been much greater; for it was not uncommon in those days for our forests to grow one cord per acre per annum. . . . But it is probable that the thinning resulting from the death of the chestnut is producing a better growth at present. Therefore these growth figures should not be taken as indicative of the growth of the forest in the future under proper management.

The rate of reproduction is generally satisfactory, and this is due to recent freedom from fire. Consequently, planting is necessary only in the old field type of 59 acres; suit-

able open areas of 26 acres have already been planted. According to Mr. Hawes:

Planting is of relatively little importance in this forest. By proper cutting the forest will reproduce itself. The forester's skill is required so to regulate this reproduction that the percentage of valuable species will be greater in the next generation.

Special effort will be directed in this forest to securing an increased proportion of white pine, hemlock, white ash, tulip, and red and white oak. Owing to the fact that small white pine cannot compete with a dense growth of hardwoods the opportunity for increasing the percentage of this species is limited to the more poorly stocked stands where there happen to be enough pine to leave for seed purposes. Large spreading-topped trees produce the most seed and should be left until the ground is well seeded.

The expense of converting hardwood forests to pine forests is too great to be practiced on a large scale, even if it were desirable. Since hemlock produces more lumber than oak in a given period, a controlling object in the management of the People's Forest will be the gradual increase of hemlock in certain of the hardwood stands by natural means. . . . One to ten hemlocks per acre . . . produce a continuous under story beneath the hardwood. . . . When this hemlock upper story is cut, the under story of hemlock will develop into a pure hemlock forest. There are considerable areas in this forest which should be treated in this way.

This state forest is being managed in order to produce timber for Connecticut industries, to yield a revenue to the state, to protect the wild life, to protect the water

Little was done to control forest fires prior to the time that the state began to acquire forest land. Now the organization includes not only efficient protection against fire, but also adequate protection against insects, fungi, and other destructive agents. Special efforts are made to safeguard and increase the water supplies originating in the state forests. Seventeen municipalities derive their water supply from watersheds wholly or more than half within the state forests.

The state forests of Pennsylvania are handled as a business enterprise. Though most of the trees are still immature, the total receipts from the state forests during the last twenty-seven years have been more than six hundred and thirty-nine thousand dollars. In all of these forests one can see marked improvements of forest growth. From an average price of \$2.26 per acre the value has risen to \$12.50 per acre and the future has still better returns in store.

Summarizing the great change which has taken place, Mr. Illick says:¹⁶

The commonwealth's program of forest restoration, including protection, planting and many other activities, is bringing about a great change. When the commonwealth's lands were acquired most of them were in a devastated condition. Lumbermen had completed the removal of practically all the merchantable material. What little and inferior material was left from lumbering operations

¹⁶ "The State Forests of Pennsylvania," *loc. cit.*

was consumed by destructive forest fires. Under state ownership these lands have been changed from barren mountainsides to productive forests. In place of desolation there are now promising stands of thrifty trees that in time will produce valuable wood. Areas that were formerly stocked with inferior trees are now occupied by important timber trees. Most of these trees are still small to medium size, but with adequate protection and care they will grow up into valuable stands and be a big factor in supplying the wood that the people and industries of Pennsylvania need.

B. *The Peoples' Forest of Connecticut*.¹⁷ — In the Litchfield Hills, on the west branch of the Farmington River, is located the Peoples' Forest of 1200 acres, so called because given to the State of Connecticut by interested citizens. According to Mr. Hawes:¹⁸

This forest is a portion of the region known in old times as the "Greenwoods" because of the large amount of hemlock and pine in mixture. . . . The historian Barber said in 1836: "The mountains and hills were formerly covered with excellent timber consisting of oak, chestnut, sugar maple, beech, pine, and hemlock; a considerable proportion of which has been destroyed by wind and fire, and by the axe, under a system of improvidence, at a time when timber was considered of no value." It is, therefore, probable that most of the virgin timber, except on the steepest slopes, had been cut before the Civil War.

¹⁷ Based on the pamphlet, *The Peoples' Forest*, by Austin F. Hawes, State Forester of Connecticut.

¹⁸ *Ibid.*, p. 12.

supplies, and to furnish a recreational area. Accordingly, the following principles of management are laid down:

Protection against fire, insects and disease shall be provided. There shall be no clear cutting except for purposes of "salvage."¹⁹ An attempt shall be made to increase the valuable species, such as pine, hemlock, white and red oak, white ash, and tulip. Annual cut shall be kept well below the annual growth (three hundred cords or its equivalent), so that the growing capital can accumulate. The forest shall be kept open for public recreation, camp sites, and other popular uses.

Aside from the problems of *silviculture* already described, the immediate task of management will be to cut over the area bearing trees more than one hundred years of age (the adopted rotation) in order to make it more productive and to increase the area of the first "age class." Next, by reproduction cuttings made during the next ten years in all stands eighty years or more in age, "by the time the final cutting is made at age 100 years, the ground will be well covered with desirable reproduction."

The following table makes clear the abnormal "distribution of the age classes" on the twelve hundred acres of forest:

¹⁹ "The only cuttings made since state acquisition have been of this nature. Over six thousand fence posts and four thousand fence rails have been sold from the dead chestnut, and a contract has been made for the remaining trees." — A. F. Hawes.

Age Class	Years	Actual (acres)	Normal (acres)	Deficit (-) or Surplus (+) (acres)
I	1 to 20	150	240	(-) 90
II	21 to 40	140	240	(-) 100
III	41 to 60	700	240	(+) 460
IV	61 to 80	160	240	(-) 80
V	81 to 100	10	240	(-) 230
...	Over 100	40	...	(+) 40
	Totals	1200	1200	.....

All but Class III are deficient in area and it has three times the area it should have. This condition will be remedied as time goes on.

C. Adirondack Holdings of Finch, Pruyn and Company.

—The Adirondack Mountains of northern New York are a part of the great North Woods. Here logging has been practiced since the earliest days.²⁰ At first only white pine and spruce were taken for sawlogs, later hemlock also was cut—chiefly for tan bark, and later for logs,—and still later the hardwoods (beech, birch, and maple) were harvested, though to a less degree than the softwoods. Early logging in the Adirondacks was of the selective or "culling" type, whereby only occasional trees of the desired species and sizes were cut. But methods of cutting changed materially with the rapid development of the pulp and paper industry in the present century. Trees of smaller

²⁰ Cf. Fox, William, *History of the Lumber Industry in the State of New York*, United States Forest Service Bulletin 34; Recknagel, A. B., *The Forests of New York State*, New York, The Macmillan Company, 1923, Chap. III, pp. 25-32.

size can be utilized for pulpwood and, as a result, first the spruce and later the balsam fir and hemlock were cut to diameters as low as six inches on the stump. The result has been virtually clear cutting and a change in the Adirondacks' forest cover from "black" (conifers) to "green" (hardwoods).

Meanwhile, economic conditions, particularly the competition of southern and (lately) of west coast lumber, have caused the *lumber* industry in the Adirondacks to dwindle while speeding the ascendancy of the *pulp* industry until, today what was the "tail" is, in a very real sense, "wagging the dog." Of the softwoods cut today in the Adirondacks, over 90 per cent go into paper manufacture.

Transportation of softwood logs in this region is still effected chiefly by river driving, but a marked change has come through the practice of cutting logs into four-foot lengths and "sluicing" them down the stream in place of the former and more romantic methods of "driving" larger and longer logs. Logging practice has also been modified by peeling the bark from the pulpwood in the early summer; thus the winter operations are confined to hauling by sled over the snow. Here, too, tractors are replacing teams and "romance with its glitter has fled."

These modifications have proven detrimental to the forest, and the heavier cut of softwoods has raised to an acute point the problem of replacing the conifers. They have been beneficial to the forest in securing closer utilization of



(Photo by D. W. Sowers.)

FIG. 10. TYPICAL ADIRONDACK SPRUCE FOREST.

Mature trees will be cut under the provisions of the working plan adopted by Finch, Pruyn & Company, the owners of this property.

what is cut and especially in developing a stable industry which, unlike the migratory lumber business, remains in one location and must be sure of a continuous supply of its vital raw material — wood.

Outstanding among the Adirondack timberland owners who have developed an adequate forest policy for their holdings, is Finch, Pruyn and Company, Inc., of Glens Falls, N. Y. Originally a lumber company interested primarily in stocking its sawmill with logs, it now no longer makes any lumber, but is foremost among manufacturers of newsprint paper, not in quantity produced, but in quality and in "efficiency of manufacture."²¹

This efficiency reaches back to the woods and constitutes one of the best examples of progressive forest management by a private owner. The description which follows is based on the address by Mr. George N. Ostrander, head of the Woodlands Department of Finch, Pruyn and Company, before the Conference on Commercial Forestry held in Chicago in November, 1927, and published in the proceedings thereof.²²

In 1910 the company owned about one hundred thousand acres in the central and eastern Adirondacks, all of it on the watersheds of the upper Hudson River. Forestry had

²¹ "See Austin Cary's foreword to article by H. L. Churchill on "Girdling of Hardwoods to Release Young Conifers," in *Journal of Forestry*, October, 1927, Vol. XXV, No. 6, pp. 708-714.

²² "Natural Reforestation of Pulpwood," Geo. N. Ostrander, pp. 52-58 of Report of the Conference on Commercial Forestry, Chamber of Commerce of the United States, Washington, D. C., 1928.

not as yet been practiced on the land; even its character and growth were known only in general terms. In 1911 the company employed Mr. Howard L. Churchill as forester; he has been with them continuously since that time. He "cruised" and made accurate maps of the timber areas, showing forest types, areas logged, and the date of each logging. On the basis of this forest survey, he prepared a working plan — the first effective document of the sort in the state of New York.

Meanwhile, the company had expanded its timber consumption and it was evident from the data available that the forest could not meet the drain upon it without early exhaustion of the stand. Reforestation (planting) did not promise an economic solution of the problem because of uncertainties of cost and yield. Therefore, the company adopted a policy of natural reproduction and sustained yield, defined by Mr. Ostrander as "a policy of forest management which balances the annual cut and the annual increment of the forest."²³ Acting on this policy, the company increased its holdings in the Adirondacks to two hundred and forty thousand acres. It also acquired cutting rights on forty thousand acres in Quebec, which supplied half of the wood required by the mill; the other half was bought in the open market. In this manner, Adirondack holdings were afforded the opportunity to recuperate.

In 1923 a thorough study of the growth of spruce and

²³ *Ibid.*, p. 54.

balsam was made on the company's land; ²⁴ a "cruise" to compare current conditions with those in 1910 was also undertaken. The following table gives a summary of the results:

Forest Type	Acres	Spruce		Balsam	
		Total Volume in thousand cu. ft.	Annual Growth in thousand cu. ft.	Total Volume in thousand cu. ft.	Annual Growth in thousand cu. ft.
Hardwood.....	119,406	40,729	905	5,803	232
Spruce Flat.....	31,259	22,321	366	11,449	393
Spruce Slope.....	27,904	44,955	987	7,937	204
Swamp.....	3,025	1,150	32	1,834	53
Totals.....	181,594	109,155	2,290	27,023	882

In terms of cords (at ninety cubic feet per cord), this annual growth of spruce amounts to a little more than twenty-five thousand cords or slightly over 2 per cent of the spruce-wood capital; of balsam it amounts to nearly ten thousand cords, or $3\frac{1}{4}$ per cent of the balsam-wood capital. The total yearly growth of thirty-five thousand cords of pulpwood is almost sufficient to meet the mill requirements, and additional wood is obtained from the company's holdings in Maine and Vermont and in the open market.

Thus the company is definitely on a basis of sustained yield; its silvicultural practices provide for cutting only the larger and more mature spruce, and there is retained an adequate supply of smaller trees for purposes of reproduc-

²⁴ For description see *ibid.*, pp. 55-57, also *Journal of Forestry*, Vol. XXV, No. 1, January, 1927, p. 85.

tion and for a second cut. Girdling of the residual hardwoods on softwood land, while as yet experimental, promises to accelerate the reproduction of desirable spruce and balsam.²⁵

Fire prevention is adequately provided by the lookout and ranger forces of the State's conservation department, and additional patrols are maintained at times of special hazard. Lopping of softwood tops (to three inches) is a state requirement and provides an undoubted factor of safety. Furthermore, the foresters of the company not only select and mark all trees previous to cutting, but also designate the proper stump heights; this greatly reduces loss through careless and wasteful logging.

Finch, Pruyn and Company present an outstanding example of private forestry practice. To this is coupled the possession of an enviable position in the business world. Since, as Mr. Ostrander says in concluding his paper,²⁶ "the circumstances under which the policy of timber acquisition was successfully completed may not be duplicated except in a very limited number of cases, the sustained yield basis is the solution of the problem of wood supply for the paper industry in the Northeast." He adds prophetic words: "Eventually wood consumption and yield must balance. If forest management can't make the balance, paper production must."

D. The Goodman Lumber Company of Marinette,

²⁵ Cf. H. L. Churchill in *Journal of Forestry*, October, 1927, Vol. XXV, No. 6, pp. 711-714.

²⁶ P. 58, *ibid.*

*Wisconsin.*²⁷ — Just as Finch, Pruyn and Company in the Adirondacks reached the conclusion that in operating on a basis of sustained yield lay the solution of their problem of wood supply, so the Goodman Lumber Company, logging the northern hardwoods of Wisconsin, decided on the commercial practicability of developing their operation on the basis of sustained yield.

The Goodman Lumber Company, like others in the region, have been "period operators": that is, they have purchased "stumpage," logged it, and then proceeded to other operations. The reasons for the change from a basis of period operation to one of sustained yield are purely economic. In the first place, the mill can operate economically on a yearly cut of from eighteen to twenty-two million board feet of logs together with the by-products of hardwood for distillation, and softwood for pulp. To stock such a mill requires eighty thousand acres of timberland with an average yearly growth of 250 board feet per acre ($80,000 \times 250 = 20,000,000$). By 1960 the virgin timber will have been cut, and thereafter the crop will come entirely from smaller, second-growth trees. Improved utilization will make such trees merchantable, but it will require modification of the mechanics of logging and manufacturing.

The cutting cycle (period of return for logging the same area) will vary from ten to thirty years. Barring fire or insect

²⁷ Based on Mr. R. B. Goodman's address before the Conference on Commercial Forestry, *Journal of Forestry*, Vol. XXV, No. 8, December, 1927, pp. 954-965, entitled: "The Commercial Practicability of Sustained Yield in Northern Hardwood."

damage, there will always be a stand of younger timber to grow to merchantable size at the time of each successive cutting. Studies based on present market conditions²⁸ indicate 13½ inches d.b.h. as the present minimum merchantable tree in northern hardwoods. By 1960 this, due to changing conditions of conversion and marketing, will be 12 inches d.b.h.

Based on operating experience of the years 1924-1926, the net annual income on the annual cut of twenty million feet was \$139,000. Capitalizing this income at 6 per cent gives a value of \$2,316,667 which capitalizes each of the eighty thousand acres contemplated, at an average of twenty-nine dollars. Therefore, the company must seek to acquire a block of approximately eighty thousand acres at a cost not exceeding twenty-nine dollars per acre and must induce other owners tributary to the block to adopt such methods of forest management as will complete the aggregate. This the company proposes to do as follows:

(1). Present ownership of forest suitable for selective cutting under sustained yield	40,000 acres
(2). Additional purchase of similar land	5,000 "
(3). Land now cut-over requiring thinning and for planting	15,000 "
(4). Adjacent woodlots tributary to operation, but in alien ownership	20,000 "
Total	80,000 acres

²⁸ See especially Zon and Garver, *Selective Logging in the Northern Hardwoods of the Lake States*, Northern Hemlock and Hardwood Manufacturers' Association, Oshkosh, Wis., 1927, 23 pp.



(Photo by courtesy of R. B. Goodman.)

FIG. II. HARDWOOD FOREST.

On lands of the Goodman Lumber Company at Marinette, Wisconsin, selectively logged. Fifty per cent of the sawtimber has been removed.

(1). On the forty thousand acres, the first cutting cycle of ten years specifies a flexible diameter limit of twenty inches d.b.h.²⁹ and a cutting of *one-half* the timber, or five thousand feet per acre. Thus the annual cut from this area is twenty million feet.

