CONSERVATION BULLETIN 42
(REVISED 1962)

UNITED STATES DEPARTMENT OF THE INTERIOR *Forest Conservation*

STEWART L. UDALL
Secretary of the Interior

Created by Act of Congress in 1849, the Department of the Interior is responsible for a wide variety of programs concerned with the management, conservation, and development of America's natural resources. For this reason it has often been described as the "Department of Natural Resources."

Through a score of bureaus and offices the Department has responsibility for the use and management of millions of acres of federally owned lands; administers mining and mineral leasing on a sizeable area of additional lands; irrigates reclaimed lands in the West; manages giant hydroelectric power systems; administers grazing and forestry programs on vast acreages of federally owned range and commercial forest lands; protects fish and wildlife resources; conserves hundreds of vital scenic, historic, and park areas; conducts geologic research and surveys; promotes mine safety; conducts saline water research; administers oil import programs; operates helium plants and the Alaska Railroad; is responsible for the welfare of many thousands of people in the Territories of the United States; and exercises trusteeship for the well-being of additional hundreds of thousands of Indians, Aleuts, and Eskimos, as well as being charged with resource management of millions of acres of Indian-owned lands.

In its assigned function as the Nation's principal natural resource agency, the Department of the Interior bears a special obligation to assure that our expendable resources are conserved, that renewable resources are managed to produce optimum yields, and that all resources contribute their full measure to the progress, prosperity, and security of America, now and in the future.

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(REVISED 1962)

UNITED STATES
DEPARTMENT OF THE
INTERIOR *Forest*
Conservation

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Foreword

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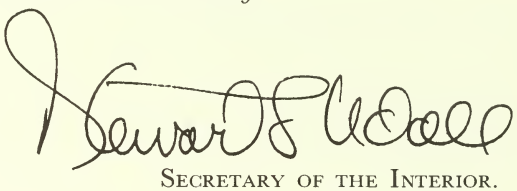

SECRETARY OF THE INTERIOR.

Introduction

SINCE ITS CREATION as the Home Department in 1849, the Department of the Interior has had jurisdiction over vast areas of public and Indian land. Millions of acres of forest land have been included within these areas. At present, the Department is responsible for the administration of nearly 184 million acres of forest and woodland. The intent of this bulletin is to show the magnitude and diversity of the Department's responsibility in the field of Federal forest management as well as its development.

The forests supervised by the Department vary tremendously as to extent, forest types, geographical location, accessibility, and availability. They may be divided, however, into five main groups from the standpoint of management objectives:

1. For recreation, inspiration, and aesthetic purposes as represented by the forests of approximately 8 million acres found within the National Park System.

2. For the purpose of advancing the science of wildlife management throughout the Nation by protecting, improving, or modifying the wildlife habitat within slightly over 1 million acres of forests in the national wildlife refuges.

3. For the purpose of managing on a sustained-yield basis, for the benefit of the Indian owners, the approximately 13 million acres of forests found within the Indian reservations, with the ultimate objective of terminating Federal management responsibility.

4. For the purpose of managing on a sustained-yield basis the more than 2 million acres of Douglas-fir forests found on the Revested Oregon and California Railroad Grant lands and the Reconveyed Coos Bay Wagon Road lands in western Oregon (hereinafter referred to jointly as the O. and C. lands).

5. For the purpose of providing sound management including protection from fire, insects, and disease for approximately 160 million acres of forests and woodland found on the national land reserve and including the public lands in Alaska.

Forestry—Department of the Interior

FOR A CLEAR understanding of the development of forestry within the Department of the Interior, it is necessary to review briefly events prior to the Department's creation in 1849. Two Federal agencies, later to become important nuclei of the new Home Department, were functioning organizations within the Treasury and War Departments shortly after the turn of the 19th century. Policies and programs established within these agencies, the General Land Office (now the Bureau of Land Management) and the Office of Indian Affairs (now the Bureau of Indian Affairs), had a definite influence on the policies and programs of the Department of the Interior during its birth and development.

Early Forest Land Policy

Earliest conception of the Government's custodianship of the public domain was that such lands should be converted into cash for defraying governmental expenses and for extinguishing the public dept. Disposing of public domain was regarded as a real estate business, a viewpoint that continued until the present century. As a result of a sense of obligation to those who served in the armies during wartime, the public lands were regarded as suitable rewards for veterans: indeed, gifts of lands had been held out as inducements for enlistment into the army. Thus the early policy was dominated by the idea that the new public domain should be disposed of as a source of revenue and as a substitute for cash to reward soldiers.

Settlement was accompanied by certain needs which had to be met or it could not have succeeded. One such need was lumber. The settler took it for granted that he could cut and remove whatever timber he needed. Soon the needs for lumber were such that the settler himself could not satisfy them. He might take his own logs to another settler who had a mill and have them converted into lumber. This contributed to the development of a timber business. As small towns grew up, they required lumber and the practice of removing logs from public lands for general local market lumber manufacturing became accepted.

The business soon widened to include the sale of lumber to settlers at distant points and this too was accepted. Essentially the lumber went to bona fide settlers who were the favored claimants to the land and its products and who needed lumber for their homes and barns. Actually, these procedures were illegal. Not even the early day squatter had a legal right to cut and remove timber, except for clearing and improvement, from the land he proposed eventually to claim.

The laws provided inadequately for the lumber needs of the growing settlements. So, out of necessity grew abuses that reached great proportions by the middle of the last century. The practice of removing timber from vacant lands, conceived originally without dishonest motives, soon attained such a standing that the local conscience condoned it. The Department was not unmindful of what was going on, but was unable to prevent such actions. When the General Land Office attempted to stop the illegal cutting of timber, it met with violent protests from the local people and members of Congress, upon whom the local attitude of condoning these illegal actions had made a favorable impression.

It was not until 1878 that the Congress enacted legislation providing for the development of timber resources on the public domain. Prior to 1878 timber land could be obtained only under the Pre-emption and Homestead Acts, although these Acts were intended primarily to open land for agricultural settlement. In order to obtain timber, the land had to be entered under the cloak of intent to settle. Furthermore, lumbering required larger tracts than the 160 acres allowed under the settlement acts. The growing Nation needed vast quantities of lumber. Entries under the existing acts were made with a bare pretense of settlement and were then consolidated into larger holdings, some for speculation, some for operation. Abuses naturally grew and, to remedy them, Congress passed the Timber and Stone Act.[1] Matters were little improved by this Act as the 160-acre limit was continued and, worse, a ridiculously low price of $2.50 per acre was placed on the land. This invited more abuse. Lands were taken up under this law by subterfuge for speculators and for legitimate operators as well. Despite repeated recommendations for its repeal by successive Secretaries of the Interior from 1900 onward, it was not until 1955 that it was finally eliminated by the Congress. Approximately 14 million acres of timberlands were patented under its authority.

Protection of the public domain against damage from fire was a serious problem even before the Civil War. Man, then as now, was the major offender. Early settlers burned the timber to "open the

[1] 20 Stat. 89

country" and to replace timber with grain for forage purposes. Prospectors burned the soil bare more readily to examine the ground for minerals. Those guilty of setting fires could be apprehended but, since no penalties were provided for and because local sentiment in many regions favored burning, convictions were of no use.

The story of the disposal of the great bulk of the public domain lands is the story of the settlement of the country. It reflected a frontier spirit that brooked no restrictions. And finally, the story reflects the triumph of conservation over unrestricted private enterprise. The policy affecting disposal and use of public lands was determined by Congress. As public attitude changed, laws and their administration changed also, though not without the inevitable lag which characterizes all great changes of national policy. A full century passed before the Nation began to consider a change. In spite of the abuses under the land disposal laws by which a billion acres were patented, great good did result. A continent was settled and developed; its outlying segments were tied together by railroads made possible by land grants; and great school systems were inaugurated through other grants that could be turned into cash. The funds received by the Treasury totaled about one-half billion dollars while the cost of the disposal program was less than one-fifth of this amount.

Inception of the Forest Conservation Idea

As settlements grew and the front of the forest was pushed back, there was localized alarm over a possible shortage of timber before the beginning of the 19th century. However, since much of the timber was tributary to floating streams and inasmuch as shipping became a most important industry, the local needs were always amply met by timber cut from the more remote country. With the construction of the railroads, greater and more distant areas of timber land were tapped and the feeling still persisted that the timber supplies could never be exhausted. But the demands of the Nation for lumber were so great that it became evident the apparently endless supply of virgin timber could come to an end. By the 1850's great stretches had been logged with little or no provision for regrowth. In this period conservation was understood to mean restraint in the disposal of the public lands. That these lands could be more valuable for timber management than for agriculture was not understood and was given little consideration.

As early as 1785 the Government had provided for the reservation of certain minerals. However, until the last of the 19th century no congressional action was taken to reserve timber, except in limited areas for certain shipbuilding purposes. In 1872 the Yellowstone National Park was set aside, followed by similar reservations which now

constitute parts of Sequoia, Kings Canyon, and Yosemite National Parks.

In the early 1870's an impending timber famine was being predicted, and societies and associations were being formed to advance conservation thinking and to appeal to Congress for appropriate conservation legislation. Predictions were made that there would be a timber famine by 1900. Other predictions varied only as to the date. Actually, these predictions were pure guesses as no data existed on which to analyze the problem. The first appropriation for the purpose of ascertaining the facts with respect to annual consumption, importations, exportations, and probable future needs of timber was made to the Department of Agriculture in 1876. The basic research work to determine growth and drain has continued to the present in that Department.

Development of the Forest Conservation Idea

The modern forest conservation idea as far as governmental attention is concerned was initiated in the Department of the Interior in the 1870's by Secretary Carl Schurz and Commissioner of the General Land Office James A. Williamson. These men brought forceful official attention to the theory that the timber and the land belong together and that timber cutting should be handled under forestry principles. Although subsequent Secretaries were, likewise, zealous in their appeal for conservation legislation, the passage of another decade was necessary to crystallize the forestry idea and to muster sufficient public support for the enactment of legislation relating thereto.

Before 1890 many forestry bills had been presented to Congress, but none were enacted into law. Several called for the withdrawal of all public forest lands and for the sale of the timber thereon separate from the fee. A really technical approach came when Dr. B. E. Fernow made his leadership felt. He was a contemporary of Secretary Schurz, and, like him, was a native of Germany where he had been trained as a forester. To Dr. Fernow is due more credit, perhaps, than to any other man of the time for changing the groping public interest into one of practical forestry, and for making a start toward changing timber mining to timber management.

American forestry as it is known today dates from the time Dr. Fernow took an active interest. His leadership in organizing public sentiment through public associations and his technical contribution as head of the Division of Forestry in the Department of Agriculture were an important prelude to the passage of the famous Act of March 3, 1891.[2] Under this Act timber lands were withdrawn from entry and

[2] 26 Stat. 1095.

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set up as forest reservations under the administration of the Department of the Interior. The Act, however, did not provide for forest management.

Early forestry bills called for setting up technical forestry in the Department of the Interior and Dr. Fernow himself apparently felt it should be in that Department. However, Congress willed otherwise, undoubtedly being guided by the prairie afforestation plans, a pursuit then regarded as an agricultural matter, and the presence of an able, though small, technical forestry bureau within the Department of Agriculture. So, in 1891, the Nation had forestry reservations established in the Department of the Interior and technical forestry in the Department of Agriculture. When management according to forestry principles was authorized for the Department of the Interior in 1897, two Departments were then engaged in similar activities.

Administration of the forest reservations was transferred to the Department of Agriculture by congressional action in 1905. Undoubtedly, the existence in that Department of the technically trained forestry staff was an important factor in effecting this transfer. This action closed for the time being any authorization for the Department of the Interior to practice forestry on public lands. The Department was, however, the custodian of other forest lands, including the Indian forests, and continued its interest in forest conservation.