At the end of this ten-year cycle the four thousand acres cut in, say, 1928 will have grown 250 feet of additional timber per acre so that seventy-five hundred feet per acre are available by 1938 for a second cut (5,000 feet + [250 feet $\times$ 10 years] = 7,500 feet). At the time of this second cut, 3,875 feet per acre must be left, so that the amount cut per acre at the time of the second cut in 1938 will be 3,625 feet (7,500 - 3,875 = 3,625). This second cut will take in trees as small as fourteen inches d.b.h.³⁰ At the end of the second cutting cycle of ten years the growth of 250 board feet per acre yearly will have produced, for the forty thousand acres, a total of 205 million feet of standing timber of all

²⁹ The first selective cutting to a flexible twenty inches d.b.h. limit to remove approximately 50 per cent of saw timber by volume has been determined by analysis of grades and market values to produce approximately 70 per cent of the value of lumber product per acre. The increased cost of logging half instead of all of the saw timber per acre can only be accurately determined by logging and milling practice; careful studies lead to the conclusion that the net increase in cost of production will be less than 20 per cent and this is offset by an increase of 40 per cent in the value of the (larger, better) trees removed.

³⁰ The increased value of this product compared with the clear cutting from trees ten inches d.b.h. and up (the prevailing commercial practice) is found to be 20 per cent; the increased costs in the second cutting, the railroad grades being all in place for the second laying of spur tracks, is only 10 per cent, a net gain of 10 per cent.

size classes up to about fourteen inches d.b.h. This is the commercial sustained yield, the capitalized value of which at 6 per cent is approximately twenty dollars per acre.

When the company has proceeded with selective logging, cutting to smaller diameter limits in each cycle, it will, eventually, remove all merchantable trees to the twelve inch d.b.h. limit. This tract of forty thousand acres will then be on the sustained yield basis and it will have more than paid its way in the process. The work of fire prevention, supplementing that of the state fire wardens, will consist of erecting lookout towers, maintaining fire-fighting equipment and seasonal patrol, and educating the public.

Slash disposal is accomplished by the removal of all bodywood (to 4 inches) for cordwood, and the choppers are required to lop down the remaining small branches and brush so that in two or three years it will have rotted completely.

(2). The additional area of five thousand acres to be acquired will be treated in the same manner as the main block of forty thousand acres. This is necessary since, for the second cycle of ten years, the cut from the main block will be only 14,500,000 feet ($3,625 \times 40,000$ acres).

(3). The fifteen thousand additional acres to be "reforested" are, in part, covered with young growth which needs to be thinned; other parts require planting to produce commercial species. After the initial thinning or planting, pro-

vided fire prevention measures are adequate, the investment will develop of itself.³¹

(4). The development of forest growth on the twenty thousand acres of "alien" woodlots is facilitated, for there is no other use to which the land can be put. Adjacent mature timber will be cut by its owner selectively when he learns that selective cutting is more profitable. In a few years, what are now innovations will have become approved practice.

E. *The Great Southern Lumber Company*.—A few years ago, before the gigantic sawmills of the Northwest were built, the town of Bogalusa contained the world's largest sawmill. Here a cut of one million board feet of lumber was an everyday occurrence. Southern yellow pine—chiefly the longleaf pine (*Pinus palustris*)—was the material from which the famous "Bogalusa pine" boards and timbers were produced.

The head of this concern is Colonel A. C. Goodyear of Buffalo, whose wide business experience and broad intellectual background gives him vision beyond that of most lumbermen. He recognizes that, within thirty to thirty-five years, the so-called virgin forests of the South will be no more. Despite the constant natural re-growth of southern pine, the supply will diminish and, as Colonel Goodyear puts it: "With diminishing supply, history shows, there

³¹ Mr. Goodman figures that the reforestation costs involved would be less than the increase in income from selective cutting (as opposed to clear cutting) of the remaining virgin timber. This conclusion, he feels, applies only to all-aged, mixed hardwood forest operations.

comes a diminishing demand for any species of lumber; satisfactory substitutes are found."³² As in many another forest region, complete utilization is the criterion of successful forestry practice in the southern pineries, but, as Colonel Goodyear says, "complete utilization implies large investment in plant and large reforested areas under a single ownership or tributary to such plants."³³

Acting on this belief, the Great Southern Lumber Company has developed its forestry practice in the mill and in the woods. In the mill it has supplemented lumber production by erecting two large paper plants (producing high-grade Kraft from sulphate pulp of the yellow pine wood formerly burned as sawmill refuse). Only the best of the refuse can be used in this way, but the remainder is no longer burned (except as needed for fuel to run the mill); it is treated for the extraction of turpentine, pine oil, and other by-products. The company maintains a fully equipped laboratory for experimental work, believing that "to the chemist and mechanical engineer we must look for the future success of wood utilization and commercial reforestation."³⁴

In the woods, the forestry department of the Great Southern Lumber Company has, on its vast holdings, "refor-

³² Colonel A. C. Goodyear, as reported in the Proceedings of the Third Annual Meeting, National Committee on Wood Utilization, Washington, D. C., May 4 and 5, 1928, pp. 4-6 (Mimeographed).

³³ *Ibid.*, p. 5.

³⁴ *Ibid.*, p. 6.

ested about 18,000 acres by setting out small nursery-grown pine trees, about 1000 per acre. Altogether, it has some 140,000 acres of land, mostly well stocked with a young pine forest."³⁵ Local farmers have coöperated in keeping the land not suitable for agriculture continuously at work growing trees; the company guarantees to purchase these, when mature, at a fair market price.

An adequate supply of seed trees is left on the land which is cut over. Fire prevention is practiced by patrol, by fire lines, and (perhaps most important of all) by educating the local population away from ubiquitous burning toward a realization that fires mean loss for everyone. Against the razorback hog, to which the root of the seedling is a tempting morsel, the "only protection is a horse-high, bull-strong, pig-tight fence."³⁶ Such fences, well built and well maintained, are part of the company's forestry practice.

It is the plan of this company to make periodic thinings, first for charcoal, and some years later for pulpwood. At the end of thirty-five or forty years, the trees will be cut for lumber and then a new cycle will be initiated.

Thus the broad forestry plan of this progressive company means continuous forest growth, continuous utilization, and continual development of by-products in both the paper and

³⁵ J. K. Johnson, Forester, Great Southern Lumber Co., in "Growing Pine Timber for Profit in the South." Forest Service, U. S. Department of Agriculture, Miscellaneous Publication 24, 1928, p. 13. See also note by P. C. Wakeley, p. 15 of the *Forest Worker* for July, 1928 (Vol. 4, No. 4).

³⁶ Colonel A. C. Goodyear in "Report of the Conference on Commercial Forestry," Washington, 1928, p. 31.

pulp mills and the sawmill. Their slogan is: "We are going to grow a new forest, let the future be what it may."

In looking over the foregoing examples of applied forestry, one is impressed with their variety — not only variety of natural conditions encountered, but variety of purposes to be achieved by forest management and variety in the means employed to reach these ends. This lesson is perhaps the most important that forestry can teach: there is no best practice which can be categorically prescribed; for each forest has its own problems, which can be solved only by a knowledge of local conditions. Yet throughout there runs, like a golden thread, the central thought that the practice of forestry means continuous production and perpetuation through wise use of all forest resources.

CHAPTER VII

RECONSTRUCTION

Just as it is highly important for the forest industries to work more actively on a program of maintaining their industry permanently, so it is vital for the nation and the states to focus their vision on reconstruction work rather than on depletion. The framework of our forestry structure is up and it calls for vigorous continued work by the builder rather than a recall of the architect to draw new plans and specifications. Such changes as are necessary may be worked out by way of alterations as the work of construction proceeds.

The day of second-growth forests is here, particularly in the eastern part of the United States where the greater portion of our forest area lies. These lands, in some cases for long periods, have been furnishing useful forest products and contributing in the aggregate a very considerable amount to the annual cut.

Logging the first-growth and merchantable stands that followed these has not necessarily wrecked the land for future natural production. If it had done so there would be no second-growth stands such as one sees on every hand today.

A single ensuing fire after logging has altered the vegetation temporarily in coniferous stands of the Northeast and has increased decay and death of trees in hardwood stands; repeated fires have greatly lengthened the necessary period of natural restoration so that on areas of considerable aggregate extent complete reconstruction of the stand may be required.

Grazing of farm woodlands in the central hardwood region is more damaging than the most drastic logging operation. On the former, nothing of value follows a cut of all merchantable material; on the latter, a reasonably dense growth of seedlings and sprouts springs up if fire is excluded. The process of culling the forest of the best species (the only ones for which there was a market) has handicapped the natural renewal of these valuable elements and a continuance of the process in the same forest has, in many instances, degraded it. Under-stocking and an increase of so-called inferior species constitute changes wrought by such logging.

"First aid" to be applied to our cut-over lands and to our young, actively growing stands should consist of the prevention of fire, and of the complete exclusion of grazing from our eastern hardwood forests in all stages of growth, in the early period of development of young pine stands, and especially in the reproduction period. What determines the treatment, or the reconstruction work following first aid? Whether the patient can pay or not; that is to say,

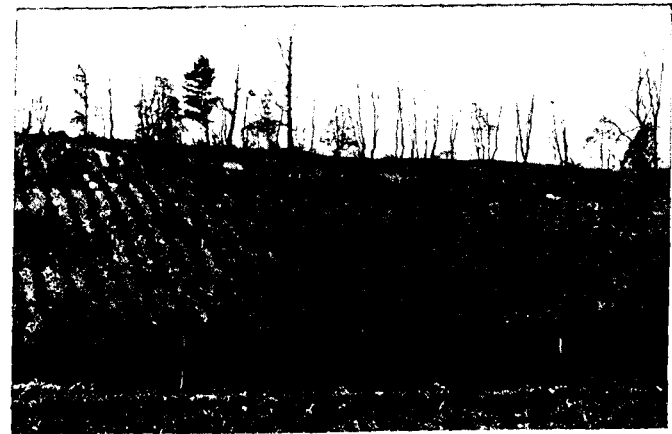


FIG. 12A. CORNELL UNIVERSITY FARM.
Plantation on a steep hillside formerly used for pasture.



(Photo by courtesy of O. G. Agne.)

FIG. 12B. IN JEFFERSON COUNTY, NEW YORK.
A profitable cordwood operation for the improvement of second growth hardwoods on the farm wood lot.

whether it can return a profit on the expense of initiating certain cultural operations that aid nature. These comprise giving the better species a place in the light, eliminating undesirables, and taking out the defectives. Such is the work on farm woodlands for which the Clarke-McNary Act furnishes the means of stimulation. Economic market studies of disposal of fuel, special products, low grade material, and the like must aid here.

Permanency of ownership of forest tracts dictates the adoption of treatment that will enhance future merchantable value in quantity and quality of yield, but only on the basis of profit. Intensive practice where market permits is postulated on the theory that increased expenditures will bring in commensurate returns by the time the final cut is made. In the beginning, however, the idea of intensive treatment should give place to practicable, attainable results based on local conditions of forest, on costs of logging and transportation, and on market prices.

Reconstruction does not imply undertaking a whole series of expensive cultural operations. Let it be clearly understood that there will be a yield if only the inescapable costs of protection from fire and of fair taxes are covered. That alone will bring thousands of undamaged acres to a useful maturity. Beyond this, as economic conditions improve, silvicultural treatment to aid nature in reconstruction will rapidly follow. The greatest deterrent, however, to the present application of such constructive silviculture to improve

coniferous forests and to secure regrowth is the present overproduction and competition of relatively cheap virgin timber in the West. With broadleaf forests the greatest difficulty is the profitable disposal of small products and low-grade material.

Areas which have been logged over and subsequently subjected to fire present widely varying conditions. In comparison with the previous heavy stands, as of pine in the Great Lakes states, the present growth is aptly termed "brush." Must the forest, then, be reconstructed upon many millions of acres by forest planting? The authors of this book believe that the estimate of acreage of "land not restocking," commonly quoted as 81,000,000, cannot be substantiated. Much natural restoration has been overlooked or discounted as to its ability slowly to restock the land. Nevertheless, both in the South and in the Great Lakes states there is a large area of land that only seeding and planting can renew.

Only by detailed economic survey can a state safely make its plans for the reconstruction of such areas; furthermore, a sound advance planting program is essential. In Menominee County, Michigan, it was discovered by economic survey of the land (see Appendix, p. 224) "that 94.4 per cent of the forest area will make satisfactory forest without other help than fire prevention." This is not conclusive, but it is suggestive of what careful field studies may reveal.

A planting program involves a huge burden in the

expenditure of time and money. It is wise to protect and to leave to natural processes those lands that give fair promise of restocking themselves. Where the proportion of valuable species is extremely low or the prospects are of idle, desolate lands for an indefinite period or for all time, reconstruction of the forest by federal, state, county, and municipal planting is admittedly in order on cut-over lands, sub-marginal for settlement. The work on such strategic areas alone constitutes a large program for all agencies to undertake.

In the northeastern coniferous forest old burns have furnished poplar for pulp and white birch for the spool industry; by the natural processes of succession temporary growths have given place to permanent and more valuable species of the original forest type. Some pulp companies have undertaken planting as a part of their forestry program in order to maintain production of pulpwood. It will not be possible to gauge the necessity for reconstruction work by seeding and planting in the South until education and other protective measures have minimized the annual loss of young growth by fire and until the grazing situation is better in hand. At the present time first aid measures are the order of the day and land economic survey is desirable. Beginnings have been made in several states of the South in distributing planting stock, and one large lumber company has inaugurated an extensive planting program with this end in view.

In the national forests planting is considered necessary to keep forest land productive wherever it has been denuded by fires in the past and where, consequently, the timber species will not reproduce naturally. The area to be reforested is estimated to comprise over two million acres, but this is a relatively small proportion of the whole. The total area seeded or planted in 1928 comprised more than twelve thousand acres. Evidently the appropriation for this item, although increasing, permits only of a long drawn-out program. The principal work lies in the more moist regions of western forests and in the Lake states, with a small amount of planting on burns in the eastern national forests.

In the eastern United States there exists another class of lands—the abandoned farm lands—the use of which is a matter of great concern. The chief cause for abandonment is to be found in the poor quality of the land. In the rush of settling the country, poor areas as well as good ones were cleared. This was pointed out before the Revolutionary War by a French colonist, Crèvecoeur,¹ who wrote: “Great parts of the colonies of Massachusetts and Connecticut have cost more in clearing than the land was worth.”

Changing economic conditions have since brought about abandonment on a large scale. The competition of fertile western lands resulted in the abandonment of many farms in New England during the last century. Conditions in the

¹ *Sketches of Eighteenth-Century America* by St. Jean de Crèvecoeur. Edited by H. L. Bourdin, R. H. Gabriel, and S. T. Williams, New Haven, Yale University Press, 1925.

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South during the Civil War period created a similar result. In both of these regions natural regeneration was prolific. Second-growth white pine on former farm land in New England has given rise to the local box board, wooden pail, and match industries; in the South, second-growth pine stands on former fields of the Atlantic coastal plain have been great sources of timber for twenty-five years. Logging, as for example in the pinceries of the Lake States, brought with it farming to supply the ready market and farms were operated while logging was at its height. Following the completion of utilization of the first-growth timber, the farms on poor lands were abandoned, due to the fact that their owners lacked markets and the wages consequent on work in the forest.

Abandonment of farm lands has not only been in progress for a long time but has been increasing during the last fifty years. Without going into the details of economic conditions which have been ably discussed by G. F. Warren and L. M. Vaughan² for portions of New York state, one may say that this abandonment is land classification by actual use. These abandoned lands have proven to be sub-marginal for crops and pasture. They have been tried many times and found wanting. Neither is there a prospect that such lands will be required for food production at least within a century. The problem of their future use is one

² *Farm Economics* (No. 50), January, 1928, and (No. 56), December, 1928. Ithaca, New York. State College of Agriculture, Cornell University.

that should concern the many states where this economic shift from the poor to the good lands is in progress.

The process of restoration is relatively rapid in regions of prolific natural reforestation where there are valuable species, possessing light-winged seeds, adjacent to the areas. This has in general been characteristic of New England's abandoned farms in the spruce and in the pine regions. Fields and pastures, however, may revert only very slowly to forest in the central hardwood region where the wood lots are covered with heavy-seeded species and other species which, unlike the white pine, find conditions of soil and exposed site unfavorable.

Certain areas in central and southern New York have lain idle for twenty years without attaining appreciable natural reforestation. The state has approached the solution of this problem by purchasing some of these areas with the purpose of making them public game preserves and demonstration state forests. Approximately one-third of these acquired areas of abandoned farm land are wooded, and the state is planting forests on the open areas. The rate of abandonment in New York increased from one hundred and forty thousand acres per year in 1920 to two hundred and seventy thousand acres per year in 1925; this, however, does not imply a decline in agricultural production. Statistics show that it has in fact increased in the state, but on a lessened acreage. This merely illustrates by one instance a process going on in many states. Abandonment is likely

to continue until land use is adjusted by this process; consequently the state, in its concern over idle acres, in 1928 appointed a Commission on Reforestation to study the situation and to formulate a policy and a broad program for procedure.

The use of these farms for crop and pasture having been eliminated by thorough, repeated trials and successive failures, there is left the restoration of forest use or use for recreation including hunting, and fishing of the streams. Public ownership in some form seems advisable. Bare-land forestry with non-resident ownership is least attractive. A considerable proportion of areas now abandoned originally possessed good forest, but this is not true for all. Forest soil, as is other crop land, is divisible into quality classes. Thin, relatively poor soils originally produced rather open, short-boled timber. It is quite possible that the first forest crop grown under a policy of reforestation on the poorest of these lands will be of small value, especially in view of the changed character of the land. By thoughtful selection of species the best of these lands will produce satisfactory forests if planted. They should be first to be reforested.

These planted forests will mature in from forty to seventy-five years following the period generally conceded as inevitable for the nation to adjust itself to a changed quantity and quality of raw wood material, adoption of substitutes or other modifications, unknown and unpredictable. Ample supplies of wood from this source will undoubtedly give

rise to industries to use it at maturity, and the adoption of a policy of making all lands productive therefore seems wise. But it does not help our present declining small forest industries in the eastern states to reforest land that will come into bearing far in the future.

By no means should the value of reconstruction by planting be minimized; on the contrary it should be vigorously prosecuted after thorough investigation has shown the way. There should be, however, a much greater stimulus than is at present given to the wise handling of those of our forest lands already possessing wood capital. Private initiative aided by beneficent legislation can measurably sustain supplies for today's small industries in order to build these up. The creation of industrial commissions to investigate the situation in the several states, with the coöperation of the wood-working industries, is of very great present importance and worthy of the formulation of far-seeing workable programs to increase the output of forests and maintain it. Just as a National Wood Utilization Committee has been working effectively with the states and the industry, so it is possible for a National Industrial Forestry Committee effectively to further the reconstruction of our forests, linking utilization and forest production. Knowledge of wood utilization needs to be applied in the forest as well as in the mill and in wood-working industries.

Where should the work of reconstruction be most vigorously conducted? Effective aid, in the form of preventing

and controlling fires, must be adequately given from coast to coast for every class of forest ownership, and federal, state, and private effort should be linked together to this end. Adjustment of taxation methods, advantageously based on the research now being made by the federal government, is an urgent matter for every forested state. To the end of making all land productive, the process of reconstruction by planting should be forwarded vigorously. This holds especially true for states possessing large idle areas, but the policy must be formulated with a clear understanding of the financial ability of the state, and must be so designed as to bring it to successful conclusion within a reasonable period of years.

Forest improvement and timber growing practice, including fire protection, constitute the greatest task, however, to meet our needs. Although in every forest state this phase of industrial progress is essential, yet from a national point of view the regions of most rapid growth, the Pacific Northwest and the South, have the greatest responsibility. They must continue, forever, to be great producers of a large part of the national supply of timber.

CHAPTER VIII

RESEARCH IN FORESTRY¹

It is a far cry from the appointment in 1876 of "some man of approved attainments" at an annual compensation of two thousand dollars, who was "to prosecute investigations and inquiries," to the federal expenditure of more than one million dollars in 1928 for systematic research by technically trained men who "seek the basic knowledge necessary for the successful practice of forestry in the United States."

Many studies have been made during these years but the backbone of systematic research is to be found in the work of the United States Forest Products Laboratory at Madison, Wisconsin; this was established by the Department of Agriculture in coöperation with the University of Wisconsin, which furnished the land and buildings. The body of forest research was further developed by simultaneously initiating the establishment of national forest experiment stations, and also by coöperating with other federal departments and bureaus and state and private institutions and organizations.

¹ Based on Reports of the Forester and *A National Program of Forest Research*, Committee's Report, Washington Section, Society of American Foresters, 1926.

The need for scientific investigation of problems of forest re-growth became pressing not long after the Forest Service took over the administration of the national forests, subsequent to their transfer from the Department of the Interior to the Department of Agriculture. The first forest experiment station was established in 1908 on the Coconino Forest near Flagstaff, Arizona; this was followed shortly by a few similar establishments on other national forests at strategic points, but all on a meager basis of men, money, and equipment.

In 1915 a great advance was made by organizing a Branch of Research in the Forest Service which has control of all the varied investigative activities and studies except grazing investigations, and thus segregated research from administration. In 1921 the Department of Agriculture announced a plan to establish forest experiment stations in each of the important timber-growing regions after dividing the country into geographical units on the basis of similar or related forest conditions and problems. Because of the vigorous discussions which arose at that time concerning private forest production, research assumed greater importance through the very lack of reliable facts on which to base both forest policy and practice. In reference to forest experiment stations and research in forest products, the Forester in his annual report for 1921 said:

In the development of national forestry such stations are fundamental. Their function is to secure the scientific basis

necessary for the growing and protection of timber, alike on public and private lands. They can do this in the cheapest, quickest, most effective, and most authoritative way, for they substitute systematic, well-directed research as a means of solving the problems of forest management, in place of slow progress by the method of trial and error. Hardly less will be their value as demonstration areas illustrating successful methods of timber growing.

Research in forest products, closely coordinated with the actual practice of forestry and with forest research along other lines, is fundamental for the solution of the national timber-supply problem. This work seeks, on the one hand, extension of our existing timber supplies and reduction in the quantities which it will be necessary to produce to meet our future needs, and, on the other hand, furtherance of the practice of forestry through bringing about utilization along lines that will make forestry more widely remunerative. In other words, the primary purpose is to contribute toward bringing into balance production and consumption.

The policy of establishing research stations was supported by Congress and rapid progress was made in locating a series of these, particularly in the East. But, according to the report of the Forester, the individual stations could not keep pace with the growing demand for technical information on which to build sound timber-growing policies and practices. The highest point yet reached in the program of research was made possible by the passage of the McSweeney-McNary Law, the most comprehensive bill dealing with forest research that has ever been introduced into Congress. The measure, ably supported by individuals and

organizations throughout the country, was passed unanimously both by the Senate and the House of Representatives with unusual speed. The public evidently has faith in research; the responsibility for thorough work is expected to be met fully by the experiment stations and other agencies engaged in this program of investigation.

The provisions of this law and comments thereon, as follows, constituted a letter-report by R. S. Kellogg, chairman of the National Forestry Program Committee,² whose able support with that of many others has been a great aid to progress in legislation for many years.

The McSweeney law provides in detail for a long-time program of fundamental forest research by five different government bureaus. To the Forest Service is assigned the conduct of the Forest Experiment Stations (which are as essential to tree growing as Agricultural Experiment Stations are to farming), forest range research, and forest products. The present appropriations for these items total \$881,800. The authorizations for them under the McSweeney law are \$2,275,000. If stepped up under the proposed ten-year program, this is equivalent to an annual increase of \$139,320.

For investigations into the diseases of forest trees and the causes of decay and deterioration of forest products and the development of methods for their prevention and control, the Bureau of Plant Industry receives an authorization of \$250,000 annually, as compared with the present appropriation of \$98,500 for this purpose. On a ten-year basis this is equivalent to an annual increase of \$15,150.

² From a circular letter of May 24, 1928 (unpublished), The National Forestry Program Committee, New York, N. Y.

For the development of methods for the prevention and control of infestations of forest insects, of which the gypsy and browntail moths and the pine bark-beetles are conspicuous examples, the Bureau of Entomology receives an annual authorization of \$350,000, compared with the present appropriation of \$174,570. According to the ten-year plan, this will amount to \$17,543 annual increase.

For studies in the life histories and habits of forest animals, birds and wild life, the Biological Survey receives an annual authorization of \$150,000, compared with the present appropriation of \$10,000. An annual increase of \$14,000 for ten years will be necessary to bring this item up to the authorized maximum.

For studies into the relationship of weather conditions to forest fires, leading to the possibility of forecasting forest fire dangers, the Weather Bureau receives an authorization of \$50,000 yearly, compared with the present appropriation of \$23,600.

In total, the present appropriations for these various items are \$1,188,470. The authorizations for them carried in the McSweeney law are \$3,075,000. In carrying out the suggested ten-year plan of gradual increases, in order to build up the work with maximum effectiveness, the additional annual appropriations for these purposes would be \$188,653, which is a very moderate program.

Beside these specific annual authorizations, the new law carries two other items assigned to the Forest Service. One is a maximum annual appropriation of \$250,000 for studies of the costs and returns and the possibility of profitable reforestation under different conditions in the different forest regions and for various other economic investigations of forest lands and forest products, in order to assist in the most effective distribution in the interests of both timber grower and timber user. The other item is a total authorization of

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\$3,000,000, at the rate of not more than \$250,000 annually for a comprehensive survey of the present and prospective requirements for timber and other forest products in the United States and of timber supplies, in order if possible to arrive at means of balancing the timber budget of the country. This work is to be carried out with the coöperation of the appropriate officials of each state, and also with the assistance of private and other agencies which may be able to help in the problem.

It may be easily judged that the most important parts of the new law are those which make provision for much larger appropriations for the Forest Experiment Stations and the forest products investigations. There are now eleven Forest Experiment Stations, whose fields are so sub-divided as to cover all the most important forest regions. One or two additional stations (including one in Hawaii) may be established under the new law, and with the long-time program of more adequate financial support now assured, it will become possible for the Government to build up and hold the scientific personnel required for research of this kind. The forest products investigations, carried on chiefly at the Forest Products Laboratory, operated at Madison, Wis., in coöperation with the University of Wisconsin, deal primarily with the determination of the properties of all our commercial woods, treatment by means of seasoning and preservatives to prolong their life and usefulness, studies into the practical uses of the various woods, and the products which may be derived from them, and also studies of new and improved methods for the manufacture of pulp and paper from wood.

The comprehensiveness of this program is very great and rightly so because forest production is complex, not simple; nature's processes operate over a long growing period on

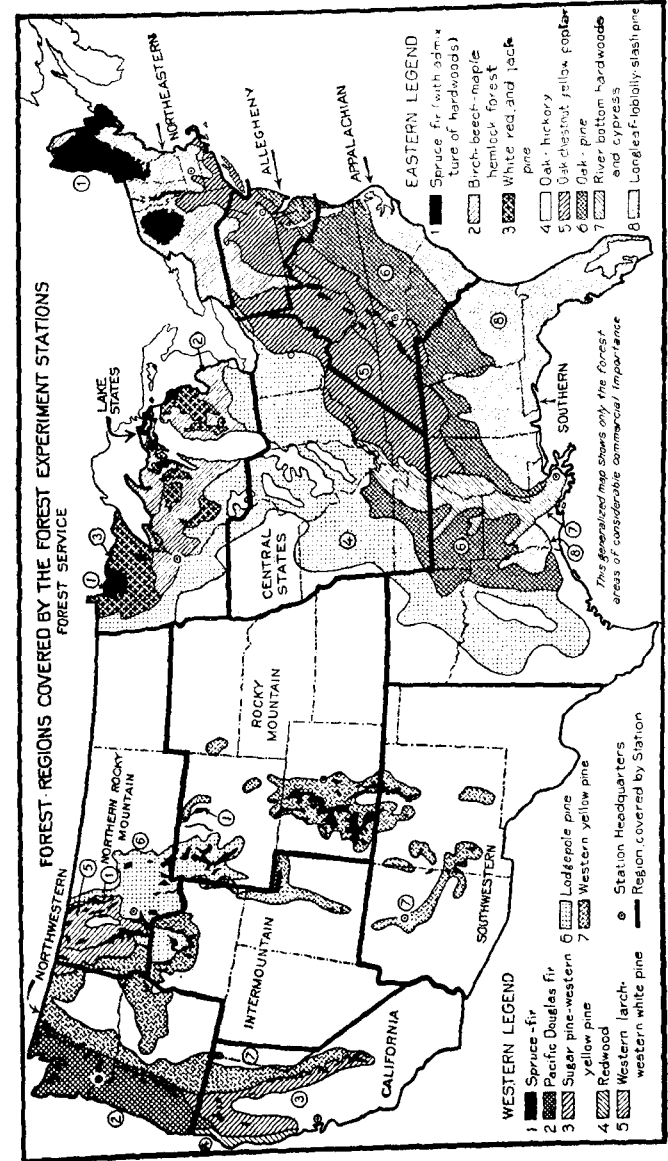
a great expanse of forest area, with a wide variation in forest types, climate and soils, and under very different economic conditions, according to the region. Present methods of forest protection and of cutting, intended to secure forest development and renewal, are based on relatively limited experience. The method of trial and error is both slow and expensive. Although we have gained by experience in managing American forests and have made remarkable progress in research, practically the entire basis of knowledge for intensive timber growing in the United States remains to be uncovered in the future.

The Forest Research Bill confirms the leadership of the federal government, already well demonstrated by the progressive research work of the Forest Service. It provides adequately for forest experiment stations in the principal regions of the United States (see Fig. 13 and Appendix, p. 242). This does not mean that the federal government through its various departments is to act as the sole agency for the solution of the forest problem, for already other agencies are doing valuable work. Regional experiment stations of the Forest Service, in addition to working upon many excellent projects, are accomplishing much in coördinating research work and bringing other agencies into coöperation. They will tend to stimulate state agencies to greater effort in research.

Each forest experiment station has an advisory council composed of representatives from public and private

agencies engaged in research, including the forest industries. This council is important in that it reviews the yearly program as it is initiated and progresses, and thereby guides regional investigations harmoniously. Others contributing to research are universities, state agricultural experiment stations, agricultural colleges, research institutions and private industrial agencies. Results of work of excellent quality have been appearing in published form from such sources for a considerable time.

The main phases of forest research may be placed under four main headings, forest management, range management, forest economics, and wild life. Management of a forest involves the application in a business-like way of protection, silviculture, and utilization, but it will not prove successful unless there exists an intimate biological knowledge of the major vegetation of trees, the lesser plants, the animal life of the forest, and of the soil and its living inhabitants, both plant and animal. The forest as we find it is the outward expression of many influences. Cutting brings about changes that may be favorable or prejudicial to permanent productiveness of the area. Nature may be aided or its work may be destroyed. Not only must the forest receive protection from fire, but forest insects and forest fungi that may kill trees or increase defects must be reckoned with. The problems of growing and renewing forest crops are many, even if viewed only from the side of nature and of protective measures.



On the other hand, we are concerned with the determination of volume, growth, and yield in this forest industry. Basic knowledge of logging, transportation, and market enter into utilization of the timber to be removed in silvicultural operations. Disposal of logging debris is closely related to protection and to renewal of the forest. Production costs enter into the problem of forest management at every step.

Forest range management is concerned with forage for grazing animals and is particularly associated with western forests, for it constitutes one of the products of the land embraced within the national forests. It is the management of lesser vegetation of the forest, and is comparable in many ways to the management of major vegetation in its problems of growth and use: biology and business problems are involved in both.

Forest economics involve studies of economic conditions in the whole country, for these are basic to the development of forest policy. Land use, ownership, and classification by economic survey is one phase; timber, its supply, consumption, increment by growth, manufacture, distribution, price, and other statistical data comprise another line of investigation; taxation is a third. Facts determined accurately, and not by estimates, are applicable to regional forest management and to individual tracts.

Fundamental studies of forest products, their properties, manufacture, uses, treatment, and specifications, as well

as industrial surveys, may be included in this same category. They measurably influence both policy and the practice of timber growing and the use of its products.

The influence of the forest on climate, soil, the regularity of streamflow, and erosion have attracted public attention for over a half century and have always been a matter of discussion. Its importance is great since it exerts an influence, particularly on streams, effective far beyond its limits. Facts through research are needed to interpret this influence in each region and to clear up conflicting opinions destructive of progress in forestry.

Wild life of the forest and its streams bears a distinct relation to forest management, for animals are both a source of damage and a means of assistance. They bring about, not only destruction of seeds, but also distribution of seeds, and may thus either prevent or cause natural reproduction. An interesting fact is to be found in the recent discovery that field mice in certain locations destroy the cocoons of the destructive larch saw-fly.³ Wild life should serve as a by-product of the forest to furnish food, fur, and recreation, but research must supply a basis for preventing the extermination of useful animals and for maintaining biological balance.