Legislation in 1890[3] and 1902[4] relative to management of the forests of specific Indian tribes contained conservation measures such as limiting the total annual cut of timber and requiring a given percentage of the timber be left standing. In 1908,[5] however, the Congress authorized the hiring of "skilled foresters" in an act establishing specific cutting limits on the Menominee Indian Reservation. Subsequent Congressional action in 1910[6] authorized forest management on all Indian reservations on a technical forestry basis. Indian forestry was put on a sustained-yield basis by the Indian Reorganization Act of 1934,[7] the first such act in Federal legislative history.

The remainder of the public domain was withdrawn and placed under grazing management by the Taylor Grazing Act of 1934.[8] This area included some 25 million acres of forest and woodland. By act of August 28, 1937,[9] the Revested Oregon and California Railroad Grant Lands in western Oregon were given the status of a separate forest management unit to be administered on a sustained-yield basis. This act further provided for cooperative sustained-yield units, the first act of Congress ever to make such a provision.

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[3] 26 Stat. 146.
[4] 32 Stat. 400.
[5] 35 Stat. 51.
[6] 36 Stat. 855.
[7] 48 Stat. 984.
[8] 48 Stat. 1269.
[9] 50 Stat. 857.

Present Departmental Forestry Policy

In general the forest conservation policy of the Department of the Interior calls for the management of forest resources of the lands under its jurisdiction according to the most practical technique and to the purposes for which Congress set aside the several categories of forest land. Insofar as is possible, technically trained foresters are employed for those details of management requiring such knowledge. The well-established conservation theory of optimum use for the greatest public benefit, first officially recognized in this Department, is the guiding principle of the Department. While cognizant of the national character of the ownership of these forest lands, the rights of the local communities are fully recognized. Furthermore, forest management costs are held well within income except where incompatible with the objectives sought through congressional action, as on the national parks and national wildlife refuges.

On the national parks and monuments, the forest cover, by law and regulation, is kept as near as possible in its natural condition. This mandate is being strictly adhered to as far as human use for recreation permits. Trails, roads, structures, and camp sites are planned for each park and monument unit as an entity and construction is not undertaken unless approved as being in accordance with the master plan laid out for the unit. Forestry in the national parks and monuments is concerned with the conservation of the forests in their natural state and their protection against fires, insects, diseases, and destructive use, together with provision for public enjoyment.

The forest lands on the national wildlife refuges are managed to demonstrate practical means of developing and maintaining optimum game populations. Surplus forest and woodland wildlife species which are produced on these refuges may be made available for restocking projects undertaken by other Federal and State agencies. The forests are also used to determine the practicability of research findings in the management of forest habitat. Likewise, they are utilized to explore means of managing wildlife populations by removal of annual increment through regular public hunts. Consistent with these objectives, the timber lands are managed in accordance with technical forest management practices to obtain the maximum timber yield and return.

Indian timber is handled on a commercial basis with stumpage being sold to the highest qualified bidders. Cutting is conducted under the supervision of trained foresters and in accordance with rules and regulations designed to assure sustained-yield continuity of timber growth and returns. Management is such as to yield maximum returns to the Indians, since the Indian forests are private property and

the Indians have the status of stockholders in the Indian reservation forests. Costs are kept as low as good management and administration dictate. The Government's responsibility, as trustee, for the management of these lands is expected to be terminated eventually.

The forest management policy outlined in the act of August 28, 1937, specified that the timber on the railroad grant lands should be harvested in conformity with the principle of sustained yield. This means that annual cutting is to be approximately the same as annual timber growing capacity with cutting practices designed to provide for reestablishment of timber stands. As stated in the act, management is designed for the purpose of, "providing a permanent source of timber supply, protecting watersheds, regulating streamflow, contributing to the economic stability of local communities and industries and providing recreational facilities * * *"

Forest management practices on the public domain forests and woodlands are extensive. This means that harvesting practices are designed to maintain forest productivity at the highest possible rate but capital investments such as roads are held to a minimum. All the national land reserve forests and the public lands in Alaska are managed in this manner except those in western Oregon where intensive management is applied. Advanced forest management includes provisions for protective measures for all types of disasters, rehabilitation and reforestation, sustained forest production, and multiple use of the forest lands.

All forest lands administered by the Bureau of Land Management derive the benefits of long range planning.

Bureau of Indian Affairs

Early History of Indian Forests

Federal Control over Indian Affairs

From colonial times until a century ago, the British, the French, the Spanish, the Colonial, and later the United States governments regarded the Indian groups as semi-independent nations. These governments all attempted to regulate relations with the Indians, primarily in the interest of peaceful occupancy of the historic Indian lands. The involved history of these dealings is the subject of many publications and need not be discussed in detail here.[10]

The United States acquired ownership of the Indian lands through treaties, where necessary, which provided for various reimbursements, often in terms of reservation lands, goods, and services to be provided by the United States Government.

Reservations were also established by executive orders and a few by purchase of the land by the Indians. Extensive Indian lands were established from territory acquired from Mexico in the present southwestern portion of the United States.

Early in our Nation's history it was generally considered that the best means of instilling and assuring habits of self-support was to allot each Indian a small tract of reservation land.[11] These allotments were comparable to the homesteads which were available to non-Indian families. Unfortunately, the amount of agricultural land on some reservations was wholly insufficient for the number of allotments needed to establish each Indian family on a farm. In these situations it was considered necessary to "fill-in" the individual allotment acreages with some forest land. Most of these allotted timber lands were unfit for agricultural use, even if cleared of forest growth, and have continued, therefore, as forest land.

The Indian lands held in trust by the United States are thus of two ownerships; tribal and individual. Tribal trust lands are owned by all members of the Tribe and may not be disposed of without the con-

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[10] Among these publications are:
"Federal Indian Law," U.S. Department of the Interior, Government Printing Office, 1958.
"A Continent Lost—A Civilization Won," J. P. Kinney, Johns Hopkins Press, 1937.

[11] General Allotment Act of February 8, 1887 (24 Stat. 388).

sent of Congress. An individual trust allotment may be patented in fee at the request of a competent allottee and with the consent of the Secretary of the Interior.

Federal Trusteeship over Indian Affairs

The Federal Government serves as trustee for Indian lands in order to protect the Indians and their resources. The goal of the trust relationship has been to prepare and encourage the Indians to take their place in the American community.

This unusual role of the Federal Government, as the trustee of a privately-owned estate, should be kept in mind when reviewing the history of forestry on Indian trust lands. It must also be considered that the policy of trust responsibility of the Government developed gradually over the years; in fact, little control was exercised for a full century after the Federal Government was established in 1789.

With the advent of the allotment policy, there arose a need to protect the allottees' interests. Many of these Indians were incompetent to handle their individual holdings successfully.

Early Timber Operations on Indian Lands

One phase of the development of the Federal Government's trust responsibility was the supervised sale of timber from Indian lands. The first such sales were made in the late sixties and early seventies of the nineteenth century. Sales continued in the following decade on several reservations in Wisconsin and Minnesota. It was not until after 1890, however, that extensive logging operations became firmly established under the direct supervision of the Indian Service.

By 1889 the Indians were permitted to cut and sell dead timber on trust lands with the authorization of the President.[12] The following year an annual allowable timber harvest of 20 million board feet of green timber was authorized by Congress on the Menominee Reservation in Wisconsin.[13] During the following 20 years other laws were enacted authorizing the harvesting of timber from allotments and tribal lands on various reservations.

Introduction of Forest Conservation on Indian Lands

During these early years, the supervision and requirements of the timber sales were left almost exclusively to the local reservation Indian agents, who rarely had even a rudimentary knowledge of forestry.

[12] Act of February 16, 1889 (25 Stat. 673).
[13] Act of June 12, 1890 (26 Stat. 146).

Men hired as "farmers" to teach the practice of agriculture to the Indians on their allotments were drafted into the timber sale business. Under these conditions the sales were frequently conducted inefficiently and with little regard for sound forestry principles.

The arising national conservation movement of the early twentieth century spurred on the improvement of forest practices on the reservations. Services of the Bureau of Forestry of the Department of Agriculture were utilized in selling some timber and in supervising logging operations on Indian lands in Wisconsin.[14]

Not all efforts toward conservation were successful, however. Under the direction of President Theodore Roosevelt, an attempt was made to introduce the seed tree method of logging on the reservations in Wisconsin and Minnesota. This practice was abandoned on allotted lands because of objections from the timber purchasers and the allottees.

In 1908 an agreement was reached with the Secretary of Agriculture whereby the Forest Service (formerly the Bureau of Forestry) would provide the timber sale, forest fire control and management planning services on reservations. This arrangement lasted only a short time, but it marked the beginning of approved forestry principles on Indian forests.

Developing a Forestry Organization

The first division of forestry in the Office of Indian Affairs was organized in 1910. This Forestry Division soon established standard regulations and instructions for administering the Indian forests.

By 1915 several technical foresters were assigned to various reservations to administer the regulations and instructions governing the development of the forests. It was not until 1930 that the Forestry Division was assigned the general responsibility for administering all grazing activity.

World War I generated an active demand for timber. Large sales were made of Indian timber, and the Forestry Division expanded considerably. This new interest in Indian timber continued until the great depression of the 1930's when a general cut-back of production and timber values swept the Nation.

Shortly before World War II the timber sale activity on reservations had recovered and the demand for timber began opening up reservation forest reserves hitherto considered uneconomical. Forestry staffs were hard pressed to administer the expanded timber sale programs, and manpower shortages precluded easing these pressures.

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[14] Act of June 27, 1902 (32 Stat. 400).

A reorganization of the Bureau in 1954 moved range and wildlife management into another branch and left forest management and protection, and fire protection on range lands, in the newly designated Branch of Forestry.

Present Forest Resources [15]

Approximately 53 million acres of Indian trustland are presently managed by the Bureau of Indian Affairs for the use and benefit of the Indian owners. Roughly one-fourth of this land (13 million acres) is forested, of which nearly one-half (5½ million acres) is commercially important for the production of timber.

It is estimated that the commercial forests contain 37 billion board feet of merchantable timber. Over 90 percent of this volume, as well as the area, is in unallotted (tribal) ownership.

While this timber is located on 23 States, excluding Alaska, about 75 percent of the area and more than 90 percent of the volume are in Washington, Arizona, Oregon, New Mexico, California, and Montana, in that order of magnitude.

There is a great variation in the types of Indian forests. They include the Appalachian hardwoods, the pine-hemlock-hardwood forests of the Lake States, and the rain forests of the Pacific coast. Most extensive and of the greatest economical importance, however, are the Indian forests within the Western Pine Region of the Intermountain States.

Importance of the Forest Resource in the Indian Economy

Nearly 300,000 Indians live on reservations. These people depend upon the land, to varying degrees, for their support. Much of the land is uneconomical for development other than range use. Wise use of the forest and range resources is of great importance to those Indians choosing to remain on the reservations.

On forested reservations the Indian economy is largely dependent upon the bounty of the forest. It furnishes berries, roots, fish, and game as an essential part of Indian subsistence supplies. It furnishes cheap fuel for the Indian homes, logs and lumber for housing, and essential range for livestock. The forest protects watersheds for domestic and industrial uses. Recreation is being developed rapidly on some reservation forests for added income to the Indians. All of these benefits

[15] Excludes all terminated reservations.

of the forest are of great importance in the economy of resident Indians.

Of even greater economic importance to the Indians are the timber resources. They provide substantial income from timber sales and employment opportunities in harvesting and processing the timber.