Although the forest experiment stations are attacking fundamental problems, the demands made on them for

³ Graham, S. A., "The Influence of Small Mammals and other Factors upon the Larch Sawfly Survival." *Journal of Economic Entomology*, XXI, 2, 1928.

immediate facts have given rise to many projects, the results of which have been found applicable in forest management. Some of these projects, taken from recent reports of the Forester, are quoted below as illustrations of results obtained from research at these stations.

One of the outstanding contributions of the year was the standardization of methods used in the preparation and presentation of volume and yield tables, which are indispensable to the forester in estimating standing timber and predicting growth. In this work, which was largely done at the forest experiment stations, the Forest Service had the coöperation of the Society of American Foresters and the Association of State Foresters. Studies of the growth and yield of the important forest types were continued and several basic and important preliminary phases were finished. They show how much woodlands of different productive capacity will yield at different ages and provide a basis for determining the value of lands for forestry, the product which can be obtained, and the length of the rotation. The studies on which the preliminary work has been completed concern the four important yellow pines of the Southern States, New England spruce, Lake States jack pine, Douglas fir in the Pacific Northwest, and yellow poplar in the Appalachian region.

Much progress in the study of forest fire weather has been made at the Northern Rocky Mountain Forest Experiment Station. The study has reached a point where rules have been formulated and made available for use in the measurement of weather changes which indicate fire danger. Close coöperation from the Weather Bureau in this work has resulted in the installation of a regular fire-weather warning service. Warnings are of great value to

fire organizations on national forests and on private holdings in order that adequate preparations may be made for an emergency.

A major research project undertaken this year has for its object the definition in American lumber standards of (1) the degree of dryness of lumber at which the standard sizes shall apply and (2) what constitutes seasoned and unseasoned lumber in different commercial uses. Field tests proved that the proposed plan of basing standard sizes on the weight of the lumber at time of shipment was unreliable, because of the great variation in the weight of the dry wood. They also showed the actual variation in moisture content of lumber shipped from different regions as kiln dry, air dry, etc. In the case of certain pine mills, kiln-dry lumber as shipped had a moisture content averaging 9 per cent, and 80 per cent of such stock had a moisture content between 4 and 14 per cent. When similar data are obtained for other conditions and regions and when work now under way on the moisture content that woods attain under service conditions is completed, the basis for trade agreement will have been provided.

The laboratory at Madison, Wis., has been working on the possibility of expressing lumber seasoning and size definitions either in terms of permissible shrinking and swelling or in terms of actual moisture content. Since either method depends upon rapid, practical means of making measurements, considerable research has been devoted to these ends. Several devices have been developed by the laboratory for quickly determining the moisture content of wood. None of the methods is yet ready for commercial use, but with the additional refinements and tests planned the laboratory is hopeful of soon providing the industry with these much-needed tools.

For a number of years there has been under way in

California a study of the effect of different cutting methods upon the rate at which natural reproduction becomes established. In connection with this study over twenty thousand trees have been remeasured at five-year intervals. A recent analysis of these measurements developed a new classification of the trees in the western pine forests. It appeared that certain classes of trees, readily recognizable in the forest, are especially subject to insect attack; others are liable to windthrow or breakage, while still others make too poor growth to be worth retaining in the forest. This discovery has made it possible to select trees for cutting far more discriminatingly, and it has found general application on the national forests of the California pine region. The simplicity of the method makes the checking of marking practices on timber-sales areas easy and more systematic. Study of this method in relation to other stands bids fair to revolutionize practices in marking timber for cutting on national forests elsewhere.

These examples suffice to indicate the importance of research, the results of which are not necessarily something to be had in the far distant future, but surprisingly soon. After all, research is only a systematic effort to discover the truth and the truth will indeed make us free. We have been enslaved by the idea that the forest industry is a temporary one. The conception of permanent production is being rapidly accepted, but private industrial forestry must have a sound basis of fact to accomplish the transition to sustained production. This requires an attack on many economic questions, the solution of which is basic to a stabilization of the forest industry. These economic problems are of

primary importance, but should by no means replace those fundamental studies which will make possible an answer to technical questions of forest growing.

The methods of growing a forest crop directly affect both the quantity and quality of the material produced. In a study of second-growth southern pines it has become apparent that the weight or density of young pines can be controlled by regulating the crown development and that it is possible to produce as dense southern pine timber in second-growth as in the virgin stands.

In industrial forestry cutting aims to provide for satisfactory renewal of the forest. Research into the costs of logging northern hardwoods indicates that trees having a diameter of less than twelve or fourteen inches are frequently cut at a loss which could be turned to a profit if the trees were left for a later cut. The results of selective logging in northern hardwoods indicate that the highest return per thousand feet, board measure, is obtained by cutting to a diameter limit of approximately eighteen inches. Judged by results of silvicultural studies, this also leaves the forest in a satisfactory condition for natural renewal.

Such facts as these can be given direct publicity for the purpose of stimulating private forestry practice; being in business terms they are as understandable as those facts ascertained by agricultural research agencies which are directly applicable to agricultural problems and are published widely.

There exists the necessity, not only for large accomplishment in forest research, but for dissemination of the results, and this constitutes a problem of very great importance. Published material may be distributed either direct to the forest owner, or, in the form of professional papers, to the foresters in the employ of private companies and to those engaged in extension work. Direct demonstration in national and state forests, and by the states in coöperation with private individuals, is fully as effective. A growing means of stimulating private forestry is through the activities of consulting foresters. These men need the sound facts of economic research to convince private owners of the value of forestry practice.

In a word, putting the facts derived by research into practice is a problem of education to be carried on by all available means and agencies if progress is to be made in this new field of endeavor. Not only the owners, but the general public as well, must be educated concerning forestry practice.

CHAPTER IX

EDUCATION IN FORESTRY

I. PUBLIC EDUCATION

Forestry in the United States is of such recent origin that the people as a whole have yet to be educated to an understanding of its meaning. This process of education in forestry may be termed the popular aspect and constitutes one of the most important phases. As a nation we are not yet "forest-minded," as are the people of Sweden and Finland. The older generation had a background of forest exploitation of vast, seemingly inexhaustible timber resources which made the early efforts of forest educators seem like the exaggerations of fanatics. Indeed, the term "denudatics" applied to these forestry pioneers indicates the popular feeling of the "gay nineties."

Now the picture is utterly changed. Forestry and conservation generally has become an accepted part of American life; it has been accepted, but has not yet been generally understood by the people. There is, particularly in urban centers, a feeling that conservation means preservation rather than wise use. It is the object of popular education in forestry to correct this misconception and to instil the proper viewpoint.

Foremost among the agencies to promote popular education in forestry is the American Forestry Association. First organized in 1875 it has grown to a membership of more than 16,000 men and women, located in every state of the union. The association aims to bring about, through the development of enlightened public sentiment, a local and national appreciation of American forests and trees and of all the vital interests which they represent. A monthly magazine, *American Forests and Forest Life*, is the Association's principal medium of disseminating educational material in popular form to the public and of stimulating public interest. This magazine carries definite articles on the practice of forestry and on the work of the federal Forest Service. The association fosters and supports forestry movements in the various states.

In 1922 there was organized the American Tree Association "to further forest protection and extension and to increase appreciation of forests as natural resources essential to the sound economic future of the country." This the association does by suggesting and fostering forestry legislation, by disseminating forestry information, and by publishing and distributing material. In 1925 the association published a pamphlet entitled *If the Nation Saves the Trees, the Trees Will Save the Nation*. The following year it published *The Forestry Primer*, of which more than half a million copies have been distributed. Another new departure by this Association was its publication of *The For-*

estry Almanac, which appeared in its first edition in 1924, and in its second edition in 1926; this is a compendium of valuable forestry information. In addition, the American Tree Association publishes periodically *The Forestry News Digest* which is of special value to those active in the field of forestry.

Besides the activities of these two leading national associations, popular education in forestry is furthered by the American Reforestation Association, the National Conference on Outdoor Recreation, the American Nature Association (publishing *The Nature Magazine*, a monthly devoted primarily to nature study but in part also to the advocacy of the important fundamentals and phases of forestry), the Pine Institute of America, the American Forest Week Committee, the National Forestry Program Committee and a host of regional, state, and local associations for the names of which the reader is referred to the above-cited *Forestry Almanac*.¹ Many of these associations maintain trained foresters on their staff.

Nor should the educational influence of the various lumber trade associations be overlooked, for through their various "house organs" they reach a large share of the American public, although they attempt primarily to reach those engaged in the lumber industry. A similarly happy coöperation exists with the lumber and paper trade journals

¹ *Forestry Almanac*, American Tree Association, Washington (2nd edit.), 1926, p. 348.

and with the magazines devoted to other branches of forest products industry. Special mention should be made of *The American Lumberman*, *The Timberman*, *The West Coast Lumberman*, *The Southern Lumberman*, and, last but not least, the defunct *Lumber World Review*, whose able editor, the late Bolling Arthur Johnson, did more than any other layman to bring about a favorable *rap-prochement* between the lumber industry and forestry. Forestry has, in fact, become a vital part of these various trade journals and no stauncher advocates of conservation exist than their editors. Some of the best forestry articles appear in the trade journals.

In another field of endeavor, public education in forestry is the special concern of the federal Forest Service and of the various state forestry departments. Lectures, bulletins, pamphlets—an unending stream of educational literature issues from these various agencies, the sole purpose of which is to further public knowledge and practice of forestry. An example of the practical demonstration of forestry principles to the private woodland owner is the so-called “Maryland plan.” Upon request of the owner, the forestry officials of that state make a preliminary examination of the woodlands in question and if merchantable timber is present in sufficient quantities to justify some cutting operations, written recommendations covering the harvesting of this timber under forestry principles are submitted.

But the Maryland foresters go still farther in their as-

sistance to private owners. If the written recommendations are accepted by the owner, a forester is sent to the woodlands, the mature timber is marked for cutting, and an estimate of the marked material is made by species. The stumpage value of this marked material is also calculated and furnished the owner, as is a list of portable sawmill owners and other purchasers of forest products accessible to the tract in question. Furthermore, a sample contract is furnished the owner, the use of which will insure that only marked trees will be felled by the purchaser and that reasonable care will be taken not to injure reproduction and saplings. This plan has given satisfaction not only to owners, but timber buyers, after operating under the Maryland plan, actually prefer it to the old lump-sum basis of dealing with timber growers.

A similar practical demonstration in forestry, covering thinnings and improvement cuttings, is carried on in New York under the direction of the Extension Service of the New York State College of Agriculture. In this case, a forester marks the timber for a thinning or improvement cutting on a sample area of the wood lot. The owner then cuts and stacks the felled material, which is usually suitable only for fuel wood and posts. A woods meeting is then held, and here principles and practices are discussed in the light of the work just accomplished. A careful record of the costs of manufacture puts the whole problem on a sound financial basis and shows improvement as well as profit. Finally,

a "marking contest" in the woods adjacent to the sample area, participated in by all those present at the meeting, serves to drive home the forestry principles involved in wood lot improvement work.

The various colleges and universities having forestry departments are also active in furthering public education in forestry. Here again, bulletins, pamphlets, exhibits, lectures, and press notices contribute to building up a public sentiment favorable to forestry. Nor should there be overlooked, in this brief survey, the teaching of forestry in the secondary schools, in the myriad summer camps, in demonstration forests ("Show Windows"), by outing clubs, by the Boy Scouts and Girl Scouts, by the Campfire Girls, by women's clubs, by Rotary and Kiwanis Clubs — in short, by a myriad of "Public service" organizations which recognize forestry as an essential to national welfare. Well-managed national and state forests, open to recreational use, afford the best of instruction in the direct application of forestry. "Seeing is believing." State fairs and Arbor Days contribute their share toward public education, and last, but by no means least, the press, both daily and periodical, has done a tremendous work in popularizing forestry. There is, then, a thorough coverage of the educational field, and "he who runs may read" much of forestry to his profit.

More direct in bringing about the application of forestry is the work of "extension" conducted by the Department

of Agriculture and by those "extension specialists" of various states, who are usually attached to state agricultural colleges. This work is directed at the farmer's wood lot — an aggregate area of 168 million acres in the United States. The farmer, in order to get the maximum return from his wood lot, must know certain fundamentals of forestry. He needs advice concerning the management of his farm forest in order that it may be a source of continuing profit and supply.

This work is organized in twenty-eight states which coöperate with the federal government under the Clarke-McNary Law; more than fifty thousand dollars are appropriated by Congress every year to provide assistance to owners of farms in establishing, improving, and renewing wood lots, shelterbelts, windbreaks, and other valuable forest growth, and in growing and renewing useful timber crops. This work is carried on as part of the extension service of the agricultural colleges, and with the active coöperation of the state Forester and his organization.

An interesting outgrowth of extension work, as reaching the younger generation particularly, are the forestry projects of the so-called 4-H clubs. In New York state this is exemplified by the tree-identification project of 1928, wherein thirty-four boys and girls submitted collections of common trees, duly labelled and accompanied by a statement of each tree's peculiar qualities and uses. There was also required a statement of why forest preservation is a public duty and

necessity. Prizes were offered to the three most successful contestants by the Empire State Forest Products Association.²

Exemplifying the work of popular education in forestry, the American Forestry Association is inaugurating a three-year plan to create a healthy local consciousness of the disastrous effects of forest fires and burning woods in the states of Florida, Georgia, and Mississippi. Through the generosity of Mr. John D. Rockefeller, Jr., and the Commonwealth Fund of New York, together with the Forestry Association and the three states involved, fifty thousand dollars a year is available for the next three years. The association's forester, Mr. G. H. Collingwood, describes the project as follows:

The fundamental objective is to convince the people living in or near the woods that woods-burning is useless and uneconomical. Because a child's mind is more open to new ideas than an adult's, they are the ones toward whom most of the efforts will be directed. The parents will get the idea from the children. There is no thought of adding forestry to an already heavy school curriculum, but to supplement the existing education so that children and grown-ups will see the advantage of coöperating with the forest authorities in stopping fires.

To reach the people in the forested regions of these states, automobile trucks equipped with electric generators and motion picture projectors will be purchased. Men capable of telling the story and arousing enthusiastic support

² This is only the first of a series of consecutive and graded projects designed for the education of boys and girls in forestry.

will be employed to go with the trucks, and local people will be enlisted to help with the itinerary. W. C. McCormick has been appointed regional director for the project. He has been on the job since June 1, and finds the whole-hearted support of state forestry officials, forestry associations, agricultural colleges, state departments of education, the press, and all others interested in conservation.

Similar educational programs have been carried on by the Forest Service in and around the national forests of Arkansas, Virginia, Florida, and adjacent states, and by the Canadian Forestry Association.

2. PROFESSIONAL EDUCATION³

The need for men trained in forestry became apparent soon after Dr. Fernow became Chief of the Division of Forestry in 1886. A few Americans, including Pinchot and Graves, Overton W. Price, F. E. Olmstead, and others studied at the French Forest School at Nancy, or at the German schools. Some attempts had earlier been made to give lectures on forestry at one or two of the American universities, but it was not until 1898 that the first forest school was started at Cornell University, Ithaca, New York. Here Dr. Fernow organized professional instruction in forestry adapted to American conditions and set up standards that have served as beacon lights in all subsequent development.

³ Based on article by R. S. Hosmer, "The Progress of Education in Forestry in the United States," *Empire Forestry Journal*, Vol. 2, No. 1, April, 1923.

Incident to a most unfortunate controversy that arose over the management of the college forest in the Adirondack mountain region in the northern part of the state of New York, in the course of which the owners of certain recreation camps raised objection to the silvicultural methods in use on the ground that the forest was being destroyed and not regenerated, the College of Forestry at Cornell was suspended in 1903. But although short-lived, that school graduated a group of foresters who have been leaders in forestry both in the United States and in Canada. This attests to the soundness of the training they received, which, indeed, never came under criticism of any sort in the dispute over the college forest.

In 1900 there was established at Yale University, at New Haven, Connecticut, through the munificence of the Pinchot family, the Yale School of Forestry. Graduating its first class of nine men in 1902, the Yale School of Forestry at once became the principal feeder of the United States Forest Service, and helped to supply men who, under Gifford Pinchot, built up the administrative force in the national forests, or took positions as state foresters during the decade from 1900 to 1910. Other universities and colleges soon followed the lead of Cornell and of Yale and established schools or departments of forestry.⁴ Within a period of sixteen years this significantly rapid increase in schools had

⁴ See Appendix, page 243, for list of United States and Canadian forest schools.

been completed. In all, about thirty forest schools offer professional work in forestry and at least twelve give the advanced degree of Master of Forestry, or its equivalent, upon the satisfactory completion of an additional year of study subsequent to the course leading to the baccalaureate degree. Professional education in forestry has taken a recognized place in the college world of the United States and Canada. In addition to the technical curriculum, many of these same institutions, as well as some of the agricultural colleges, offer non-professional courses in forestry to meet the specific needs of agricultural students and others. There is, at present, only one ranger school, that at Wanakena, New York, which is part of the New York State College of Forestry and which is designed to train men for subordinate positions in federal, state, or private forestry work.⁵

⁵ At the dedication of the new building, Dean Graves, who presided, spoke in part as follows:—

"The problem of forest education extends beyond the professional school. The future of forestry is dependent not only on the ability, vision, and sound judgment of the professional foresters but also on the intelligence and skill of the men down the line—the superintendents and foremen of local forest activities and the workers in the woods and at the mill. The key to successful work in forest protection, silviculture, or utilization is oftentimes the interest, enthusiasm and ability of the local field officers, the ranger, the woods foreman or logging boss. The training of these men for their special work in the forestry undertaking is as important as that of the professional forester.

"Heretofore our educational efforts have been directed chiefly to the collegiate school and the training of men for the directive work in forestry. We have largely neglected the problem of training men for the special jobs in the forest and factory and for the secondary executive positions

There are two types of forest schools. In the first category may be placed the special graduate school, such as the Yale School of Forestry and the one formerly existent at Harvard. The two-year graduate course at the Yale School of Forestry is still offered, and this is devoted entirely to forestry subjects, but students come to Yale more and more for graduate work following a forestry course elsewhere. Harvard, subsequent to the reorganization effected a few years ago, now offers only graduate instruction in forestry. Harvard also gives the Master in Forestry degree, but is really more interested in training advanced students on the Harvard Forest at Petersham, Massachusetts, for service in forest investigations and research. Advanced work in forestry leading to the Doctorate may be taken at a number of American universities, and an increasing number of research workers are availing themselves of this opportunity.

for which a collegiate training is neither necessary or suitable. We have in the United States 25 collegiate institutions offering a training in forestry and only one regularly established ranger school, namely, the New York State Ranger School whose progress and success we are celebrating today.

"It is the task of vocational education to meet the pressing need for better trained personnel in the forest and mill. The recognition of this situation does not in any way minimise the importance of the collegiate school and of advanced educational work in forestry. Organized vocational education would supplement the work of the regular forest schools. It would fill a wide gap in our present structure of forest education."

Dean Graves' complete paper is printed in the *Journal of Forestry* for October, 1928, under the title "Vocational Training in Forestry," Vol. XXVI, No. 6, pages 749-761.

The other type of American forest school is that which offers a four-year undergraduate course leading to the Bachelor's degree, with, in certain institutions, a fifth year culminating in the degree of Master in Forestry. The first two years of the four-year course are devoted primarily to the fundamental sciences, the junior year in part, and the senior year almost entirely, to forestry subjects. The general feeling among the faculties of American forest schools now is that a somewhat strictly prescribed curriculum is desirable up to and including the junior year, but that in the senior year the student should have the privilege of electing freely, though under guidance, subjects in the particular branch of forestry in which he desires to specialize.⁶ Graduate instruction in forestry is available and encouraged at many of the universities maintaining undergraduate curricula.

In all the leading forest schools of the United States emphasis is put on the practical experience in the forest that is required of the student in the summer vacation periods. A civil engineering and a forestry summer camp constitute additional practical experience. In all the leading forest schools of America, the emphasis in technical forestry instruction is placed on a sound grasp of the underlying principles. Professor R. S. Hosmer says:

⁶ Penn State now prepares its students for graduate work by making it possible for them (as undergraduates) to secure the fundamental subjects necessary for future specialization. (*Yale Forest School News*, XVI, 3, p. 49. July, 1928.)

With two exceptions the forest schools of the United States have all been connected with a college or university, rather than being established as separate academies. But for 15 years, beginning in 1898, Dr. Carl Alwin Schenck conducted the Biltmore Forest School on the private forest estate of Mr. G. W. Vanderbilt, at Biltmore, North Carolina. In its later years this academy became a peripatetic school, in that every year Dr. Schenck conducted his students on long trips through the United States and to the forests of Germany. The Biltmore School was discontinued in 1913.

The other school of the academy type is the Pennsylvania State Forest Academy at Mont Alto, Pennsylvania. It was established in 1903 as a high-grade ranger school to train men for the Pennsylvania State Forest Service. It subsequently enlarged its functions and offered a regular four-year undergraduate course leading to the degree Bachelor of Forestry.

Of late years there has been a tendency for certain schools to specialize in particular phases of forestry without, however, giving up the broad training offered to meet the needs of all foresters. An example is the specialization in logging engineering that has characterized the forestry department of the University of Washington. Maine and Syracuse offer special courses in pulp and paper manufacture. At other schools some of the graduates in forestry have continued their studies in such closely allied fields as forest pathology or forest entomology, and have finally gone out as specialists in these subjects. It is probable that this tendency will continue, so that in time perhaps each of the leading forest

schools, in addition to offering a general and comprehensive course, may come to be regarded as the home of some particular phase of forestry training. Thus the reorganized school at the University of Michigan is termed the School of Forestry and Conservation with the specific objectives of showing that it provides specialized training within the broader fields of conservation.

Professor Hosmer sums up as follows:

Mention has already been made that several of the forest schools at state universities offer general courses in forestry and conservation, open to all students, in addition to the regular technical forestry work given professional students. In the field of Extension Work, much popular education in forestry is also being carried on, especially in cooperation with the Farm Bureaus that are located in each county of many of the states, and with other state agricultural associations. In the most completely organized of the State Universities one or more members of the Forestry Staff are definitely assigned to extension work and devote their entire time to it.

In the development of forestry in the United States the forest schools have had no small part. From them have gone out the men who have brought about great changes, men imbued with the spirit of public service, trained in the technique of their profession, and with a breadth of outlook that has made them leaders. It is a far cry back to the small beginnings in 1898, but thanks to the secure foundation laid then by Dr. Fernow and to the work of Yale and of the other forest schools, the advance has been steady and without serious interruption.

There are innumerable problems of educational policy

and of educational administration that remain to be solved in the United States. There are great economic questions in forestry in America that are still very far from settlement. The trail through is anything but distinct. But the fact that obstacles have been overcome in the past gives courage to American foresters to go on to conquer those that lie ahead.

Another phase of technical education of increasing importance is to be found in the activities of the Society of American Foresters. Organized in 1900, this organization has stimulated the work of individual foresters both by furnishing contacts with other men in the profession and by the publication of technical articles in its organ, *The Journal of Forestry*.⁷

In addition to the parent society, there exist fifteen regional sections, each of which holds regular meetings where papers covering the field of its particular interests are read and discussed.

⁷ In 1917 the *Forestry Quarterly* and the *Proceedings of the Society of American Foresters* were merged into this single publication.

CHAPTER X

HOW FORESTRY IS BEING ACCOMPLISHED

In the welter of propaganda in behalf of forestry and in the countless newspaper "stories" and editorial urgings, there is ground for a certain cynicism concerning accomplishment. Forestry is oftentimes the victim of its friends — those who favor it without fully understanding the difficulties and complexities of our timber problem.

To one who has watched the development of forestry in the United States during the past quarter century there is, however, ample ground for encouragement, and even for optimism, at the results achieved. Starting as a small cloud "no larger than a man's hand," the consciousness of forest needs has grown on the national horizon until now there is scarcely a man, woman, or child who does not know something about forestry progress; the difficulty is that the knowledge is fragmentary, inaccurate, and distorted by a nature-loving sentimentalism. We are on the point of becoming "forest-minded." The American people usually achieve what they set out to attain; and a knowledge of forestry will be no exception to the rule.

of the Chief Foresters—Gifford Pinchot, Henry Graves, William Greeley, and now Robert Stuart.

The national forests are, by a curious paradox, to be found chiefly in the West,² though the bulk of the forest land lies east of the Mississippi. The reason is to be found in the existence of large available tracts of public domain in the western states from which national forests could be created. Their location has served to intensify the problems of administration and led to the establishment of six National Forest Districts in 1908, since then increased to eight. These districts are headed by a district forester whose staff is a small-scale replica of the major divisions in the Washington office.

The unit of accomplishment in federal forestry is the national forest. There are (in 1928) 159 of these, each in charge of a forest supervisor. He, in turn, is assisted by a staff of trained men, foremost among whom are the district forest rangers—each a supervisor *in parvo*. The principal contacts with the public and with the forest users are made by the forest supervisor and the rangers.

The manifold activities involved in caring for a national forest are too numerous to be presented here. In effect they carry into execution the charge to the Forester contained in the letter of the Secretary of Agriculture of February 1, 1905, the day on which the Interior Department relinquished control.

² More than 132,000,000 acres lie west of the Great Plains; 4,000,000 acres lie along the Atlantic Seaboard.

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 business-like 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 live-stock 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 conflicting 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.

In addition to its field force, devoted primarily to supervising the national forests, the federal Forest Service coöperates with states and with private owners in fire control (in accordance with the Weeks Law of 1911 and the Clarke-McNary Law of 1925) to the extent of spending a half million dollars yearly out of a total of two and a half million dollars annually expended on this coöperative work. The federal Forest Service coöperates with states in the distribution of planting stock and contributes every seventh dollar of the quarter million dollars spent by twenty-two states in establishing forest tree nurseries. Especially important and worthy of notice is the research work of the forest experiment stations and of the Forest Products Laboratory, described in Chapter VIII.

Lest it be thought that accomplishments in federal forestry are restricted to the Forest Service of the Department of Agriculture, mention must be made of the United States Indian Service Forestry Branch, which protects and administers, for the benefit of the Indians, the forests on Indian lands, comprising six million acres of timber located principally in the West and yielding an income in excess of one and a half million dollars yearly.³

Closely allied to forestry progress is the excellent support given by the Bureaus of Entomology and of Plant Industry in insect and fungus control, respectively — a support which

³ Jenks Cameron aptly terms this an "obligation to administer them with an eye single to the interest of the Indian." "Development of Governmental Forest Control," p. 247.

in 1923; Arkansas possesses no similar bureau; Florida established a Forestry Department in 1928; Georgia inaugurated a Department of Forestry in 1924; Kentucky's Forest Service was formed in the same year; Louisiana has a highly effective Department of Conservation, which is controlling forest fires by means of fire patrolmen, each of whom is assigned definite units of fifteen to twenty thousand acres. Mississippi has a State Commission of Forestry and is also actively attacking the prevalent practice of woods burning; Missouri's Department of Forestry was created in 1925; that of North Carolina⁴ was established in the same year and was founded on the knowledge derived from the Geological and Economic Survey of twenty years previous; Oklahoma also created a Forestry Commission in 1925; and South Carolina appointed a State Forester in 1928. Since 1923 Tennessee has maintained a Division of Forestry, brought into being two years previously as a bureau; Texas created its State Forestry Department in 1915. Virginia carries on forestry work under the direction of the Geological Commission, and since 1914 has had a State Forester as head of the Forestry Department; West Virginia puts the practice of forestry under the supervision of the Game and Fish Commission created in 1921.

From this brief review it will be seen how heterogeneous are the classifications of state forestry in the South. Never-

⁴ Called the Forestry Division of the Department of Conservation and Development.



(Courtesy New York State Conservation Department.)

FIG. 14. FOREST AND FIELD.

Second growth forests that add to the nation's supply of timber.

is more essential to the accomplishment of forestry than even foresters commonly recognize. Other branches of the government have contributed to the maintenance and development of the nation's forests.

In looking over the field of federal forestry perhaps the most reassuring feature to be found is the stability of the work. Freed from political interference and safeguarded by civil service, the men engaged in forestry work are enabled to devote their entire efforts to professional accomplishments. The result is to be seen in the generally recognized leadership of federal foresters in the movement and the confidence of the public that its timber interests are in competent and trustworthy hands.

State Forestry.—Turning from the accomplishments in federal forestry, one is at once struck by the inequality of corresponding progress in the states. Forty-four states, it is true, have taken some official cognizance of forestry but to varied extents and not in proportion to actual needs. The New England states are, without doubt, the leaders in state forestry. Since 1891 Maine has had a Forest Service; Massachusetts established a Department of Conservation in 1904; Connecticut maintains a State Park and Forest Commission; New Hampshire created a Forestry Department in 1909; Vermont established a Forest Service in 1909; and even little Rhode Island has had its Commissioner of Forestry since 1904. To avoid confusion, only present names of state forestry departments are given.

Equally prominent in forestry accomplishment are the North Atlantic states: New York's highly developed Conservation Department, which is the successor to the Forest Commission created in 1885, vies with Pennsylvania's Department of Forests and Waters which was established in 1895. These two states furnish an interesting contrast in the policy of timber-use on state forests. New York emphasizes reforestation and recreation and denies itself the right to cut its own timber, whereas Pennsylvania has adopted the broad gauge policy of development sketched in Chapter VI. New Jersey began with a Forest Park Reservation Commission established in 1906 and now pushes forward a well-balanced program of forestry work under the supervision of the Department of Conservation and Development. Outstanding in accomplishment is Maryland's Department of Forestry, established in 1906; Delaware had no active state forestry organization until 1927.

Below the Mason and Dixon line, progress in forestry so far falls short of urgent needs. Here climate and species combine to furnish unusual opportunities for the growing of trees, yet so far most of the southern states have made only a beginning, while the menace of forest fires has been largely ignored. Yet the "new South" is awakening to the possibilities of state forestry and the strong prevalent spirit of States Rights will undoubtedly cause it to achieve rapid progress.

Alabama has a State Commission of Forestry established

theless, there is a thread of similarity and all, in effect, tend toward a solution of the common problem educating the people of the state to the great needs and opportunities of forest management.

The Central states show a greater degree of uniformity. Here the farm wood lot is the principal problem. Illinois has a recently formed Department of Conservation, an outgrowth of the Natural History Survey made in 1917; Indiana's similar department was created in 1919; Iowa has combined the position of State Forester with that of State Secretary of Agriculture. Ohio established its Department of Forestry at the Agricultural Experiment Station in 1906.

In the three Great Lakes states forestry has always been a foremost problem, yet there, as perhaps nowhere else, political vicissitudes have prevented much of the progress which should have been made. Michigan began with a Forestry Commission in 1899 and now has a Department of Conservation, established in 1921; Wisconsin has a Conservation Commission which functions through the Division of State Forests and Parks; Minnesota has a Conservation Department headed by a specially designated Commissioner of Forestry and Fire Prevention.

In the Prairie states it is natural that tree planting and woodlots should come foremost. Consequently, North Dakota has its State Forester at the School of Forestry; South Dakota and Nebraska lag behind; Kansas relegates

forestry to the State Agricultural College and to the State Forester located at Manhattan.

In the Rocky Mountain states progress has been most marked in the northern and tardy in the southern group. Montana created its State Forestry Department in 1909; Wyoming possesses none; Idaho established a State Coöperative Board of Forestry in 1925; Colorado's State Board of Agriculture serves also as State Board of Forestry; Utah, Nevada, Arizona, and New Mexico have done nothing so far.

Finally the Pacific Coast states — repositories of the last great remnant of our virgin forests — deserve great credit for the timeliness and energy of their forestry activity. Washington began in 1905 with a State Board of Forest Commissioners and since 1921 has had a Department of Conservation and Development; Oregon created its State Board of Forestry in 1907; California's similar Board antedated Oregon by two years.

Conspicuous in the development of state forestry is its close connection with conservation. These two are often synonymous in the mind of the public, and to some extent this conception is justified. However, undue emphasis on the conservation aspects has tended to limit the accomplishments in forestry. Perhaps Pennsylvania serves best to show how these diverging views may be successfully combined (see Chapter VI).

Private Forestry.— The terms "industrial forestry" and

"commercial forestry" have lately come into prominence. The reports submitted at the Commercial Forestry Conference in Chicago⁶ show an effort on the part of private timberland owners to facilitate the establishment of a second timber crop. There are, however, nearly two and a half million acres of forest land in industrial ownership and on only one-tenth of this area is there, to date, any practice of forestry.⁶ This is equally divided, by area, between the North Atlantic, the southern, and the western states.