COMMERCIAL INDIAN FORESTS AND 1960 HARVEST

State	*Commercial Forests*		*1960 Harvest*	
	Acres	*M ft. BM*	*M ft. BM*	*Cash Income*
Arizona	881,173	5,517,599	80,046	$939,374
California	110,117	2,016,055	48,463	1,283,629
Colorado	25,741	119,789	3,571	46,762
Florida	8,662	14,000	50	2,877
Idaho	61,487	117,390	2,396	60,039
Iowa	965	8,100	none	none
Michigan	16,171	49,175	211	2,448
Minnesota	492,587	1,352,685	19,003	210,142
Mississippi	12,337	50,889	3,829	98,016
Montana	580,289	1,659,518	18,965	345,794
Nebraska	6,500	8,750	116	599
Nevada	2,674	6,455	none	720
New Mexico	586,647	2,379,433	14,170	211,134
North Carolina	46,582	38,020	1,707	7,254
North Dakota	5,758	25,715	33	570
Oklahoma	156,453	108,967	none	none
Oregon	354,129	3,498,407	90,038	2,514,132
South Dakota	111,584	86,590	none	none
Utah	43,215	120,028	129	502
Washington	1,668,364	17,893,832	255,880	4,997,939
Wisconsin	166,014	522,503	23,499	552,725
Wyoming	257,708	744,118	275	1,377
TOTAL	5,595,167	36,338,018	562,381	$11,276,033

Note: Acreage and volume of commercial timber in Alaska, while known to exist, has not been determined. Also, the small acreages of commercial timber in Louisiana have not been included.

The Indians benefit from some free use of certain forest products such as posts, fuel wood, house logs, poles, etc. This free use amounted to more than 100 million board feet, valued at $300,000, during 1960. (These figures are not included in the above table.)

Using the estimated conversion factor of 10 man-years of labor to process a million board feet of standing timber, the 1960 harvest from the commercial Indian forests produced more than 5,500 jobs.

Indians are also employed extensively in the managing and protecting functions of the Bureau of Indian Affairs. Seasonal employment of firefighters, tree pruning and planting crews, and forest pest control projects employ additional Indians.

National and Regional Importance of the Indian Forests

The 5½ million acres of commercially important Indian owned forest lands are only 1½ percent of such forests in the continental

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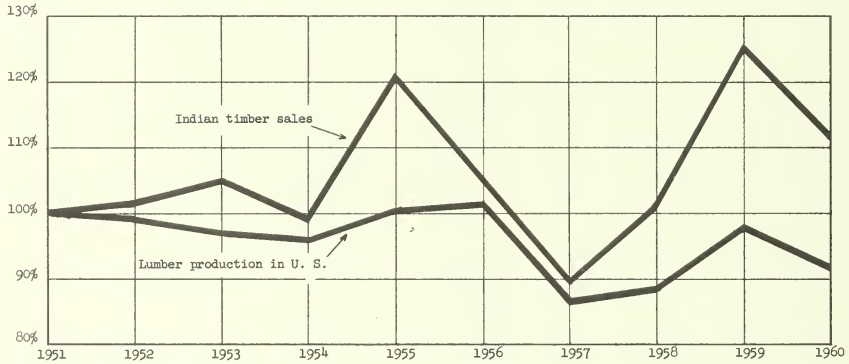
United States, exclusive of Alaska.[16] However, they have contributed substantially to the economy of the forest-using industries. They are often a principal source of raw material for dependent mills in their vicinity.

Production from many of these Indian forests is being increased. Current forest inventory studies have indicated that the sustained-yield harvests can be increased without damaging the forests.

The annual timber harvest, or any allowable increases, is largely controlled by economic conditions in the wood-using industries. However, the trend in the cut of Indian timber has generally outstripped the trend of total lumber production in the United States. This is indicated in the following chart.



Comparison of Indian timber sales with lumber production in the United States. 1951 lumber production and Indian timber sales equals 100%.

Management of Indian Forest Resources

Objectives of Management

The results of Indian forest management have been summarized above. They have been achieved under sustained-yield forest management, modified sufficiently to serve the best interests, first, of the Indian owners and, secondly, of the dependent communities.

The concept of good forest management became a stated policy in the Bureau of Indian Affairs in 1911. It was written into the "Regulations and Instructions for Officers in Charge of Forests on Indian

[16] "Timber Resources for tne Future," U.S. Forest Service, 1958, gives total area of commercial forests in the United States, exclusive of Alaska, as 485 million acres.

Reservations" that: "The superintendent of each reservation will be expected and required to do all in his power to secure a wise and advantageous use of forest resources." The forest officers were charged to familiarize themselves thoroughly: "* * * with all phases of forestry work on the reservations to which they are assigned, including a knowledge of * * * the total stand of timber, of the relative quality, rapidity of growth, seeding qualities, character of reproduction, adaptability to location, etc., of the different species found. They must also acquaint themselves with the cost of logging and manufacture under different systems, * * * and all other practical and technical work which will aid the office in so managing the Indian forests as to obtain the greastest revenue for the Indians consistent with a proper protection and improvement of the forests."

This management policy was confirmed and strengthened in 1934 by the Indian Reorganization Act[17] which directed the Secretary of the Interior: "to make rules and regulations for the operation and management of Indian forestry units on the principle of sustained-yield management * * *." This is believed to be the first reference in Federal legislation to sustained-yield forest management.

Management Problems Incident to Indian Forests

Management of Indian forests is subject to most of the same problems as the management of public or private forests. The scope and intensity of the work of determining the inventory, growth and mortality, and development of the forests are based on the allowable finances available for this management. The Bureau works cooperatively with other forest managers in developing better solutions to these management problems.

Some other problems are peculiar to Indian forests, however. For example, the individual trust allotments range in size from 8 to as much as 160 acres. Some of the reservations, such as the Quinault, are almost entirely allotted; others, such as the Fort Apache, contain no allotments. Between these extremes are found varying intermixtures of tribal and allotted lands within the reservation forests. Timber from allotted land as well as tribal is sold only with the consent of the owners and the Secretary of the Interior. Separate contracts must be issued for the sale of timber from each allotment, and separate accounting of the income must be made. Many of the original allottees have died, as have some of their heirs. In these cases, the heirship interests may include non-Indians, unprobated estates, and many very small

[17] 48 Stat. 986.

fractions. This creates many administrative problems in acquiring the consent of the heirs to the sale of their timber and the distribution of receipts.

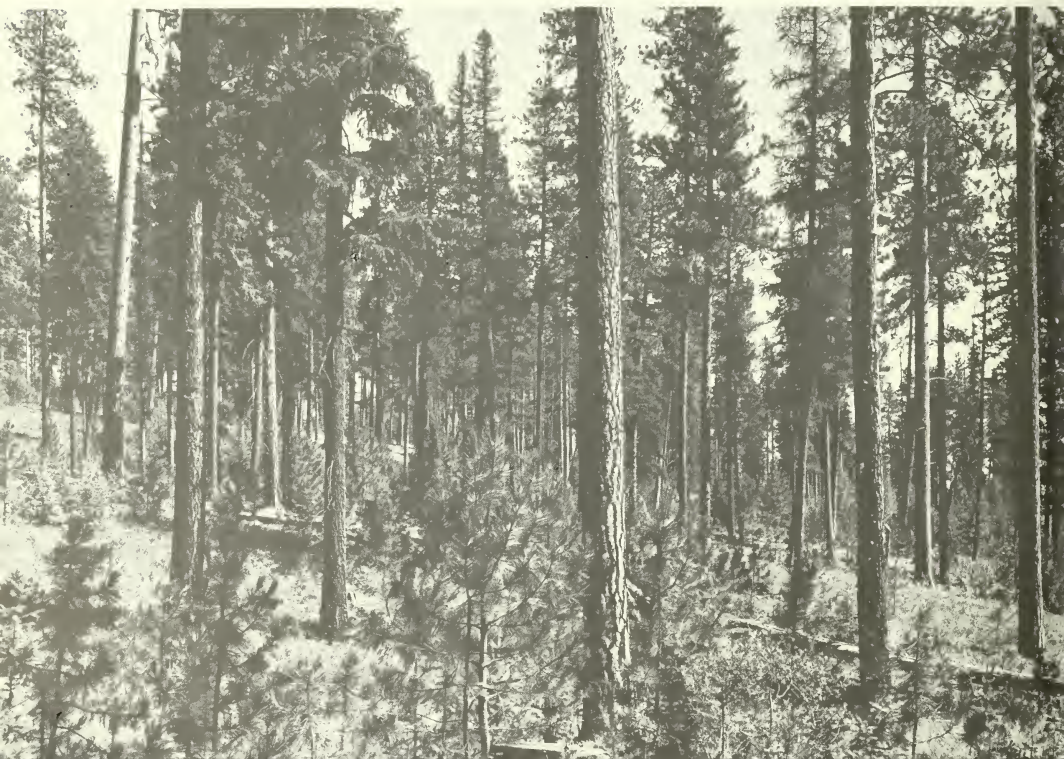
The orderly development of the Indian forests must be tempered occasionally with the allottees' needs. A balance between tribal and allotted forest development, acceptable to the owners and the Bureau of Indian Affairs, may actually be a compromise between the ideal and practical management of the reservation forest.

In managing the Indian forests, as in all functions of the Bureau of Indian Affairs, the ultimate goal is to develop the Indians' ability to manage their own affairs. The Indians are continually encouraged to become better accquainted with their forests, the management problems, and the plans for development. They are encouraged to participate in the planning stages of the forest management programs.

Financing the Management of Indian Forests

Funds for managing the Indian forests are obtained from two sources: (a) Congressional appropriations and (b) tribal appropriations. In 1960, about 20 different tribal groups were contributing toward the cost of managing their forests. The Bureau encourages the financial participation of the tribes.

Good reproduction following selective logging and slash disposal in a mixed conifer stand on the Colville Indian Reservation, Washington.



An administrative deduction is made from all timber sale receipts to cover, in whole or in part, the cost of forest management. Ordinarily the deduction is 10 percent of the gross receipts, although a lesser percent is deducted where the accumulative administrative cost for the reservation warrants the reduction. The administrative deduction is deposited into the Treasury as miscellaneous receipts, or returned to the tribes in proportion to their amount of financial contribution to the total cost of forest management.

Forest Protection

Protection from Fire

Despite a fairly good record in the past, the Bureau is basically weak in fire protection. Until recently there have been insufficient personnel and funds to develop a modern fire control organization. Nor have there been sufficient funds to develop or maintain the fire roads and trials, lookout stations and communication systems that are essential to fire detection and suppression. These facilities, largely constructed under the Civilian Conservation Corps program in the 1930's, have deteriorated and lost much of their effectiveness.

More recently, the picture has partially improved. Some tribes have increased the allotment of their funds for this work, and appropriations of Treasury funds have been more liberal. The fire control organization, however, is still not adequate and needs to be emphasized in future planning. Anticipated increases in the recreational uses of Indian forests will focus attention on the protection problem.

For all Indian lands protected, the five-year record 1956–1960 shows the following:

Area requiring protection	acres	[18] 47,887,790
Average annual number of fires		1,260
Average annual area burned	acres	116,292
Average annual acres per fire	acres	92
Average annual monetary damage		$707,343

Fifty-four percent, or less, of the fires in an average year are man-caused with the remainder being set by lightning. The proportion of man-caused fires follows the experience of other protection agencies operating primarily in the West.

Protection from Insects

Indian forests, in common with forests in other ownership classifications, have suffered great damage from destructive insects. During the years 1893–1895 the pine butterfly, a defoliating insect, killed an esti-

[18] Excludes approximately 11 million acres of intermixed State and private lands.

An all-aged forest was destroyed in minutes by a forest fire. It will take a lot of money and time to develop a new forest here.

mated five hundred million board feet of ponderosa pine on the Yakima Reservation. During the period 1918–1925 the pine pandora moth, another defoliating insect, caused serious damage to the ponderosa pine stands of the former Klamath Reservation. This insect so weakened the trees that they became easy prey to the western pine beetles, also epidemic during that period.