The reasons are not far to seek; so long as virgin supplies last (especially with the present stimulation to overproduction), it is not likely that sustained yield management (*i.e.*, cutting only what is replaced by growth) will be economically possible for most owners. The economic process under which logging proceeds with scant attention to the condition in which the cutting areas are left will continue unchecked, if present indications are correct. Timber, paradoxically enough, is still too abundant and too cheap to make forestry practice financially attractive to most private owners.

This situation is most marked among lumber companies because ruthless competition in Douglas fir has so resulted in the capture of the eastern markets as to leave the operator in southern pine or northern softwoods helpless. That

⁶ *Report of the Conference on Commercial Forestry*, Chamber of Commerce of the United States, Washington, 1928, p. 195.

⁶ *Progressive Commercial Forestry*, Chamber of Commerce of the United States, Washington, 1927.

this state of affairs is without profit to the west coast operator makes it still worse. Curtailment of production may serve as a palliative, but it would seem that only by mutually organizing for, and agreeing upon, sustained yield management can the big timberland owners of the nation solve the problem which is forcing many of them to the brink of financial ruin.⁷

Among the resolutions adopted by the Commercial Forestry Conference, held in Chicago in November, 1927, was one to the effect that forest land owners "recognize the national necessity of continuous productivity of their lands when economically feasible," followed by the recommendation that they, "recognizing their responsibility, assume as a civic duty the leadership in this great national business enterprise, already well begun."

The accomplishments in private forestry, aside from certain outstanding examples (see Chapter VI) are necessarily in the future. The obstacles of overproduction, overtaxation, and the forest fire menace will be surmounted. Better markets and transportation will bring about the practice of silviculture on areas where now it is out of the question without financial sacrifice. Most important, most encouraging for the future is the fact that industry itself has undertaken the leadership. The genius of the American business man is addressing itself to the great problem of

⁷ This is the solution proposed by David T. Mason in *The Journal of Forestry*, October, 1927, reprinted in *The Commonwealth Review* of the University of Oregon.

timber growing and there is visible the dawning of a new era when forestry on private lands will make progress undreamed of by the present generation.⁸

The total area of privately owned timberland in the United States is estimated at more than three hundred and seventy million acres. Of this area nearly two hundred and fifty million acres are owned by industries, leaving a million and a quarter acres in miscellaneous holdings. On these the accomplishments in forestry are varied but, on the whole, meagre. Certain owners of "preserves" — particularly in the northeast — have consistently followed a policy of forest preservation with results beneficial to the forest, if not always financially profitable. These owners are, however, in the minority. The bulk of privately owned land, other than that owned by industries, is lying fallow; some of it is held speculatively for rises in timber values, other areas are in such small and scattered parcels that no particular policy of management has been or probably will be put into effect by the owners.

⁸ At the December, 1926, meeting of the Society of American Foresters, Col. W. B. Greeley, head of the United States Forest Service, stressed the fact which is also brought out in his annual report for 1926, that the big task immediately ahead in forestry in this country is the improving of methods of handling privately owned timberland. Col. Greeley foresaw a rapid development in private forestry, due to the needs of business stability. "Business men," he said, "are in a frame of mind to put stability and assurance ahead of immediate profits. This is the time for foresters to bring to private land owners the value of sustained yield through management. The forester may weave into the desire for stability the opportunity for sustained yields of woodlands." He added, "With this in mind other problems of forestry will be comparatively easy of solution."

The farm wood lots are in a separate category; on these forestry is being accomplished to a greater degree because of the emphasis now given to forestry in agricultural extension work and to the many instances in which timber production is taking definite form as a farm or farm-community activity.

This chapter can not be closed without some reference to the development of communal forestry in the United States. Slow to gather headway, this movement is now in full swing and there are many counties, cities, school districts, fish and game clubs, and various civic organizations which have acquired and are developing forests of their own. For the most part this takes the form of forest planting — reforestation has a tangible appeal which is easily carried to the people. Such efforts, in the long run, will do their full share in furthering the practice of forestry and will exert tremendous educational influences on all who participate.

Finally, mention should be made of the great upward swing of reforestation in this country. We are a nation of tree planters — thanks to Arbor Day, state nurseries, and the appeals of various associations and the press. Certain individuals have done private planting on a huge scale, many others on only a few acres. Yet the aggregate of area planted mounts yearly and will contribute no small share to the forest wealth of the future.

Looking at the accomplishments in forestry during the last twenty-five years, there is ample ground for

encouragement as to the future. True, there have been many mistakes; oftentimes bad judgment, over-impetuousness, and zeal have led even foresters to advocate measures far in advance of the time. But the progress is great, measured by any standard, from the point of view held in the closing years of the 'nineties to that of the present.

Many years must elapse before we, as a nation, attain the level of forest productivity reached by European countries, but it is the peculiar glory of America that it attains its goals in its own way; without too much regard for precedents. And America has set forest perpetuation as a definite goal for the nation, for the states and for the private owners. The youth of our country are forest-conscious and it is by the youth of today that the accomplishments of the future will be realized.

APPENDIX

APPENDIX TO CHAPTER I

*American Forests
Their Destruction and Preservation
by Rev. Frederick Starr, Jr.*

(Extract from an article in the Report of the Commissioner of Agriculture, p. 210, Washington, D. C., 1865.)

It is my intention in this article, by a simple array of important facts and a few passing suggestions, to call the attention especially of our landholders, farmers, and mechanics, to an impending national danger, beyond the power of figures to estimate, and beyond the province of words to express. . . . Could each farmer, having timber on his land, be led by the facts presented to so husband his trees, or improve their quality, or replace judiciously and speedily those removed, as to equal one-half acre of common forest each year, and if those whose lands are destitute of timber could be led to plant the equivalent of one-half acre per annum, we should either save or produce, annually, 1,022,038 acres, which would be something towards offsetting the destruction, and warding off the coming desolation.

It is feared it will be long, perhaps a full century before the results at which we ought to aim as a nation, will be realized by our whole country, to wit: that we shall raise an adequate supply of wood and timber for all our wants. The evils which are anticipated will probably increase upon us for thirty years to come, with tenfold the rapidity with which restoring or ameliorating measures shall be adopted.

Every hour, therefore, is precious. We have, as a nation, far too long disregarded this interest. Growth is slow and restoration tedious, while destruction is rapid and injury instantaneous. Delay, therefore, is both cruel and disastrous to ourselves.

Statistics of Forestry

(Extract from the Report of the Commissioner of Agriculture, p. 244, Washington, D. C., 1876.)

Forestry has excited much attention in the United States in recent years, in consequence of the rapid deforesting of large areas, and the expression of fears of a timber famine at no distant day. That the great white-pine forests are being rapidly despoiled of their original growth, and that inroads are being made upon the heavy timber of the Sierra slopes and deep valleys, there can be no question; and yet, there is much that is sensational and extravagant in the views of alarmists on this subject. The pine forests are only culled, and are left to produce supplies for another generation; the western slopes of the Sierras are prolific of new growths in place of the old, and except in the vicinity of the Central Pacific Road, are almost untouched by the woodman's ax, as also are the immense forests of Washington Territory and Oregon. More than half the entire area of the South is woodland, and the requirements of its present population, year by year, do not equal half the annual increase by growth. A large portion of the present consumption is sheer waste in clearing lands for agricultural purposes. Were the more than 200,000,000 acres of woodland in the South cut off at once, the annual growth upon the denuded area would be little less than 200,000,000 cords of wood per annum. Yet it is true that the heavy timber of "original" growths is gradually disappearing.

As population increases, and manufacturing operations are

extended, timber will, of course, become scarcer, and consequently dearer, rendering remunerative judicious effort and expenditure in forest-culture. But our people will ultimately learn that we can produce our wood and timber supplies as surely and profitably, though not with so frequent harvests, as we can grow our grain or meat supply.

Forests and Timber

(Extract from the Report of the Commissioner of Agriculture for the year 1868, Washington, D. C., 1869.)

The following abstract is from a communication by the Hon. J. M. Edmonds, late Commissioner of the General Land Office, on the waste of forests, their preservation, etc. The paper appears in full in the monthly report of this Department for January, 1869: Except in the mountain regions, nearly the whole surface, from the Atlantic to the Mississippi, has been despoiled of its primeval growth. The absolute waste is less than formerly, but the waste and consumption are far greater than at any former period. No considerable effort has been made toward production. . . . Our people have now gone through and surrounded the great primeval timber reserve, and have already entered on the margin of the vast treeless plains and plateau, with three-fourths of the original store consumed, the demand accelerated, and the number of consumers rapidly rising from 38,000,000 to 50,000,000. Look forward fifty years — our forests will be exhausted, the demand for the products quadrupled, and the country and people be suffering for the protection which forests would afford.

Maine, Michigan, Wisconsin, Minnesota, and Florida are the only States east of the Mississippi which now export an appreciable quantity of timber more than they import, and the reserve in these States is being rapidly cut away. . . . The

mountain and plateau region, occupying the interior of the continent, has only a moderate supply. . . . No supplies can be drawn from this region for the older States, or even for the great plains, without exhausting a reserve which is already below the immediate prospective demand. In the Pacific States and the Territories there is still an adequate supply, but not beyond the early prospective wants of their own people. The States bordering the Mississippi on the west have no surplus, and most of them are at this moment importing to meet the demands of even their sparse population. . . . Arizona, New Mexico, Colorado, Wyoming, Montana, Idaho, and Dakota have but a meager supply, not sufficient for a population as dense as now occupies Ohio, Indiana, or Illinois. Only the newly acquired territory of Alaska remains to be considered. Very little is known of its timber resources, but, in much the largest portion, it is known that its rigorous climate precludes the growth of valuable forests, and it is not too much to presume that the timber in that Territory will be insufficient to meet the demands of the trade now opening with the great populations of China and Japan. Considering, then, the present and the prospective forest products in this country in the light of their necessity for domestic purposes, and for the protection of men, animals, fruits, and grain, and of their value in inducing moisture, protecting the soil, and tempering the climate, it is, indeed, important that every section of the country should retain, if it has them, and if it does not have them, should immediately engage in their production, at least to the extent of supplying local use and protection.

Government Timber Land

(Extract from the Report of the Commissioner of Agriculture for the Year 1886, Division of Forestry, B. E. Fernow, Washington, D. C., 1886.)

In 1883 the area of timber-land remaining in the hands of the General Government was estimated in round figures at 73,000,000 acres, (probably an underestimate). The greater part of this is situated in the mountain regions of the West. Neither its condition nor its exact extent and location are ascertainable from the records of the General Land Office, no efforts having been made to note sufficiently the condition of the public domain when surveys were platted. No attempts are made at forestry management, and in the disposal of land no adequate distinction is made with a view to aiding the development and settlement of the country.

The efforts to prevent depredations, amounting yearly to many million dollars, are mostly frustrated for lack of means or organization. The laws relating to the protection of the forest domain are either inadequate, or ineffective for want of execution. This is often made practically impossible by the existence of "servitudes" or privileges like those which hamper the forest administrations of Europe, i.e., rights of certain corporations or persons to cut timber on the public domain for specified uses, such as railway construction, mining operations, charcoal burning, domestic use, etc. These privileges were granted by the Government to stimulate and aid development, but their abuse causes continued depredation on this valuable property of the people.

The General Government should of course protect such public property until disposed of, as well as any private owner would protect his own, and should dispose of it only to subserve the

fundamental idea of our land policy, in the development of the country.

But from the foregoing exposition it would appear that a broader consideration of this property, a more distinct policy in regard to it, should prevail than the mere consideration of the best manner of parting with it.

It may be confidently asserted that—

(1) The remaining public timber domain would not be best disposed of by sale, nor is it needed for settlement.

(2) It is principally more valuable for the timber on it than for agricultural purposes.

(3) It is likewise more valuable, by its position on mountain slopes and crests, for other objects than for its material.

(4) Its retention and administration, under Government control, is demanded by the best interests of the adjoining territories as well as of the country at large.

Though it cannot be expected that, by the withdrawal of such lands from sale and their administration by the Government, much will be contributed towards warding off scarcity in the lumber supply of the future, the area being insignificant, it would to some extent tend toward accelerating a wholesome change in the methods of the lumber industry, curtailing the area for speculative enterprises. The lands thus reserved would form a nucleus and an example for American forestry, making possible the organization and economical working of a Forestry Department, to which we must ultimately come.

APPENDIX TO CHAPTER II

Percentage of the Total Forest Products Industry of the United States Contributed by Each State.

<i>Rank</i>	<i>State</i>	<i>Per Cent</i>
1	New York	9.4
2	Michigan	9.2
3	Washington	5.9
4	Wisconsin	5.4
5	Illinois	5.4
6	Ohio	5.1
7	Pennsylvania	5.1
8	Indiana	3.9
9	Massachusetts	3.6
10	Louisiana	3.3
11	California	3.0
12	Maine	2.9
13	Oregon	2.4
14	New Jersey	2.2
15	North Carolina	2.2
16	Mississippi	2.2
17	Texas	2.1
18	Arkansas	2.1
19	Virginia	1.8
20	Florida	1.8
21	Minnesota	1.8
22	Tennessee	1.6
23	Alabama	1.5
24	Georgia	1.4
25	New Hampshire	1.4
26	Missouri	1.4
27	Iowa	1.2
28	West Virginia	1.2

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<i>Forestry</i>		
<i>Rank</i>	<i>State</i>	<i>Per Cent</i>
29	Kentucky	1.1
30	Maryland	.9
31	Idaho	.7
32	Vermont	.7
33	Connecticut	.7
34	South Carolina	.6
35	Delaware	.3
36	Montana	.3
37	Rhode Island	.2
38	Oklahoma	.2
39	Kansas	.2
40	Nebraska	.1
41	Colorado	.1
42	New Mexico	.07
43	South Dakota	.06
44	Arizona	.05
45	Utah	.03
46	Wyoming	.03
47	North Dakota	.01
48	Nevada	.00

APPENDIX TO CHAPTER III

Land Economic Survey

(Extract from "Director's Summary," Biennial Report,
1925-26, Department of Conservation, State of Michigan.)

The Land Economic Survey inventory describes the resources of each county in detail and without prejudice by means of maps and reports which are being published for general distribution.

"These maps and reports will show the kind, location and distribution of (1) towns, roads, railroads, schools, dwelling houses, summer cottages and hotels, garages, cheese factories, creameries, sawmills, dams, power plants, mines, quarries, etc., (2) the different upland, swamp and stream bottom soils such as sand, loam, clay, muck, peat, etc., (3) the lay of the land whether level, slightly sloping, moderately sloping or steep and hilly, (4) the lakes, rivers, streams, and drainage ditches, (5) the different kinds of forest growth such as poplar, white birch, maple, yellow birch, hemlock, cedar, tamarack, spruce (including the average size and comparative density of the stand), the recently cutover and burned over land, the grass swamps, cranberry-sphagnum bogs, the cropland, pasture land, apparently idle and abandoned farm land, the U. S. and State Forests, State Game Refuges, private hunting and fishing grounds, parks, summer resorts, townsites, villages and industrial land, (6) who owns the land and why they own it, (7) the nature and character of the county's business and production such as the shipments of forest, farm and factory products into and out of the county, (8) the location and character of the State owned and tax delinquent lands, (9) the nature, location and extent of the rocks and minerals such as iron and copper bearing rocks, limestone, shale, clay, gravel, sand, marl, peat, mineral water, etc., (10) the amount of developed water power and an estimate of the undeveloped water power with possible dam-site and storage reservoir locations. . . .

For Menominee County the Inventory has shown:

1. That with 128,394 acres in man-made clearings Menominee County has a higher percentage of improved farm land than any other Upper Peninsula County.
2. That this improved farm land is most compactly grouped on the fertile brown loam soils of the central part of the county.

3. That there are important and accessible areas of similarly fertile soil for future farm development.
4. That soil and climate suit these lands for dairying and diversified farming based on such crops as clover, alfalfa, timothy, pasture, oats, barley, wheat, peas, sugar beets, potatoes, corn for silage, and apples.
5. That 510,196 acres are occupied by forest growth, 24,799 of which is now of merchantable size.
6. That 94.4 per cent of the forest area will make satisfactory forest without other help than fire prevention.
7. That 57,950 acres of the uncleared land will not make satisfactory forest unless it is planted, and protected from fire.
8. That the county has valuable marl deposits and local areas in which exploration for iron deposits seems justified.
9. That the Menominee River in this county is capable of producing 197,000,000 kilowatt hours of electric energy at an approximate cost of \$7,000,000 for developing additional power plants.
10. That the Menominee River, the Shakey Lakes and the Bay Shore offer many sites suitable for resort and recreational development.
11. That at least two large areas of unbroken wild land possess a character suitable for wild life refuges or private hunting preserves.