It has been estimated that the western pine beetle killed three billion board feet of timber on the Warm Springs, Yakima, Colville, and the former Klamath Reservations during the years 1918–1940. In combating this insect, the Bureau attempted to destroy overwintering broods of beetles by felling, peeling, and burning the infested trees. During the years 1918–1941 a total of 126,000 infested trees were treated on 897,000 acres at a total cost of $681,000. The most extensive of these operations were conducted under the Civilian Conservation Corps

program. Though these efforts failed to control the beetle completely, comparative loss records from treated and untreated areas indicate that they did result in the saving of substantial volumes of valuable ponderosa pine.

With increased demand for Indian timber at the start of World War II, it became possible to substitute sanitation-salvage selective logging for the expensive and wasteful peel-and-burn control method.

During the years 1951 and 1952 a severe epidemic of the defoliating spruce budworm was controlled, in cooperation with the Forest Service of the Department of Agriculture, on the Warm Springs Reservation and on surrounding national forests. This insect was attacking the Douglas-firs and the balsam or true firs. Approximately 40,000 acres were treated on the reservation.

These destructive insects have been present in the forest for hundreds of years, usually in the normal or endemic stage, during which their activities are scarcely noticeable. At intervals, however, they build up to epidemic numbers and cause great damage. The Bureau of Indian Affairs cooperates with the Forest Experiment Stations and other agencies to record and study potential outbreaks, and to take preventive action promptly.

A perpetual source of products and employment is developed through multiple-use management of this vast forest on the Yakima Indian Reservation, Washington. The light appearing trees are western larch in their fall foliage. Mt. Rainier is in the background.

A primeval forest near the Washington coast. After these centuries old trees are harvested, a new forest will grow to a merchantable size in less than 100 years.

When epidemic attacks are detected, and the affected timber is accessible by roads, a sale of the affected timber is immediately made. To expedite early removal of the dying or dead trees negotiated sales may be authorized.

Protection from Disease

Thus far the Bureau's disease control program has been concentrated largely against the white pine blister rust on Indian lands of the Lake States. This disease, originally imported by accident from Europe, has caused damage in the immature white pine stands on reservations in Wisconsin and Minnesota. It has been found possible to control the disease without excessive cost through removal of the alternate host plants; namely, the currant and gooseberry bushes (*Ribes* sp.). Ribes eradication programs have been under way on these forests since 1942 and it is believed that continued protection is practicable, provided periodic follow-up work is performed.

The chestnut blight, accidentally introduced from Asia, has killed all the mature chestnut trees of the Cherokee Reservation in North Caro-

This stand of timber on an Indian allotment is being thinned to accelerate its merchantable potential. Part of the cost of thinning is borne by the Agricultural Conservation Program.

lina. Sprouts arise but after a few years succumb to the disease. No satisfactory method of controlling this disease has yet been found.

Various parasitic wood-rotting fungi cause great loss in what would otherwise be merchantable wood, particularly in old, over-mature trees. One of the most feasible methods of controlling these diseases is through proper silvicultural practices. By removal of infected trees, sources of infection are reduced, and the spread of the disease to younger reserved trees is less apt to occur.

The parasitic dwarf mistletoe has become a tree killer in the pondersoa pine forests of the Southwest. On the Mescalero Reservation in New Mexico the disease has caused great damage in the uncut virgin stands and in the reserve stands and has made it necessary to revise the cutting budget and the management plan. Sanitation-salvage logging operations and supplementary direct control work are now being conducted.

Modern mobile logging equipment has increased the efficiency and range of logging operations.

Indian Sawmills

Objectives

It was the general policy of the United States, for many years, to erect sawmills on Indian reservations to furnish both employment and building materials for the benefit of the Indians. Various treaties provided for the erection and operation of sawmills and grist mills, and the former were constructed on nearly every reservation having forests suitable for saw timber. Most of these mills were small, and were operated mainly to produce building materials for the Indians rather than as commercial enterprises. With minor exceptions they have long since ceased operating, because changing conditions have made it possible to purchase lumber more cheaply on the open market. In two notable instances, however, logging and milling operations are being conducted as Indian enterprises on a commercial basis, under the supervision of the Bureau of Indian Affairs. The two commercial plants are the Red Lake Tribal Sawmill at Redby, Minn.; and the Navajo Tribal Sawmill near Fort Defiance, Ariz. Another Indian sawmill is now under construction on the Fort Apache Reservation at Whiteriver, Arizona.

Red Lake Tribal Sawmill

An item in the Indian Appropriation Act of May 18, 1916,[19] created the Red Lake Indian Forest, with an area of nearly 110,000 acres, within the Red Lake Indian Reservation of Minnesota. The act provided "That said forest shall be administered by the Secretary of the Interior in accordance with the principles of scientific forestry, with a view to the production of successive timber crops thereon, * * *." It also authorized the Secretary "* * * to construct and operate sawmills for the manufacture of the timber into merchantable products and to employ such persons as he shall find necessary to carry out the purposes of the foregoing provisions, including the establishing of nurseries and the purchase of seeds, seedlings, and transplants when needed for reforestation purposes: * * *"

Shortly thereafter a sawmill was constructed and operated on the reservation. It was replaced in 1925 by a new singleband mill, which produced from 4 to 5 million board feet of white and Norway pine annually.

The severe and long continued depression in the lumber market subsequent to 1929 seriously affected the financial position of the Red

[19] 39 Stat. 137.

Lake mill. Since fiscal year 1936, however, the mill has been operated profitably. The operation of this sawmill has been an important source of revenue and employment for the Indians.

The tribe and the Bureau are planning to replace the 1925 mill with a high-speed band mill which can economically handle the substantial volumes of aspen and jack pine remaining in the forest. It will also be able to process the other hardwoods and conifers as they are encountered in the logging operations.

Navajo Tribal Sawmill

A small sawmill was operated on the Navajo Reservation in the southwest for many years. During the days of the Civilian Conservation Corps and the Works Progress Administration, some rehabilitation of the mill was accomplished to provide lumber for those two programs.

Based upon early inadequate knowledge of the forest resources, the allowable annual cut by the sawmill was held to 15 million board feet. In 1952 the Navajo Tribal Council authorized the use of tribal funds to obtain a forest inventory, using the most modern techniques of aerial photography supplemented by ground surveys. The management plan, developed on the basis of this new inventory, revealed that the annual cut could safely be increased to 38 million board feet plus 15 million board feet per year during the eight or ten years required to complete logging operations on the area adjacent to the present sawmill.

The tribe, with its own funds, then retained engineering consultants to make a survey and to recommend action for utilizing the indicated increase in cut. After considering the relative merits of various possibilities (selling the standing timber, contracting with outside agencies for a partnership arrangement, or an expanded tribal enterprise), it was finally decided to construct a new sawmill on a new location.

The new mill will have a 38-million-foot annual capacity on a one-shift basis and will produce kiln dried and finished lumber. The plan also contemplates, eventually, a completely integrated plant at the new location, including a hardboard mill or similar facilities.

In order to assure freedom of action in the new enterprise, with a minimum interference from tribal politics and minimum control by the Federal Government, a plan of operation was developed and approved by the tribe and the Commissioner of Indian Affairs. Under this plan the tribal representatives selected a governing board for the mill enterprise. This nine-man board includes four members of the tribe and five non-members with demonstrated business experience and ability. The Commissioner retains authority to step into the operation if he determines that efficient management is lacking.

Fort Apache Tribal Sawmill

A small tribal sawmill and planing mill were operated for many years on the Fort Apache Reservation, Arizona, to meet local requirements. The sawmill burned, but the planing mill was not lost. The tribe then contracted with a private operator to log, rough saw and deliver the green lumber to the tribal planing mill. This gradually developed into a commercial type enterprise, selling lumber beyond the reservation boundaries. It had a precarious existence for several years.

At present the production of the tribal enterprise is about 9 million board feet annually. A recent inventory, financed by the tribe, indicated that the annual harvest of the reservation forest could be substantially increased. The tribal enterprise presently contemplates the production of about 20 million board feet annually.

The tribe decided to expand their planing mill enterprise to include a sawmill and thus provide some of the additional production capacity needed to fully develop their forest. They have secured loans from private as well as Bureau sources, and construction of the mill should soon be accomplished.

Policy

The objecives sought in the management of forest lands, are:

(*a*) The preservation of such lands in a perpetually productive state by providing effective protection, by applying sound silvicultural and economic principles to the harvesting of the timber, and by making adequate provision for new forest growth as the timber is removed.

(*b*) The regulation of the cut in a manner which will insure method and order in harvesting the tree capital, so as to make possible continuous production and a nerpetual forest business.

(*c*) The development of Indian forests by the Indian people for the purpose of promoting self-sustaining communities, to the end that the Indians may receive from their own property not only the stumpage value, but also the benefit of whatever profit it is capable of yielding and whatever labor the Indians are qualified to perform.

(*d*) The sale of Indian timber in open competitive markets in accordance with good business practices on reservations where the volume that should be harvested annually is in excess of that which is being developed by the Indians.

(*e*) The preservation of the forest in its natural state wherever it is considered, and the authorized Indian representatives agree, that the recreational or aesthetic value of the forest to the Indians exceeds its value for the production of forest products.

(*f*) The management of the forest in such a manner as to retain its beneficial effects in regulating water run-off and minimizing erosion.

(*g*) The preservation and development of grazing, wildlife, and other values of the forest to the extent that such action is in the best interest of the Indians.

In all phases of the management of the forest, it is recognized that the ultimate objective of the Bureau and the Tribes is the transfer of the management responsibility to the Indian owners.

Every reasonable effort is made to keep the Indian forest owners well informed of the management objectives. The Indians are encouraged to assume an increasing measure of self-sufficiency by participating in all phases of the management of their forests. The Indians' specific wishes in carrying out the objectives are respected whenever they do not act to violate the Government's trust responsibility.

Bureau of Land Management

History

Development of the Forest Conservation Idea

The development of the forest conservation idea in the Department of the Interior was traced in the introduction. Within the Bureau of Land Management, formerly the General Land Office, this idea began to be translated into an action program in the late 1930's. The necessity for measures to protect and improve public lands and resources became more and more evident to the Nation. This fact is reflected in the legislation enacted over the years. A trend developed from the philosophy of indiscriminate land disposition to that of land management with selective transfers in the public interest.

One of the early acts which at least embodied the principles of conservation was the Timber Culture Act of 1873.[20] Under the terms of this act one could obtain 160 acres of land by cultivating trees on 40 acres of it. The act was amended in 1878 to reduce the acreage of trees from 40 to 10. Probably no other statute relating to conservation was more generally abused. The land was taken up, but little checking was done to see whether the trees were planted, or if planted, whether they survived.

The Dead and Down Act of March 4, 1913 [21] was the only authority for the actual sale of timber from the unreserved public domain lands in the United States until the passage of the Materials Act 34 years later. The Act of 1913 permitted the sale of dead and down timber and timber seriously damaged by forest fires. This was a useful legal tool for salvaging material that would otherwise have become a complete economic loss. It was good as far as it went, but sustained-yield forest management and advanced conservation of timber resources require that mature timber should be harvested before much of its usefulness and value is destroyed by rot, insect and disease attacks, or other defects attendant with over-mature trees.

On September 20, 1922 [22], an act was approved which authorized the Secretary of the Interior to protect and preserve from fire, insects or disease all the public timberlands under his jurisdiction. Protection,

[20] 17 Stat. 605. [21] 37 Stat. 1015. [22] 42 Stat. 857.

of course, is basic to any forest management program. This act embodies the primary authority for the protection of all of the public lands under the jurisdiction of the Department of the Interior.

In 1937 with the passage of the Act to manage the Oregon and California railroad grant lands in western Oregon, there was for the first time in the history of American forestry, a plan of sustained-yield management authorized by law for a specific Federal forest property.

A temporary act, passed as a war measure on June 5, 1942 [23], authorized the Secretary of the Interior to lease or sell public timberland in connection with the war effort. The General Land Office administered the timber sale contracts which contained stipulations designed to further good forest practice. Although this act was limited to the duration of the war and was terminated December 31, 1946, it formed the basis for the Materials Act of 1947.

The Materials Act of July 31, 1947 [24], authorized the sale of green, standing timber. This is an essential tool in the proper management of the timber found on the public lands.

The history of the O&C lands demonstrates a transition from the principles of land disposal to that of land management. The lessons learned in establishing a sustained-yield forest program on these lands influenced the pattern of programs on private lands intermingled with the O&C lands, as well as on the Bureau of Land Management's forest program in other areas.

In 1866 practically all of the lands in Oregon were part of the unreserved public domain. In that year Congress granted the Oregon and California Railroad Company all of the odd-numbered sections of land in a strip extending 20 miles on each side of the proposed right-of-way for a railroad from Portland, Oregon, to the California State line. Since many of these sections had already passed into private ownership the railroad was granted, in addition, an indemnity strip extending 10 miles on each side of the original grant. The total area included in both the original and indemnity grants was approximately 3,728,000 acres.

This type of subsidy was common in those days and contributed immeasurably to the development of the west. Construction of a railroad increased land values of the area through which it passed. This increase in value was distributed equally over the lands held by the railroad and those intermingled with them. The checkerboard type of grant also prevented the railroad company from restricting the development of the country through the ownership of all lands bordering the right-of-way.

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[23] 56 Stat. 323.
[24] 61 Stat. 681.

A similar grant of a strip of 12 miles wide by approximately 50 miles long was made to aid the building of a military wagon road from Coos Bay to Roseburg, Oregon. This grant contained 105,240 acres and is known as the Coos Bay Wagon Road grant (CBWR).

In order to promote settlement of the area the Acts of July 25, 1866,[25] and March 3, 1869,[26] spelled out the following provisions:

(1) The grant lands were to be sold to bona fide settlers only and not to speculators.

(2) Not more than 160 acres of O&C or CBWR lands could be sold to any one settler.

(3) No grant land would be sold for more than $2.50 per acre.

As time passed all three of these provisions were violated.

Since these lands were owned either by the grantees or subsequent purchasers, the 18 Oregon counties in which the lands were located were not only collecting taxes from most of these lands, but, after 1900, were assessing taxes on valuations well above the $2.50 per acre. Hence, these grant lands counties had a sizeable stake in this checkerboard.

By 1887 the best and most accessible agricultural lands had been sold. Most of the remaining lands were forested and unsuited to agricultural development.

Between 1890 and 1900 the rising tide of timber speculation reached Oregon. Timber suddenly became valuable. Grant timberlands were sold for prices far exceeding the legal maximum of $2.50 per acre.

In 1903, the Southern Pacific Railroad which had succeeded the original grantee, announced that it would not sell any more timber land but would reserve such land for future railroad use. This aroused considerable resentment among the citizens of the area. They complained to Congress charging the railroad with breaking the stipulations of the grant and demanding its cancellation.

After litigation which reached the Supreme Court, the Chamberlain-Ferris Act of 1916[27] revested the remaining 2,891,000 acres of unsold O&C lands to the United States. Three years later 93,000 acres remaining unsold of the original Coos Bay Wagon Road grant were reconveyed without litigation to the United States. Jurisdiction was placed with the Department of the Interior.

These acts provided that the timber be sold and the cutover land opened to homestead entry. The proceeds were to be used to meet certain Government obligations arising out of the revestment proceedings. Any surplus remaining after meeting these obligations was to be

[25] 14 Stat. 239.

[26] 15 Stat. 340.

[27] 39 Stat. 218.

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distributed as follows: 25 percent to the State, 25 percent to the land grant counties in lieu of taxes, and the balance to the Federal Government.

Timber was sold under 10-year timber patents. Even where the cutover land was reclassified as agricultural, no great amount was sold because much of that sold was not suitable for farming. Abandoned homesteads on these cutover lands bear mute evidence to this fact.

Sales of land and timber for more than a decade resulted in a meager income. The land grant counties received nothing in lieu of taxes and soon found themselves in dire financial straits. In 1926 Congress appropriated money to the counties in lieu of taxes covering the period from 1916 to 1926 and added over seven million dollars to the obligation which was to be reimbursed from future receipts. Another decade passed in which income was insufficient to pay tax claims. After 20 years under this plan of land and timber disposition the ledger sheet looked like this:

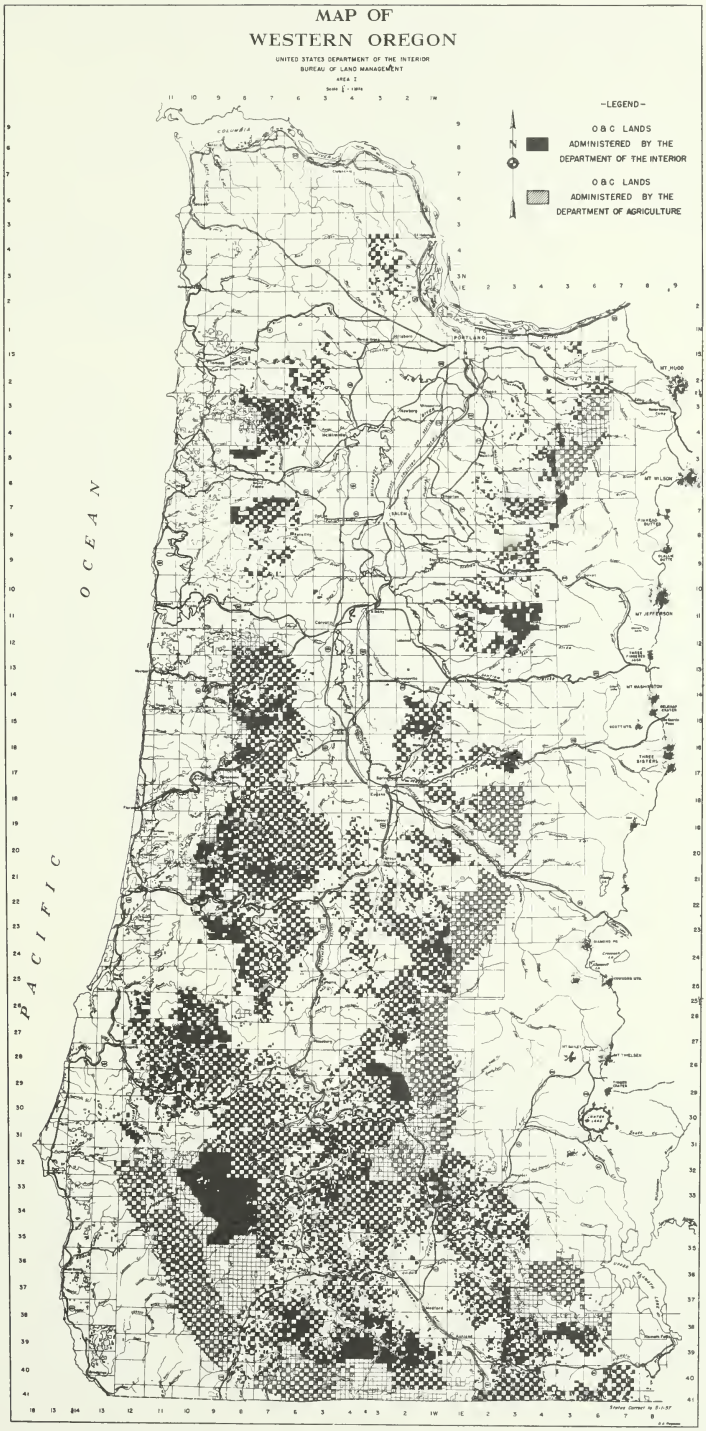
Total obligations of the O&C fund	$18,742,612.47
Total receipts from the sale of land and timber	8,269,719.09
Total obligations against future receipts	10,472,893.38

The record of the Coos Bay Wagon Road grant was somewhat better. It showed a little over a million dollars of receipts in excess of disbursements.

It became obvious that the policy of land and timber disposition was impractical, and public opinion pressed for a change. Sustained-yield forest management was recognized as a logical solution. The O&C Act, which became law on August 28, 1937, provided for the administration of the over 2,600,000 acres of O&C and CBWR lands under the principles of prudent utilization.

Experience under this plan of management offers proof that good forest practices pay. The financial returns have consistently exceeded expenditures. Even though 50 percent of the proceeds went to the counties in lieu of taxes and only 50 percent was available for reducing prior obligations and for reimbursing the cost of administration, by the end of fiscal year 1951 the entire indebtedness against the O&C fund had been liquidated.

Between that date and the end of fiscal year 1961 a surplus of income in excess of expenditures for all purposes has accumulated in the Treasury. This surplus, totaling more than $26,000,000, came chiefly from the portion of the revested O&C lands administered by the Bureau of Land Management, while a lesser part came from the portion, inside the national forests, administered by the Forest Service, U.S. Department of Agriculture. In addition, the value of the timber on these lands is being increased steadily by the construction of a net-



Map of western Oregon showing the location of all classes of O & C lands.

work of timber access roads. The total of these road investments to the end of fiscal year 1961 amounted to more tha $38,400,000.

The Coos Bay Wagon Road grant lands are managed in conjunction with the O&C lands under the provisions of the same Act of August 28, 1937. The distribution of income, from the CBWR lands, however, is governed by the Act of May 24, 1939,[28] which requires payments to the counties equivalent to ad valorem taxes. After meeting all costs of administration and making the required payments in lieu of taxes, the excess of receipts over disbursements to date is approximately $10,000,000. This net return to the Treasury amounts to more than $130, per acre.

Forestry Organization

During the transition period from a course of land disposition to one of land management an effective forestry organization came into being.

[28] 53 Stat. 753.

Clear cut settings in Western Oregon. Green trees adjacent to cuttings are reserved to provide seed source as well as a fire buffer.

Reforestation of cut-over lands.

After the passage of the O&C Act, the O&C Administration was set up, with headquarters on Portland, Oregon, to carry out the sustained-yield forestry provisions of this legislation. The Administrator reported directly to the Commissioner of the General Land Office.

In 1939 the Alaska Fire Control organization was established under the general authority of the Secretary of the Interior. Its primary function was to protect the potentially valuable forest resources of Alaska from further damage by fire. This organization functioned solely as a fire control group until 1944 when the Department secured a regular appropriation for the administration and management of forest resources on the public lands in Alaska. What had been primarily a protective organization now became responsible for forest management as well. This marked the first time that Congress authorized forest management on all of the commercial forest lands under the jurisdiction of the Department of the Interior.

On March 19, 1946, a Forestry Division was re-established in the General Land Office for the first time since 1901, with responsibility for the establishment of effective procedures for the management of

the forests on the O&C lands and on the other public lands. The Forestry Division became a part of the Bureau of Land Management when the General Land Office and the Grazing Service were merged under the President's Reorganization Plan No. 3 of 1946. This Division was later designated Division of Forest Management and is the forestry staff arm for the Director of the Bureau of Land Management.

In all of the western States, including Alaska, the Bureau has established offices for the purpose of carrying out its forest management practices. Bureau of Land Management State Offices located in each of these States include a forestry staff. In addition, district offices have been established within each state. Districts in which forestry is a major activity are located at Coos Bay, Eugene, Medford, Roseburg, and Salem, Oregon; Sacramento, Ukiah, and Redding, California; Missoula, Montana; and at Coeur d'Alene, Idaho. Foresters are located in all districts having a forest resource.

Size of Resource

There is a tremendous volume of wood suitable for lumber, paper, and other products on the forest and woodlands areas of the Bureau of Land Management. The best available estimates indicate that there are about 160 million acres of forest and woodland in the continental United States including Alaska. The volume of timber thereon is estimated at a little in excess of 450 billion board feet; of this amount the O&C lands, including one-half million acres administered by the U.S. Forest Service, contain an estimated 60 billion board feet.

Timber Types Found in the Various Areas

Almost 84 percent of the estimated 60 billion board feet of timber on the O&C lands in western Oregon is Douglas fir. Due to the nature of the original land grant this timber is located at the lower elevations and is one of the most valuable single pieces of forest real estate in the United States.