APPENDIX TO CHAPTER IV

Forest Utilization in Wisconsin

("Cellulose Propagators," by Howard F. Weiss. Report of the Wisconsin Commercial Forestry Conference, Milwaukee, March 28-29, 1928.)

This is a very changing world; especially is that realized by those who are engaged in business pursuits. An excellent paper along that line was published only a short time ago, entitled "Business has Wings," and I think that applies to the forestry movement just as fully as it applies to any other form of modern business activity.

In this forestry problem it is necessary for a good many of us to get quite a new viewpoint on the problem, at least on forest utilization, if we are to understand the problem of reforestation. We must get over the idea of viewing trees as containing simply so many logs. We must more closely adhere to the view of looking at the tree as a national product which develops a wood substance, or to put it in a more technical phrase, a plant which grows cellulose. If we will grasp it in that light, it makes the problem of reforestation take on a very optimistic hue, because looking at it in that light, it is very easy to conceive and to appreciate the possibility of creating out of the forest growth a great diversity of products and not only wood products; and this great diversity of products makes it possible to put the forest growth to a great many commercial usages. Some day we may change the forester's title to cellulose propagator!

It is not fair and it is not practical to expect all of the burden in this general problem of reforestation to be borne by lumber. Lumber cannot do it — lumber has got to be helped by more complete and economic utilization. If you don't believe that, talk to some of the men who are on the road trying to sell

lumber in competition with other structural commodities, or talk to some of the lumber manufacturers who are trying to make a profit out of their operations. Lumber has enough of a load to carry now.

Federal Recreation Policy

(Extract from "Recreation Resources of Federal Lands,"
National Conference on Outdoor Recreation,
Washington, D. C., 1928.)

These initial steps are suggested as elementary in the formation of a Federal recreation policy:

1. Creation by law or executive order of a continuing agency or commission to promote and develop a Federal outdoor recreation policy; to advise concerning means of coordinating the common functions of various agencies of the Government which relate to outdoor recreation and the conservation and administration of natural plant and animal life resources, including forestry, fisheries, game and bird life, the national forests, parks, monuments, and public domain; to serve as a means of bringing the agencies of the Government into active cooperation with national and other bodies in the field of outdoor recreation and conservation; and to promote specific projects of research and plans of practical application for the utilization and enjoyment of the recreational values of the Federal natural resources.
2. A clear definition by law of the status of recreation on the National Forests as a coordinated use of the forests in relation to their primary purposes and their economic uses in general.
3. Adequate annual appropriations for the prevention of forest fires on the Federal lands, and complete reversal of the

present pinch penny policy which denies sufficient funds for fire prevention, and relies upon the uneconomic procedure of drawing upon the Treasury for emergency funds to extinguish fires after they have started.

4. The initiation through inter-bureau cooperation of regional studies and planning to determine the policy which should govern forms of use, occupancy and management which will most completely realize potential education, scientific, inspirational and recreational values of the national parks and forests.

5. Establishment by law of the objects and standards of the national parks system in order to (a) differentiate this system clearly from other land systems, Federal and state, and (b) provide a definite basis for development of recreation in the parks in coordination with recreation in national forests and other permanent Federal reservations.

6. Addition to present park system of areas fully meeting the national park standards. (Reference, Great Smoky Mountains National Park, Public No. 33, 70th Congress.)

7. A definite long term program for the acquisition of national forest lands in the Lake States, the Appalachian Range of New England and the mountain states of the South, and in the coastal plains region of the South. (Reference, McNary-Woodruff Act as passed by the 70th Congress, Public No. 326.)

8. Formal delimitation by proclamation of the Secretary of Agriculture of wilderness areas within the national forests and suppression of the exploitation of social uses or speculative economic uses inimical to the enjoyment of simple wilderness sports. (Reference, Leavitt Bill, H.R. 10659 in the 70th Congress.)

9. Appropriation for adequate sanitary facilities for all national forest public camps.

10. Addition to national forests of adjoining timber lands

of the unreserved public domain under the provisions of the Clarke-McNary Act and repeal of the Timber and Stone Act. (Reference S. 3677, 70th Congress.)

11. Passage of an enabling act to establish within national forests, with the consent of the states, sanctuaries and refuges for game, fur bearers, birds and fish. (Reference Robinson Bill S. 2456 in the 70th Congress.)

12. Strengthening of cooperative agreements with the states to provide for complete game administration.

13. Reconnaissance of the public domain for the determination of winter range sanctuaries for big game animals of national importance. (Reference Leavitt Bill Public No. 425 — 70th Congress and Winter Bill H.R. 478 — 70th Congress.)

14. Passage of legislation making possible creation of needed reservations for the protection of the natural habitat of migratory birds. (Reference Public No. 304, 70th Congress, establishing the Bear River Migratory Bird Refuge and the Norbeck Bill S. 1271, 70th Congress.)

15. Adequate appropriations for the development and administration of all Federal game reservations.

16. Reorganization of national monuments so as to standardize selection and administration by the three government departments creating and administering them, and appointment of a coordinating commission of members of these departments and civilians to build them into a balanced system for the protective and scientific uses for which they were intended.

17. Adequate appropriations for the administration of national monuments.

18. Consideration by the Office of Indian Affairs of the possible application of wilderness forms of recreation to certain Indian reservations.

19. Reconnaissance of the public domain to determine areas for inclusion as national monuments.

20. Passage of legislation for the regulation of the grazing

of live stock on the public domain. (Reference Colton Bill H.R. 7950 and H.R. 9283 in the 70th Congress.)

21. Classification of lands of the public domain chiefly valuable for recreation under the terms of the Act of June 14, 1926, and their administration by the state or minor political units.

22. A definite long term program establishing a firm basis for forest research and the relation of wild life and recreation to forestry. (Reference McSweeney Bill as enacted by the 70th Congress, Public No. 466.)

APPENDIX TO CHAPTER V

*Area of National Forests 1891 to 1928, Inclusive*¹ and ²

Year	Gross Area Acres	Net Area Acres	Gain or loss in area compared with preceding year Acres
1891	1,239,040	.....	
2	3,252,260	.....	+ 2,013,220
3	13,053,440	.....	+ 9,801,180
4	17,564,800	.....	+ 4,511,360
5	17,564,800	.....	.....
6	17,564,800	.....	.....
7	18,993,280	.....	+ 1,428,480
8	40,719,474	.....	+ 21,726,194
9	46,021,889	.....	+ 5,302,415
1900	46,772,129	.....	+ 750,240
1	46,410,209	.....	- 361,920
2	60,175,765	.....	+ 13,765,556

¹ Net areas for 1905 to 1912, inclusive, are estimated.

¹ Prior to 1906 the gain or loss is of gross areas.

² *Journal of Forestry*, Vol. XXIV, p. 130.

Year	Gross Area Acres	Net Area Acres	Gain or loss in area compared with preceding year Acres
3	62,354,965		+ 2,179,200
4	62,763,494		+ 408,529
5	85,852,229	75,352,175	+ 23,088,735
6	106,994,018	94,159,492	+ 18,807,317
7	150,832,665	132,731,865	+ 38,572,373
8	167,976,886	147,819,660	+ 15,087,795
9	194,505,325	172,230,233	+ 24,410,573
1910	192,931,197	168,028,752	- 4,201,481
1	190,608,243	168,165,163	+ 136,411
2	187,406,376	165,027,163	- 3,128,000
3	186,616,648	165,516,518	+ 489,355
4	185,321,202	163,848,524	- 1,667,994
5	184,505,602	162,773,280	- 1,075,244
6	176,088,608	155,399,809	- 7,373,471
7	176,340,353	155,220,429	- 179,380
8	175,955,771	155,374,602	+ 154,173
9	174,261,393	153,933,460	- 1,441,142
1920	180,299,776	156,032,053	+ 2,098,593
1	181,820,459	156,666,045	+ 633,992
2	181,799,997	156,837,282	+ 171,237
3	182,099,802	157,236,807	+ 399,525
4	182,817,159	157,502,793	+ 265,986
5	184,125,912	158,395,056	+ 892,263
6	184,123,951	158,750,210	- 1,061
7	183,938,106	158,800,424	- 185,845
8	184,403,819	159,480,856	+ 465,713

^a Reports of the Forester 1926, 1927, 1928.

Appropriations, 1928-29, U. S. Forest Service

(From Experiment Station Record, September, 1928.

Pages 304-305.)

The Forest Service receives \$8,870,105, together with \$2,000,000 for the acquisition of additional lands at the headwaters of navigable streams (an increase of \$1,000,000), \$75,000 for the cooperative distribution of planting stock, \$1,200,000 (an increase of \$200,000) for cooperative fire protection, and \$7,500,000 (a decrease of \$880,000) for the construction of forest roads and trails. These various appropriations, together with \$3,430,500 from the permanent appropriations, make a total of \$23,075,605 available for forestry work, a net decrease of \$528,215. This expenditure will as usual be offset to a considerable degree by the receipts from the national forests, which in 1927 amounted to \$5,166,605.74.

APPENDIX TO CHAPTER VI

Summary of Forest Vegetation

Classification of forests of the United States into forest regions, subregions, and sites

Atlas of American Agriculture, Part I, Sect. E., U. S. D. A.
Washington, D. C., 1924

THE WESTERN FORESTS

Forest region	Subregion	Association	Sites
Western yellow pine-Douglas fir.	Lodgepole pine.	Lodgepole pine-Douglas fir.	At the lower altitudinal limit of the lodgepole pine zone, on south slopes and on dry, rocky knolls.
		Lodgepole pine-Engelmann spruce.	At the upper altitudinal limit of the lodgepole pine zone and on moist

Forest region	Subregion	Association	Sites
		Larch-balsam-pine.	bottom lands along stream courses. On flats and drier situations in northwestern Idaho.
	Pure yellow pine.	Pure yellow pine.	Occurs on dry, hot slopes or flats at low elevation, from 3,500 to 4,500 feet in California and on the east slope of the Sierras, where it consists of Jeffrey pine and white fir. Typical of Arizona and New Mexico. In the southern part of each of these states the belt lies between about 6,000 and 7,500 feet. At its upper edge Douglas fir and Engelmann spruce come in and above 9,000 feet dominate the stand. In the northern part of New Mexico these forests are nearly 1,000 feet higher. Also occurs in northern Nebraska and the Black Hills, in northern Nebraska at an elevation of 3,000 feet and in the Black Hills from 3,000 to 5,000 feet. Also on south slopes and all lower altitudes in Washington and Oregon between 3,000 and 5,500 feet. In northern Montana and Idaho at the lower altitudes on warm, sunny exposures, low ridges, and rather dry benches and gravelly flats.
	Rocky Mountain Douglas fir.	Yellow pine-Douglas fir.	On northwesterly moderately cool slopes at moderately high elevations (4,500 to 5,500 feet) on the

Forest region	Subregion	Association	Sites
			west slope of the Sierras. In Arizona this type occurs at elevations between 8,500 to 10,000 feet on south slopes and between 7,500 feet and 9,000 feet on the north exposures; in the central Rockies at elevations from 6,000 to 9,000 feet, chiefly on sandstone and granite soils.
		Douglas fir.	On cool northerly and northeasterly slopes at elevations of about 5,000 to 6,000 feet on the moist slopes of the Sierras and at elevations between 8,000 and 10,000 feet in the central Rockies.
		Yellow pine-Douglas fir-larch.	On moderate westerly slopes throughout northwestern Idaho.
	Yellow pine-sugar pine-incense cedar.	Yellow pine-sugar pine.	On cool slopes, chiefly on clay, slates, quartzite, and limestone soils at elevations of 3,500 to 5,500 feet on the western slope of the Sierras.
		Yellow pine-incense cedar.	On moderately dry western slopes, especially on soils of serpentine formation on the western slope of the Sierras.
		Yellow pine-sugar pine-Douglas fir.	On cool slopes on clays, slates, quartzites, and limestones, at elevations of from 4,000 to 6,000 feet on the west slope of the Cascades.
Cedar-hemlock (<i>Thuja, Tsuga</i>).	Western larch-western white pine.	Pure western larch.	On flats and moderate northerly and northwesterly slopes in northwestern Idaho.
		White pine-Douglas fir-larch.	On moist northerly slopes, flats, and basins at various elevations up to the

Forest region	Subregion	Association	Sites
Spruce-fir (<i>Picea, abies</i>).	Pacific Douglas fir.		point where alpine fir and Engelmann spruce take possession throughout northwestern Idaho.
		White pine-larch-cedar.	Practically the same as for the previous one, except that it is in a more advanced stage of maturity.
		Douglas fir-hemlock-cedar.	On humid lower slopes and valleys from sea-level to 3,000 feet.
		Pure Douglas fir.	On lower slopes and valleys moderately humid, from sea-level to 3,000 feet.
		Sitka spruce.	Coastal valleys and benches from sea-level to 200 feet.
		True firs.	Middle altitudes on all slopes and aspects, from 3,000 to 4,500 feet, on the west slope of the Cascades.
		Alpine fir-white bark pine-Lyall larch.	At high altitudes above the commercial forest, from 4,500 to 7,000 feet, in the Cascades.
		Engelmann spruce-bristle cone pine-cork-bark fir.	At elevations from 10,000 to 11,500 feet in the mountains of Arizona.
		Pure red fir.	At elevations above 6,000 feet on northerly and northeasterly slopes in the Sierras.
		Red fir-white fir.	At same elevation as that of red fir (6,000 feet), but on less moist or cool situations.
		Sub-alpine fir-hemlock.	From 7,000 feet to timberline in the Sierras.
		Lodgepole pine.	On cool meadows with plenty of moisture, varying in elevation from

Forest region	Subregion	Association	Sites
Pinon-juniper.		Engelmann spruce-balsam fir.	5,300 to 6,500 feet in the Sierras. At elevations from 7,500 to 10,000 feet in the central Rockies.
		Pinon-juniper.	In central Rocky Mountains, Rocky Mountain juniper (<i>Juniperus scopulorum</i>) and one-seed juniper (<i>J. monosperma</i>) are the chief species, often with some Gambel oak (<i>Quercus gambelii</i>), and western yellow pine. In Arizona and New Mexico pinon, Mexican pinon (<i>P. cembroides</i>), single-leaf pinon (<i>P. monophylla</i>), alligator juniper (<i>Juniperus pachyphloea</i>), one-seed juniper, Rocky Mountain juniper, and Utah juniper (<i>J. utahensis</i>) are the chief species, often with some Gambel oak and western yellow pine. In Utah, single-leaf pinon, Utah juniper, one-seed juniper, and rocky Mountain juniper, often with some Gambel oak and western yellow pine. In California, single-leaf pinon and Utah juniper, often with some western juniper (<i>J. occidentalis</i>) and Jeffrey pine.
		Juniper.	In the northern Rocky Mountains juniper is the chief species, usually with some limber pine, western yellow pine, or Douglas fir; in California, juniper, often with some Jeffrey pine and western yellow pine; in Wash-

Forest region	Subregion	Association	Sites
Birch-beech-maple-hemlock (northern hardwood forest).	.....	With mixture of spruce, balsam and hemlock (transition forest); ¹ with mixture of ash, elm, basswood, or red oak; with mixture of paper birch or aspen; with beech predominating; ² with sugar maple predominating.	Fresh, well-drained fertile soils within the drainage system of the St. Lawrence, the Great Lakes, and the upper Mississippi; throughout northern New England and southward along the northern and southern Appalachian Mountain ranges to extreme northern Georgia. It coincides with the range of yellow birch and centers about the region of best development of white pine. In Minnesota the beech and hemlock disappear and the forest is made up of aspen, white birch, basswood, and maple of inferior development.
White pine-Norway pine-jack pine.	.....	Jack pine plains. Pure Norway pine. Norway-white pine in mixture with hardwoods.	On the driest, sandiest soils. On dry, sandy soils, slightly better than those characteristic of the jack pine plains. Usually on moderately moist, well-drained soil underlain with a clay subsoil.
Oak.	Chestnut-chestnut oak-yellow poplar.	.....	Cove. — Poplar, hemlock, basswood, black birch, cucumber, ash, buckeye. Most abundant, probably chestnut. Very abundant, chestnut, oak, hickory, red oak, white oak, black gum, dogwood, sourwood, silver bell, white pine. There may be distinguished poplar cove, hemlock cove, white oak cove, etc.

¹ With mixture of white pine or tamarack.