More than 18 billion board feet of timber grow on the commercial forest lands on the unreserved public domain in Washington, Oregon, Idaho, and California. This timber is composed largely of Douglas fir, pines (ponderosa, lodgepole, sugar, and western white), western hemlock, cedars (western red, incense, and Port Orford), true firs (grand, silver, noble, shasta, and white), larch and a few hardwoods such as red alder and Oregon maple.

Mature ponderosa pine stand on the national land reserve.

BUREAU OF LAND MANAGEMENT FOREST AREAS AND VOLUMES

(As of July 1, 1961)

State	Area—Acres		Estimated Volume—M ft. B.M.	
	All Timberlands	*Commercial Timberlands*	*All Timberlands*	*Commercial Timberlands*
Alabama	3,000	3,000	3,000	3,000
Alaska	125,000,000	40,000,000	350,000,000	180,000,000
Arizona	1,333,000	4,000	291,000	13,000
Arkansas	3,000	3,000	2,000	2,000
California	1,854,000	304,000	9,721,000	6,621,000
Colorado	3,553,000	640,000	3,558,000	2,700,000
Florida	1,000	1,000	1,000	1,000
Idaho	724,000	332,000	3,960,000	3,869,000
Louisiana	9,000	9,000	5,000	5,000
Michigan	5,000	5,000	2,000	2,000
Minnesota	53,000	53,000	213,000	213,000
Mississippi	3,000	3,000	1,000	1,000
Montana	848,000	635,000	1,743,000	1,100,000
Nevada	10,100,000	100,000	10,500,000	500,000
New Mexico	1,870,000	71,000	1,297,000	102,000
Oregon [29]	3,429,000	2,532,000	57,057,000	56,091,000
South Dakota	16,000	6,000	21,000	6,000
Utah	9,388,000	633,000	16,500,000	1,900,000
Washington	169,000	169,000	946,000	946,000
Wisconsin	2,000	2,000	1,000	1,000
Wyoming	1,031,000	437,000	2,630,000	1,070,000
Total	159,394,000	45,942,000	458,452,000	255,146,000

[29] Includes O&C and CBWR lands.

The California forests are composed of transition types where the pine and Douglas fir meet, plus some redwood, and true firs. Juniper and piñon pine comprise most of the Nevada woodland area.

A broad range of tree species grow in the Rocky Mountain and western plains states. Various forests are composed of several pines (ponderosa, white, and lodgepole), some Douglas fir, Engelmann spruce and western larch are present. The juniper-piñon type is found in the more arid areas. Hardwood, consisting mainly of cottonwoods are found along the streams while aspen and alder occur farther up the mountain sides.

The relatively few areas of timber land in the eastern states under Bureau of Land Management administration is made up largely of eastern pines, black and white spruce, tamarack and central and eastern hardwoods. Volumes on these areas generally range from 1,000 to 15,000 board feet per acre.

Alaska is in a class by itself with a vast potential reservoir of timber estimated at 350 billion board feet. Over the past 75 years at least two-thirds of the original forests have been destroyed by fire. Extensive portions of the fire-ravaged areas are in various stages of natural reforestation with stands of young spruce intermixed with aspen and birch. Restoration of forest cover on perhaps a third of the denuded

Young stand of Douglas fir in need of commercial thinnings to salvage mortality which would be lost prior to final harvest.

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The Bureau of Land Management administers nearly 46 million acres of commercial forest land.

area will require costly reforestation measures. The typical interior forest, whether commercial or non-commercial, is a mixture of white spruce and white birch.

The Bureau of Land Management not only administers great acreages of forest lands but is performing a substantial part of the total job of public forest and woodland management. Recently compiled figures show that it has jurisdiction over approximately one-third of the public forest acreage and 25 percent of the volume of federally-owned timber. These figures do not include non-commercial forest areas.

Management of the Resource

The Bureau of Land Management's forest program is one of sustained production.

Sustained yield for extensive forest areas, such as the O&C lands or of a large private ownership, generally is understood to mean annual wood harvest equal to annual production. The growth should be as large as possible and realized annually during each year it takes young trees to grow to maturity.

For a single large tract or an isolated individual tract of even-aged homogeneous timber, sustained yield may be obtained by:

(1) Determination of the growth age of the timber necessary for maximum yield of wood.

(2) Subdivision of the tract into a number of equal production capacity cutting units.

(3) Successive annual rotational harvest of the cutting units.

(4) Reforentation or natural regeneration of the cutting units immediately following harvest.

In many cases timber types other than even-aged homogeneous stands are involved. All ages of trees from the youngest to the oldest may be found growing in mixture on every acre. Consequently, sustained-yield management must be realized by methods other than orderly rotational harvest of established cutting units. Under such conditions selective cutting on a tree-by-tree basis is practiced and, wherever feasible, is considered the ideal practice because of the lesser disturbance to the forests. Selective cutting, however, does not automatically produce sustained-yield results. Even with selective cutting it is necessary to regulate and control the volume of timber cut so that equilibrium with the volume being grown will be maintained.

The protective function of forests is of extraordinary importance on areas which are the source of water supply for industrial and domestic purposes of towns and cities. Sustained-yield management produces

highly beneficial results to water supply and to the soil because only a small proportion of the area of a management unit is disturbed at any one time.

In addition to the general practice of sustained-yield management, the Bureau cooperates with various towns and communities in solving watershed problems. This cooperation has been of two types. The Bureau, at the request of communities whose water supply was jeopardized by logging on private lands, has undertaken to acquire such lands by exchange for other public lands in less critical areas. The other type of cooperation is to develop and carry out special management measures on Government watershed lands of critical importance so that the flow of water will not be disturbed or its purity impaired.

Sustained-yield management is an undertaking in the field of economics applied to forest utilization. It is a concept of management which can be applied with great public benefit in the use of certain other natural resources as well as timber. It is referred to most commonly, however, in connection with forests and it means using the timber of a definite area no faster than it is renewed by the growth process. Good or poor forestry determines whether new growth will be large or small and whether the yield can be sustained at a high level or at a low level.

Forests must be protected from the ravages of fire.

BLM log dump at terminus of timber access road. Logs are made into rafts and towed to tidewater mills.

The most immediate purpose of sustained-yield management of forests on lands administered by the Bureau of Land Management is to develop permanence and economic security for cities, towns, and lesser communities which depend heavily on timber as the raw material for their industries. The assured permanent timber supply resulting from sustained-yield management encourages heavy investments required for the processing and refining the endless variety of finished goods which can be made out of wood. A trend to make more products and realize fuller utilization of the limited but permanent timber supplies follows. This results in increased man-years of employment for each million board feet of the grown timber. Payrolls of such communities are bigger and the average pay rate is higher than in communities faced with timber exhaustion and only temporary sawmill prosperity.

In considerable degree, the accessory benefits of forests are automatically realized as the result of sustained-yield management, especially when such management is carried out on a localized basis. This is true with respect to the maintenance of attractive scenic conditions and favorable conditions for game and fish. These conditions, however, require special planning for full realization. Normal benefits of sus-

Sitka spruce believed to be in its most northern range, found at Stariski River on the Kenai Peninsula, Alaska, between Homer and Kenai.

tained-yield management on Bureau of Land Management lands are supplemented by limited selective cutting or no cutting at all in strips of timber bordering main roads, fishing streams and lake shores. Such protected areas are in demand as public recreational sites. Wherever encountered on timber sale areas, fishing waters are protected by special contract clauses prohibiting the disturbance of spawning grounds and requiring other measures designed to maintain favorable conditions for the propagation and growth of fish.

The Bureau of Land Management administers 169 million acres of forest and woodland on the public domain in the United States and Alaska.

Log deck of white spruce at the Fred House mill located two miles north of Kenai, Alaska.

Whether in selective cutting or clear cutting, sustained-yield management is practiced by the Bureau of Land Management.

Oregon and California Lands

The Act of August 28, 1937, required that the forests on the O&C lands be managed according to the principles of sustained-yield. It further required that the timber marketed under the plan be sold in such a way as to contribute to the economic stability of dependent local communities and industries. This meant that sustained-yield management was to be applied locally. To make this even clearer the act authorized the subdivision of the area into local units for the practice of sustained-yield management. These units became known as Master Units. A public hearing on the first of these, known as the Siuslaw Master Unit, was held on December 3, 1945, and the unit approved by the Secretary of the Interior on December 11, 1946. Eleven other Master Units on which hearings were held during June of 1947 were approved by the Secretary in November of that year. Each Master Unit was composed of a group of lesser management units known as administrative units. In general, an administrative unit consists of a drainage or some other logical topographic feature, and supports enough timber, both Federal and private, to maintain at least one sawmill of average size for the area.

In order to assist in the development of the O&C forest program, an advisory board was formed, which included broad representation of forest industry, other forest interests, mining, education and the general public. Subsequently, each of the five districts was provided with an advisory board representing a similar range of interests.

Because of the rough, mountainous character of western Oregon, logging roads are very costly and locations for them are limited. Unnecessary duplication of road systems is avoided. The approach in this matter has been to obtain reciprocal road-use rights from road builders as a condition to the granting of rights-of-way across O&C lands. When the owners of the private lands build road systems to reach their own lands they unavoidably cross the O&C lands. Long-term agreements between the Bureau and the owners of intermingled private lands are being negotiated and many are now in effect. By these agreements the road system for a large block of such intermingled ownerships is planned jointly. The costs of construction and maintenance are borne jointly by the Government and private owner by prorating them in proportion to the timber volume in each ownership.

The private cooperator or the Government builds the road system according to a development plan over a definite term of years. The Bureau requires that the purchaser of Government timber tributary to the road system pay a fair price for using privately-owned segments of the road. When the Government timber is sold, usually in oral auction procedure, access is guaranteed to all prospective purchasers.

In cases where a cooperating landowner does not purchase government timber, he makes his road system available to the successful bidder. Under such conditions, the purchaser is obliged to pay the cooperating landowner for the use of the road at rates specified in the agreement or determined through negotiation or arbitration.

The cooperator under reciprocal road-use agreement is not obligated to cut his own timber according to the sustained-yield principle. Many companies, however, are striving for permanency and recognize that such measures as tree farming and sustained-yield timber management are essential if permanency is to be achieved. The long-term road agreement does facilitate and encourage such management.

Regulations setting forth the policies and conditions governing the issuance of reciprocal permits and agreements for the construction and joint use of road systems in the O&C area were issued in 1950. They were based on the need of cooperation between the owners of intermingled land holdings and the essential requirements that access to the Government timber be available under fair and reasonable conditions whenever such timber is offered for sale. One of the principal purposes of this policy is to facilitate fair competitive bidding for Government timber by all interested operators whether small or large.

The first intensive forest inventory on these lands was completed in April, 1959, and established the annual sustained yield capacity at 874.2 million board feet. In addition to marketing the full sustained yield capacity, approximately 125 million board feet of salvage, and thinnings, which are not chargeable against the sustained yield, have been marketed annually. This produced a total of nearly one billion board feet annually from these lands.

The Act of June 24, 1954,[30] provided that 463,000 acres of valuable timber land in the indemnity portion of the O&C railroad land grant were to be treated as revested O&C lands insofar as distribution of income is concerned. The new law also set aside these lands for administration by the Forest Service, U.S. Department of Agriculture.

In addition, the Act of June 24 provided for the transfer through exchange of 450,000 acres of other O&C lands. This was done in such a manner that the existing intermingled O&C and national forest lands were consolidated in separate blocks. By appropriate adjustment of the national forest boundaries the resulting O&C blocks were placed entirely outside the national forests. The purpose of this provision was to separate the overlapping jurisdictions and facilities the solution of forest management problems of the Departments of Interior and Agriculture.

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[30] 68 Stat. 270.

Public Domain Forests of the Western States

The management program being developed for the nearly four million acres of commercial timber on the public domain in the West generally parallels that for the O&C timber lands. The chief difference in the two management programs is that on the public domain forest lands, large sums of money have not been appropriated for major investments in facilities.

To a great extent the degree of forest management practices on the public domain is a direct result of the widely scattered forest ownership pattern and the timber types. Generally speaking, the economics of the forest industry in the public domain areas are at a much lower standard than on the O&C lands. This is a direct reflection of the timber types or species and is not by design or planning.

The situation is somewhat analogous to agricultural operations. In a large ranch operation, the operator makes huge investments for machinery, roads, buildings, wells, and fencing in an attempt to develop for the highest economic return. On a smaller ranch the same type of facilities are used but the investment is not as great in order to obtain the highest dollar return consistent with the size of the operation. While the economic return to the Bureau of Land Management is not as paramount as to a private operation, it does receive due consideration in the business-like forest management practices of the Bureau.

During the past few years there has been a substantial increase in the need for various forest products and related resources on the public domain forests. This trend can be expected to continue to the extent that within the next few years approximately one-half billion board feet of timber will be removed annually. Needs for other goods and services have shown similar increases. It is evident that a program of such magnitude and diversity must be fully developed and sustained on an orderly, systematic basis.

Relatively high standard forest practices are being applied on these public domain forest lands. When timber is sold it is marked or otherwise designated for the cutting of the mature and overmature age classes. The young age classes are reserved for future growth. These and other measures including reforestation, leave the cutover lands in a productive condition for the growing of future crops of timber.

Vast acreages of juniper-piñon pine and other woodland types exist in the western States. The total area is estimated at about 30 million acres. It exists in large, well-consolidated blocks and, thus far, has relatively little commercial importance to the lumber industry. To the livestock industry, however, it has great importance as a source of posts and other materials used in range structures. Also it supplies large

quantities of fuel. Since the piñon pine occurs on millions of acres, ultimately it should attain greater commercial significance as a source of wood for pulp or other products.

The management of these woodland areas is being developed as a part of the job of area management. Foresters are engaged in advising and assisting range managers in the preparation of woodland type maps, management plans and standard cutting practices. In most districts the volume of forestry work requires the permanent assignment of one or more foresters to the staff of the manager.

Forests of Alaska

The spruce stands in Alaska have great potential value as a future source of supply for newsprint and other pulp and paper products. The character and growth rate of this timber are equivalent to the forests of our other northern states and Canada which support an extensive pulp industry. The current development of a large pulp industry on the Tongass National Forest in southeastern Alaska suggests that the day will come when similar industries will be based on the white spruce of interior Alaska.

The accessory function of the forest tends to become dominant economically in Alaska. It is a region which has superb recreational resources combining some of the world's most significant scenic attractions with abundant fish and wildlife. A network of wide well-surfaced highways connecting with the Alaska Highway is being extended to many formerly inaccessible areas. A network of commercial landing fields has been built and even the most remote mining camp and fishing village has its landing strip for small planes. Lodges and inns are springing up along the highways, lake shores and stream courses. As the fame of Alaska spreads, travel by recreation seekers expands. Supplying the needs of this rising tide of travelers has become one of the biggest industries of Alaska.

The great influx of tourists and increased settlement in Alaska, magnified by the attainment of Statehood, has created new forestry problems and accentuated old ones. More people on the highways traveling forested areas means more man-caused fires that must be detected promptly and extinguished while small. The need and demand for campgrounds for picknicking and overnight camping has grown. The lack of such facilities in certain localities has, in some cases, led to use of camping fires under hazardous conditions with resultant high cost to the public for forest fire suppression.

As a matter of economy in fire prevention and suppression and in order to prevent the destruction of outstanding recreational resources, the Bureau developed campgrounds in strategic spots. Under the Act

of May 4, 1956,[31] $100,000 was appropriated annually for several years for the construction and maintenance of such camping areas. The law also provided for the eventual transfer of these recreational sites as did the Alaska Omnibus Act of June 25, 1959.[32] The State of Alaska took over maintenance of these recreational sites and campgrounds at the end of fiscal year 1959.

Forest Protection

Forests are beset by many destructive forces. Of these, fire is usually the worst. Insects and diseases, however, while less spectacular than fire and less subject to dramatization by the press, cause losses which generally exceed those of fires.

Insect and Disease Control

The alert forest manager must always be on guard against insect and disease attacks. With forests of the size, composition, and location as those managed by the Bureau, at least one severe attack of an epidemic proportion may be expected annually. In the past, control measures for such attacks consisted of aerial spraying, in the case of sprucebudworm, or logging and removal of the dead, down, and damaged timber in order that it does not serve as a breeding ground for beetles. An annual *ribes* eradication program is carried on to control white pine blister rust.

Fire Control

Fire control on the commercial timber areas administered by the Bureau of Land Management, excluding the State of Alaska, is handled quite generally through contracts with the local fire control agencies.

The woodland areas and some commercial forest areas are within Bureau of Land Management fire protection districts and the Bureau has its own fire control organization. On the forest and woodland areas of Alaska, the Bureau has the dominant and, excepting the Forest Service organization of southeastern Alaska, the only forest fire control organization in that vast area.

In areas where the Bureau of Land Management handles its own fire protection and suppression, the most advanced techniques and equipment are employed. Airplanes are steadily becoming the backbone of the fire operational plan from the standpoint of both detection

[31] 70 Stat. 130.
[32] 72 Stat. 340.

and suppression. The planes are used in reconnaissance in the wake of severe lightning storms. Professional fire fighters study newly started fires from planes or helicopters to plan the best possible attack considering effectiveness, speed and safety.

After extensive testing, "bombing" fires promises to become a standard procedure. Such an attack consists of dropping chemical solutions from tanks and sprayer-equipped planes. Normally these attacks are most effective in putting out small fires in rugged terrain, but they also cool down hot spots in large fires, making for quicker control by ground forces. In many instances ground forces are transported locally to fires by air.

A plan of intrabureau exchange of personnel for fire overhead duties provides for sufficient qualified men for even the most disastrous conditions.

Communications for fire operations as well as for other purposes, including safety, are accomplished by a vast network of short wave radios. Radio operations are possible across vast areas. Station-to-station, ground-to-air, and station-to-ground mobile unit communications are all possible.

One of the most recent undertakings of the Bureau of Land Management in fire control is an attempt to develop a rating system of fire danger. Using fire history and occurrence coordinated with climatological data, a fire danger rating and forecasting system is being perfected. This system is becoming the basis for even better presuppression and suppression.

An innovation in Alaska is the addition of smokejumpers to the fire control organization. This addition offers the best prospect of overcoming one of the general weaknesses of the Bureau's fire control program in the vast Alaskan interior. Even with speedy discovery of small lightning fires, too many of them reach major proportions before control parties are able to reach them. The smokejumper program means that fire fighters and their equipment can be dropped by parachute close to fires and moved into action while these fires are still small and easy to control.

Helicopters are also playing a vital role in solving the forest fire problem, particularly in Alaska. They are used to transport men and equipment from place to place along the periphery of large fires. They are indispensable for the purpose of returning smokejumpers and other firefighters to their operating bases.

Many new fire control operating bases have been constructed in remote parts of Alaska where the incidence of lightning fires is high; more bases are to be built. Properly located bases play an important part in reducing elapsed time between discovery and control action on fires.

Policy

The policy of the Department of the Interior as implemented by the Bureau of Land Management is to manage and develop valuable forest and woodland properties to their highest productive capacity.

To implement this policy the Bureau of Land Management will:

Identify, inventory, and classify woodland and forest land to determine its highest and best use.

Manage each forest and woodland type to obtain its maximum permanent benefits.

Protect the woodland and forest areas to assure the management objectives.

Develop and pursue programs leading to optimum utilization of woodlands and forest products.

Each of these statements might well be examined in more detail.

Identify, inventory, and classify woodland and forest land to determine its highest and best use.

Broad classification is the basic tool of forest and woodland management. Inventories are being initiated, improved and maintained to serve as a basis for data to help determine uses as well as the productive capacity of the forested lands and their related use aspects.

Manage each forest and woodland type to obtain its maximum permanent benefits consistent with the principles of balanced use.

Maximum permanent benefits on a balanced use basis rather than maximum timber production is the goal. Some lands are better suited for recreational use, others for watershed protection, and still others might be managed primarily for grazing by either wildlife or domestic animals. Where examination shows the maximum permanent benefit to be other than timber production, the land shall be so managed.

Protect the woodland and forest areas to assure the management objectives.

The measures currently being taken to protect the public lands were previously outlined. The success of a management plan may well depend on keeping fire, insects, and disease from destroying the resource. Hence, protection is an important consideration in the realization of management objectives. Standards of protection must be in keeping with the intensity of management given an area. Protection programs are placed with the agency best qualified to service the area.

Develop and pursue programs leading to optimum utilization of woodland and forest products.

The public is the ultimate beneficiary of the forest and woodland crops grown on the public lands. Sales programs must be designed to speed forest and woodland products to market while providing for resource renewal. Older material must be removed to make room for a vigor-

ous new crop so forest and woodland products must be harvested before age and disease take their toll. Bureau sales programs must be administered to encourage the primary purchaser to make full use of the product. Timber sales made on a cruise basis have been found a useful means of promoting such use since this type of sale induces the operator to remove all the felled timber material that might possibly have any value. Management includes harvesting forest resources on a maximum allowable sustained yield basis on lands under permanent Federal tenure. As other means are discovered to promote optimum utilization consistent with land tenure, they will be put to use on Bureau of Land Management lands.

In Conclusion

The Bureau of Land Management is entrusted with the management of hundreds of millions of dollars worth of forest resources. It manages these resources well, keeping in mind a business-like operation consistent with the most advanced forest management techniques, related forest land uses, and the highest possible utilization. Its long range objective has always been a public forest management program second to none.

National Park Service

History

IN 1864 President Lincoln approved an act of Congress authorizing a grant of public lands to the State of California consisting of Yosemite Valley and the lands embracing the giant sequoia trees in the Mariposa Big Tree Grove. This act stipulated that these tracts should be held for public use and recreation. This was one of the first Federal laws relating specifically to public recreation. However, the creation of Yellowstone, the first national park, is generally considered the culmination of an ideal and the beginning of a great cultural development which has now spread throughout the entire world. The "birth" of this ideal occurred in 1870 during a campfire discussion by members of the Washburn-Langford-Doane Expedition while camping at the confluence of the Gibbon and Fire Hole Rivers. Cornelius Hedges, a member of the expedition organized to explore unusual natural phenomena reported by hunters and trappers in the Yellowstone country, proposed to the other members of the party that they sponsor a movement to have the region set aside for public use and protected from commercial exploitation. The other members concurred with this proposal with favor and enthusiasm, and as a result, Yellowstone National Park was established by Congress in 1872.[33]

The act establishing the park incorporated the ideals advanced by Hedges, for it stated that the area "* * * is hereby reserved and withdrawn from settlement, occupancy, or sale under the laws of the United States, and dedicated and set apart as a public park or pleasuring-ground for the benefit and enjoyment of the people."

In addition the Secretary of the Interior was empowered to issue regulations which "* * * shall provide for the preservation, from injury or spoilation, of all timber, mineral deposits, natural curiosities, or wonders within said park and their retention in their natural condition."

Eighteen years after the creation of Yellowstone National Park, Congress again took action to protect unusual works of nature by establishing Sequoia, General Grant, and Yosemite as national parks (General Grant is now included as a portion of Kings Canyon National Park). The intent of Congress to preserve and protect the forest in these parks is definitely stated in the preamble of the act creating

[33] 17 Stat. 32.

Sequoia National Park: "* * * whereas the rapid destruction of timber and ornamental trees in various parts of the United States, some of which trees are the wonders of the world on account of their size and limited number growing, makes it a matter of importance that at least some of the said forests should be preserved." These early legislative measures are milestones in forest conservation as they were the first efforts of a legislative body to preserve large forested areas containing natural phenomena for the enjoyment of future generations.