² With yellow or black birch predominating.

Forest region	Subregion	Association	Sites
			Ridge. — Pitch, table-mountain, and shortleaf pines; chestnut, scarlet, and black jack oaks; chestnut; black gum. There may be recognized pine ridge, chestnut oak ridge, oak ridge. Slope. — A blending of above species with heaviest proportion of chestnut and oaks. Upper slope resembles ridge, lower slope resembles cove.
	Oak-hickory.	.....	The most eastern extension of the oak region. The oaks and the hickories, together with some ash and black walnut, are the farthest avant post in the prairie region.
	Oak-shortleaf pine.	.....	Characteristic species are chiefly shortleaf pine as the predominating species, with varying amounts of black, chestnut, post, and Spanish oaks, pignut and mockernut hickories and black jack oak, approximately in the sequence given above: On dry ridges (north) — shortleaf pine, chestnut oak, scrub and some pitch pine. On dry ridges (south) — shortleaf pine, post oak, black jack oak. On average rolling lands — shortleaf pine, black oak, pignut hickory, Spanish oak, mockernut hickory (lower), chestnut oak (drier and warmer), scarlet oak, black gum (gen-

Forest region	Subregion	Association	Sites
Chaparral.		Oak.	ington and Oregon, western juniper, often with mountain mahogany, and sometimes with a little western yellow pine. In Arizona and New Mexico, Emory oak (<i>Q. emoryi</i>), Arizona white oak (<i>Q. arizonica</i>), blue oak (<i>Q. oblongifolia</i>), and whitetleaf oak (<i>Q. hypoleuca</i>) are the chief species often with some alligator juniper, Mexican piñon, and other species. In Utah, pretty scrubby Gambel oak. In California, black oak (<i>Q. californica</i>), California blue oak (<i>Q. douglasii</i>), canyon live oak (<i>Q. chrysolepis</i>), California live oak (<i>Q. agrifolia</i>), highland live oak (<i>Q. wislizeni</i>), valley oak (<i>Q. lobata</i>), and Garry oak (<i>Q. garryana</i>), often with some digger pine, madrone, and occasionally knobcone pine, Coulter, Jeffrey, and western yellow pines, and other species.
		Digger pine.	A low foothill belt made up approximately of 40 per cent or more of digger pine, often mixed with various oaks, Coulter pine, and other species. Occurs on any sites below the western yellow pine type.

THE EASTERN FORESTS

Forest region	Subregion	Association	Sites
Spruce-fir.	Spruce-fir.	Spruce swamps.	Low lying, poorly drained areas, whose soil is a muck or peat, spongy in texture, and acid. The characteristic species are red spruce, black spruce, balsam, tamarack, cedar, soft maples.
		Spruce flats.	Spruce flats occupy the level and rolling flats bordering the swamps, lakes, and water courses. It is in large measure a transition between the swamp type and the type of the mixed hardwood lands, and in many respects exhibits the characteristics of each. Spruce, birch, soft maples, white pine, hemlock, and balsam are the characteristic trees in mixture.
		In mixture with hardwoods.	These occupy the best soil sites of the region, usually the benches and the lower mountain slopes. The soil is here best adapted to hardwood growth, is deep, of more or less even texture, fresh, and well-drained. Besides spruce, hard maple, beech, and birch predominate and there is a scattering of hemlock, white pine, soft maple, cherry, and a variety of other species. The proportion of spruce in mixture depends on topographic conditions. Transition to birch-beech-maple-hemlock forest.

Forest region	Subregion	Association	Sites
Cypress-tupelo-red gum.			erally scattering), dogwood and persimmon (understory). On low southern situations — shortleaf pine, loblolly pine, red gum, black gum, white oak.
		River swamps.	“ Sloughs ”: Cypress and tupelo. “ Glade ”: Cypress, tupelo, water ash, willow, cottonwood, white and red bays. “ Ridge ”: Red gum, slash pine, overcup oak, water oak, hickory, black gum, ash, red maple, honey locust.
		Sour swamps and cypress “ ponds.” River bottom forest.	Poorly drained, highly acid soils. Cypress (<i>imbricata</i> or “ pond ” form), black gum, pond pine, slash pine, sour tupelo, southern white cedar, white and red bays. Along the larger streams and deeper narrow valleys in the upper Piedmont sections, the forest consists chiefly of hardwoods, red gum, willow and water oak, ash, shellbark, and other hickories, black and red gums, some yellow poplar and cucumber, persimmon, and dogwood. Shortleaf pine is prominent on the warm, south-facing and drier slopes mixed with black oak and post oaks, pignut and mockernut hickories. Toward the lower or southern margin of this forest formation loblolly pine occurs in increasing

Forest region	Subregion	Association	Sites
Longleaf-loblolly-slash pine.			importance in mixture with shortleaf and the species belonging to the lower and more moist soils; most important in southeast Arkansas. South of Virginia longleaf pine enters and in central Alabama, northern and western Louisiana, and eastern Texas becomes an important member of the composition.
		Longleaf, slash, and loblolly pines.	On low marshy lands in the vicinity of the Gulf and Atlantic coast. Generally flat, with deep sandy soil lacking in humus, alternately very wet and dry. Undergrowth of wire grass and palmetto.
		Pure longleaf pine.	High pine land. This is a belt adjoining low marshy lands in the vicinity of the Gulf and Atlantic coast. Here practically pure stands of longleaf pine cover the sandy hills and plains while the moist depressions bordering the creeks and streams are occupied by hardwoods, loblolly pine, and cypress. Broom sedge, turkey oak (<i>O. catesbaei</i>), and bluejack oak (<i>Q. cinerea</i>) form the undergrowth.
		Longleaf pine in mixture with shortleaf and loblolly pines and hardwoods.	A broken and hilly country lying still farther inland from the coast. Here the longleaf pine mingles with shortleaf pine forests and mixed hardwoods of the uplands.

Forest region	Subregion	Association	Sites
Mangrove			Southern shores of Florida, overflowed generally by salt tidewater. Representative of the tropical forest vegetation.

APPENDIX TO CHAPTER VIII

*Forest Experiment Stations*¹

Forest Service, United States Department of Agriculture

Allegheny (in coöperation with the University of Pennsylvania), Philadelphia, Pa.

Appalachian — Asheville, N. C.

California (in coöperation with the University of California) Berkeley, Calif.

Central States (in coöperation with Ohio State University and Agricultural Experiment Station), Columbus, Ohio.

Lake States (Cloquet — in coöperation with the University of Minnesota), St. Paul, Minn.

Northeastern (in coöperation with the Massachusetts Agricultural College), Amherst, Mass.

Northern Rocky Mountain — Missoula, Mont.

Northwestern — Portland, Ore.

Southern — New Orleans, La.

Southwestern — Flagstaff, Ariz.

¹ See map, p. 173.

APPENDIX TO CHAPTER IX

*List of twenty-five
United States and Canadian Forest Schools
with names of those in charge*

1. Prof. Walter Mulford, Div. of Forestry, Univ. of California, Berkeley, Calif.
2. Prof. W. J. Morrill, Dept. of Forestry, Colorado Agr. College, Fort Collins, Colo.
3. Prof. Gordon Parker, Colorado School of Forestry, Colorado Springs, Colo.
4. Prof. T. D. Burleigh, State College of A. & M., Univ. of Georgia, Athens, Ga.
5. Dean F. G. Miller, School of Forestry, Moscow, Idaho.
6. Prof. G. B. McDonald, Dept. of Forestry, Iowa State College, Ames, Iowa.
7. Prof. G. D. Marckworth, Dept. of Forestry, Louisiana State University, Baton Rouge, La.
8. Prof. J. M. Briscoe, Forestry Dept., Univ. of Maine, Orono, Me.
9. Dean S. T. Dana, School of Forestry, Univ. of Michigan, Ann Arbor, Mich.
10. Prof. A. K. Chittenden, Dept. of Forestry, Michigan State College, East Lansing, Mich.
11. Dean T. C. Spaulding, School of Forestry, Univ. of Montana, Missoula, Mont.
12. Prof. H. Schmitz, Div. of Forestry, Univ. of Minnesota, St. Paul, Minn.
13. Dean Franklin Moon, N. Y. State College of Forestry, Syracuse University, Syracuse, N. Y.
14. Dean G. W. Peavy, Oregon State Agr. College, Corvallis, Ore.

15. Director E. A. Ziegler, Penn. State Forest School, Mont Alto, Pa. (Combined with Penn. State College, 1929.)
16. Dean H. Winkenwerder, College of Forestry, Univ. of Washington, Seattle, Wash.
17. Prof. E. H. Steffen, Dept. of Forestry, State College of Washington, Pullman, Wash.
18. Dean H. S. Graves, School of Forestry, Yale University, New Haven, Conn.
19. Prof. K. W. Woodward, Univ. of New Hampshire, Durham, N. H.
20. Prof. Ralph S. Hosmer, Dept. of Forestry, Cornell University, Ithaca, N. Y.
21. Prof. J. A. Ferguson, Dept. of Forestry, Penn. State College, State College, Pa.
22. Prof. B. N. Prentice, Dept. of Forestry, Purdue University, Lafayette, Ind.
23. Dir. R. T. Fisher, Harvard Forest School, Petersham, Mass.
24. Dean C. D. Howe, Univ. of Toronto, Toronto, Canada.
25. Prof. H. R. Christie, Dept. of Forestry, Univ. of British Columbia, Vancouver, B. C., Canada.

APPENDIX TO CHAPTER X

United States Department of Agriculture

Forest Service

Washington

January 25, 1928.

Mr. Axel H. Oxholm,

Director, National Committee on Wood Utilization,
Department of Commerce.

Dear Mr. Oxholm:

I have been greatly interested in reading your letter of January 20, which raises important questions regarding timber

supply and timber use in relation to industrial reforestation. For the sake of brevity, I will not attempt an itemized comment on the ten statements which you propose; but I am glad to give you my viewpoint on the more important issues which they involve.

Timber Growing Essential

I agree fully with you that national interests will benefit far more by vigorous encouragement of timber growing than by hoarding the timber we now have. This is not only because a liberal use of wood is essential to our industrial and construction requirements and to high standards of living; but also because vast areas of land in the United States can profitably be employed only in timber culture. Without timber growth, one-fourth of our soil will be largely without means to pay taxes, support communities, or maintain industries and commerce. The disastrous economic and social effects of the idleness of potential forest land are already felt in several regions. Hence every reasonable incentive for farm and industrial forestry should be provided.

Timber growing, as you point out, is primarily an economic process. If it does not pay, forests cannot be widely and generally produced. To make it pay there must be an adequate market for forest products. Hence it is clear to me that liberal use of wood will promote forestry and the profitable employment of our forest land. The constructive solution of the whole problem lies in timber use and timber culture, each backing and sustaining the other.

Timber Culture Needs Speeding Up

This solution, of course, depends upon general reforestation as an integral part of timberland ownership and logging operations. Without that, we will be burning the candle at both ends.

The danger of a timber shortage arises from the large areas of cut-over land which have been left unproductive by destructive logging and fires, while the cutting of virgin stumpage has gone on apace. I believe that the United States is making real, though slow, progress in curing this situation, partly through public effort in such directions as systematic protection from forest fires and partly through industrial and farm forestry on an expanding scale. The growing interest of land owners in reforestation and the increasing extent to which it is being applied, although still far short of meeting the situation, are encouraging. I believe that we must put our faith in it as a real solution of the national problem and direct our efforts towards speeding it up to the greatest possible degree.

Curtailing Use of Timber Will Not Help

If all our available forest land can be put into productive timber culture, the United States can sustain and, in time, even expand its present consumption of forest products. How serious a timber shortage we may experience will depend mainly upon how rapidly reforestation is extended and how effectively timber growing is incorporated in industrial land management. Personally, I do not see that we can avoid a period of shortage of at least high quality, old growth timber, though I am unable to forecast it in specific terms. However, I do not believe that this probability should influence the course of public action or public thought in seeking a solution of our problem through the maximum encouragement of reforestation rather than through resort to timber hoarding. Necessarily a long time will be required to work out our situation to one of real stability, when the current re-growth of timber offsets its current use. But we can and should balance the ledger in this fashion without denying to the country a liberal use of wood. On the contrary, a continued liberal use of wood

alone will create the values and sustain the markets for forest products that are essential to industrial forestry. I agree with you that abstention from the use of timber will not help the cause of forest perpetuation.

Timber Crops Should Be Harvested When Mature

Furthermore, like any other crop, timber becomes a partial or total loss if not utilized when mature. Such waste of natural resources benefits no one. The orderly and systematic working of timberlands will put into the channels of industry and commerce much valuable material which would otherwise be lost through insects and decay. There is still an enormous wastage from these sources in our virgin forest areas, a wastage that can largely be prevented as systematic timber growing and timber harvesting are brought about.

The Public Should Aid Timber Growing

To work out our timber and forest land problems along these lines still requires a great deal more than is now being done. There should be no delusion that the problem either has been solved or that it will be solved in any adequate way if things are simply left to take their own course. Protection of forest areas from fire is not yet one-half adequate. The taxation of forest lands is still largely unadapted to the time requirements of timber culture; and in many instances is a positive deterrent to the practice of forestry. Responsibility for meeting these requirements of the situation rests largely with the public.

Closer Utilization Promotes Timber Growing

Closer utilization of timber will make forest crops more valuable and hence encourage their production. All that can

be accomplished in this field will be a powerful stimulus to forest perpetuation. While this is largely an industrial problem, its solution can be materially aided by the research of public agencies and by the promotion of more effective utilization through such admirable work as that of the National Committee on Wood Utilization.

Responsibility of Forest Industries for Timber Growing

Responsibility also rests, in my judgment, upon forest industries and land owners to progressively extend timber growing as part of their operations. There is an obligation for industrial leadership and foresight in working out this national economic problem. The future of our forests rests largely with the commercial interests which own and convert them. Success in solving our forest problems rests primarily upon the rate and degree to which forestry is incorporated in industrial timberland management. Gratifying progress is now taking place in this direction in many instances. While we cannot ask the private forest owners of the United States to undertake a business course that is economically unsound, we may rightfully look to them to thoroughly study the business possibilities offered by reforestation and to give their earnest support to industrial as well as public developments of this nature. It is an essential part of the effort now being made by the lumber industry to create greater market stability and encourage the use of wood as a commodity permanently available to the American consumer.

Right Use of Timber Perpetuates the Supply

Unlike many of our natural resources timber can renew itself. Its right use does not exhaust the supply, but perpetuates it. In the long run, indeed, right use increases the supply,

for it speeds up growth. The lumber and other forest industries can and should be perpetual. In the past they have largely followed the wild forests as these have receded before the plow and the ax, and have thus often been shifting or temporary. But they are in no sense dying industries; and with aggressive reforestation and closer use of raw material, they can not only be made permanent but will yield a greater output than at present.

Forests and Outdoor Recreation

Your letter refers to the strong public sentiment for forest preservation as an element of outdoor beauty and recreation. I am a thorough believer in the preservation of beautiful and distinctive forests for public enjoyment as parks or recreation areas. This obviously should be one of the functions of public ownership, Federal, State, or municipal; but the total area solely thus preserved for its scenic beauty would at the outside include but a small fraction of our 470 million acres of forest land.

The bulk of our forest land must be devoted to commercial timber growing. Here the public interest in outdoor beauty and recreation will be served by precisely the same development which serves the economic needs of the country. This is evident today in many portions of New England as well as elsewhere. General reforestation, with the harvesting of timber under methods that insure continuous growth, will preserve and in many cases restore the attractiveness of rural landscapes, the native fish and game, and widely available opportunities for outdoor recreation. The economic benefits from timber use and general timber replacement are as one with the social benefits from forest perpetuation, and any course calculated to promote the former will to an equal degree conserve the latter. I believe that this relationship between commercial forestry

whether on public or private lands, and the outdoor interests of the country will become more and more generally appreciated, especially as the manufacture of timber products loses the stigma of forest destruction and is clearly associated with forest renewal.

Very sincerely yours,

W. B. GREELEY
Forester.

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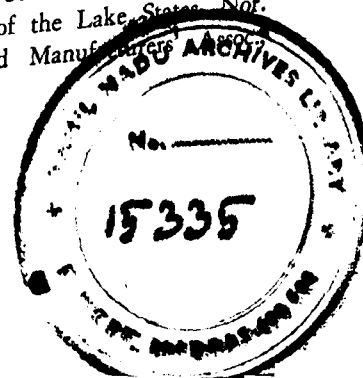
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