Following the establishment of the national parks in California other national parks were created. At present 30 such areas exist. In the West, all of the national parks were originally portions of the public domain and were withdrawn from settlement to preserve special features of national importance. In the East, however, by the turn of the century, areas of great natural significance had already passed into private ownership. Consequently, before the national parks could be established in the East, it was necessary to acquire the lands with both private and public funds. Great Smoky Mountains National Park situated along the divide between the States of Tennessee and North Carolina is an example of an eastern park set aside for the preservation of outstanding eastern forest types and scenery.

By 1900 the national parks were receiving considerable American and foreign visitors. As public use and enjoyment of these parks grew, the

Helicopter dropping water on Sequoia tree burning in top. Giant Forest area.

Yellowstone National Park. Fire on the southeast shore of Heart Lake.

ideal originated by Hedges in Yellowstone 30 years before spread. The public realized that many other features in the country merited protection for the education and scientific opportunities they offered. This realization resulted in the Act for the Preservation of American Antiquities, approved June 8, 1906.[34] The President of the United States was authorized by this act to declare as national monuments, by public proclamation, any historic landmarks, historic and prehistoric structures, or objects of historic or scientific interest that were situated upon lands owned or controlled by the Government of the United States.

Until 1916, the then 17 national parks and 28 national monuments under the jurisdiction of the Department of the Interior had no unified administration. Each area established during the 44 years from 1872 to 1915 was more or less separately managed by the Army largely because the Secretary of the Interior was empowered by the Congress to request the Secretary of War to furnish troops to protect each area. The desirability of creating an agency within the Department of the Interior to administer these areas soon became evident and on August 25, 1916,[35] Congress authorized the establishment of the National Park Service. In 1933 the responsibilities of the National Park Service were

[34] 34 Stat. 225.
[35] 39 Stat. 535.

extended to include the administration of a number of national monuments, memorials, military parks, battlefield sites and cemeteries formerly administered by either the War Department or the Department of Agriculture.

The Park, Parkway, and Recreational Study Act, approved June 23, 1936,[36] authorized the National Park Service to cooperate with various States and their political subdivisons in making a comprehensive study of public park, parkway and recreational area programs of the United States. Under this Act and other enabling legislation, the National Park Service now adminisers, by interbureau agreements, three recreation areas. These areas are the reservoirs and adjacent lands included in power and reclamation projects of the Bureau of Reclamation.

It is unfortunate that members of the camping party in Yellowstone 90 years ago could not have lived to see how their idea had led, from the creation of the first park, to the present 187 areas. The National Park Service as of December 31, 1961, administers nearly 25,704,497 acres of Federal land found in 41 of the 50 States, the District of Columbia, Puerto Rico, and the Virgin Islands.

Significance of Park Forests

Only a few national parks or monuments were established to preserve forest species or types as was done in Sequoia National Park where the best of the Giant Sequoia is preserved, or in Great Smoky Mountains National Park where one of the finest virgin spruce and fir forests in the East is situated. However, most of the 187 areas now in the National Park System contain lands bearing forest growth. On an acreage basis some of these areas are very small but three areas are over 2,000,000 acres in size. Regardless of the extent or type of forest growth found in these areas, that which is present is significant as it plays an important part in the aesthetic, interpretive, and recreational aspects of the areas. A panorama of superb mountain scenery would be incomplete without natural forest vegetation. The story of a prehistoric ruin once occupied by inhabitants who used the products of the forest for food, shelter, and comfort would be more difficult to interpret if remnants of the original forest were not present. The experience of camping, hiking, exploring, and other pursuits followed by visitors to many Service areas would be less enjoyable if the forests were not available.

Other important values of the forests are the conservation of water and wildlife. Many of the parks are situated in mountainous country with the headwaters of important streams located within their boundaries. The importance of maintaining forest growth in these areas for

[36] 49 Stat. 1894.

Yosemite National Park, California. Sugar Pines of Rockefeller Area of Yosemite National Park.

water conservation cannot be minimized. All national parks and monuments are wildlife sanctuaries and as such not only maintain the existence of many species, but at times, serve as a part-time habitat for species important to outdoor recreationists such as hunters.

The dollar value of a property containing forest growth that furnishes aesthetic enjoyment, broadens people's knowledge by interpretation of features presented by the area or makes leisure time of individuals a more pleasant experience is very difficult to ascertain. However, this value must be considerable, as the visitor use of our national parks and monuments has increased from 358,006 visits during 1916, the year the National Park Service was established, to 79,000,000 visits during 1961 to all areas administered by the Service.

The National Park Service does not attempt to inventory on a volume basis the forests contained within the areas that it administers, as these forests, by basic legislation, are not maintained as a source of commercial timber. There are those who believe it wasteful to permit large and commercially valuable trees to die, fall down, and rot when they could have been used commercially. Such individuals have in numerous instances advocated selective logging for the national parks so as to utilize the mature and overmature trees while they are still merchantable. Such logging, no matter how selective or restrictive it may be, or how carefully accomplished, is contrary to the principles upon which the national parks and monuments were established. Once logging is introduced in an area, the ecological conditions are changed and the area is no longer a superlative natural forest. Vegetative cover type maps have been made for almost all of the scenic and scientific parks and monuments. Most of the native forest types and species of the United States were identified during the mapping process. Based on broad classifications, approximately 14,584,000 acres of the 25,704,497 acres of Federal land administered by the National Park Service, support natural vegetation. This vegetation consists of 2,675,000 acres of grassland; 3,596,000 acres of shrubs and brush, and 8,313,000 acres of forest land. The forest land class includes 798,000 acres of subalpine forests and 900,000 acres of woodlands.

Forest Policy and Practices

The general forest policy, as well as a number of specific policies, followed by the National Park Service in administering the parks has been established by congressional legislation. When Congress established the National Park Service in 1916, the policy stated in the act that the Service should promote and regulate the use of the national parks, monuments, and reservations by such means and measures as would conform to the fundamental purpose of the areas. This purpose "* * * is to pre-

serve the scenery and the natural and historic objects and the wildlife therein, and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations."

Subsequent to its establishment in 1916 the administrative responsibilities of the National Park Service were enlarged to include a number of seashore, memorial, battlefield, historic, parkway, cemetery, and recreation areas and the National Capital Parks. The general policy of maintaining areas in their "natural state" does not always apply to these areas. The treatment of the vegetation in the military and historic areas is dependent on the status of the vegetation during the historic time. For example, if a battle occurred in a wheat field that in subsequent years has been replaced with a young forest, the significance of the area probably can be better interpreted if the forest growth is removed and an agricultural crop restored. The vegetation found in cemeteries, the National Capital Parks, memorials, and around historic structures is usually not "natural" and it is the policy to maintain the vegetation in appropriate condition, although several "natural" areas are within the system of the National Capital Parks. Recreation areas have been established primarily for the outdoor recreational potentialities offered by various reservoirs of reclamation projects and

Mop-up on burning snag—Yosemite National Park.

their development is based on what the individual areas offer. If possible, recreational opportunities in "natural" forests are presented. Generally, due to the limited width of the right-of-ways, parkways cannot be considered "natural" areas. However, an attempt is made to maintain the right-of-way, exclusive of the roadway, in the same condition after construction as it was at the time the parkway was located so that the motorist can drive through a countryside unimpaired by commercial features.

By the Act of September 20, 1922, the Secretary of the Interior was authorized to protect and preserve from fire, disease or the ravages of beetles and other insects, timber owned by the United States on the national parks and monuments as well as other public lands. This legislation established the policy followed by the Service in protecting the forests within the parks from these destructive enemies.

Fires within areas administered by the National Park Service are considered the greatest menace to the enjoyment of the areas since they not only threaten serious injury to the vegetation and wildlife, but also may destroy valuable property including historic objects that cannot be replaced. This is true whether the fire originates from human carelessness or from lightning, a natural cause. Regardless of the type of area in which a fire may occur, fire suppression takes precedence over all other park activities except saving or safeguarding human life.

It is the policy of the Service to endeavor to maintain its areas free from introduced forest diseases and from serious environmental troubles caused by excessive human use. To carry out this policy, advice and assistance is sought in the field of forest pathology and assistance is given the pathologists in their studies of problems in the Service areas. The Service attempts to carry out, so far as may be practicable and administratively desirable, the recommendations for solutions of such problems through the application of control measures or improvement of growth conditions.

The National Park Service insect control policy is to endeavor to keep the parks and other areas free from injurious insects and to procure and maintain, so far as practicable, efficient protection from native insect epidemics for various areas within the national parks and monuments. In general, protected areas are those of intensive use such as campgrounds, roadsides, and other developed areas; areas of important scenic and aesthetic attraction; areas of prospective intensive use within the next 10-year period; areas programed for white pine blister rust control; areas within the national parks threatening protected areas either within or without the parks; areas of present or potentially critical fire hazard; areas set aside for forest study and research unless natural agencies are to be left undisturbed; and areas of especial historical significance.

When the Service was established, the Secretary of the Interior was authorized to provide for the destruction of such animals and plant life as may be detrimental to the use of the national parks and monuments. This legislation also empowered the Secretary to grant the privilege to graze livestock within any national park or monument, except Yellowstone National Park. Consequently, some grazing by domestic livestock is permitted on a limited scale by the National Park Service. In the West where the Service inherited a number of lifetime tenure permits when various areas came under its administration, grazing will eventually be terminated. In the East a number of permits are issued each year for the pasturing of a few animals to complete either the historical or natural picture of certain areas.

All non-native species of plants, so far as practicable, are prevented from becoming established in national park areas by eradication of those accidentally introduced or intentionally planted. This is true unless such plants have some historical or practical value to exempt them, or have become so well established that eradication is no longer feasible.

Vista cuttings and thinnings within the national parks and monuments are undesirable as a general practice. However, in a few instances vista cuttings or thinnings may be considered necessary to provide for the continued enjoyment of the major park features. As the aim of historical conservation is to preserve or retain the historical scene, nature cannot be allowed to take its own course in historical areas. Tree cutting may be necessary not only to provide suitable vistas for the display of historic scenes but also to restore cultivated fields or pastures as near as possible to conditions existing in historical times.

Forest protection practices consistent with the concept of National Parks are followed in the forested areas administered by the National Park Service. Many of these are common to all forest land managers but certain modifications are required to meet park principles. As an example, in vista clearing, certain elements of forest stand improvement are applicable to these operations. In suppression of forest insect or disease outbreaks, silvicultural or logging methods are not employed. Providing adequate protection to park vegetation presents a challenge to the park forester. Land uses and land managing practices adjacent to the parks influence conditions within the parks which are difficult to cope with. Mutual recognition and understanding of incompatible uses and interests and cooperative efforts are necessary to alleviate these problems.

In conformity with the letter and spirit of the laws relating to national parks and monuments, no cutting of live or dead trees for forest

products is permitted except as specifically provided by law or regulation. Exceptions are where such utilization shall be incidental to necessary clearing for rights-of-way, building and developing sites, vista clearings, fire hazard reduction, clean-up operations in windfalls and burns, insect and tree disease control, removal of trees dangerous to life and property, improved aesthetic effect, or portrayal of the historic picture.

Protection Staffs

The park rangers constitute the primary protection organization of the National Park Service. They are responsible for executing the protection activities related specifically to forests and other vegetation. They are assisted in the technical phases of their work by staff men located in the parks, regional offices and the Washington office. Foresters, biologists, agronomists, horticulturalists and arboriculturists are some of the categories of these technical staff positions. Additional technical assistance is provided the National Park Service by the Bureau of Sport Fisheries and Wildlife and the Forest and Range Experiment

Olyympic National Park Washington. Trees, several centuries old, that grew out of the trunk of a fallen tree, and stand in a row, just above Jackson Ranger Station on the Hoh River Trail.

Stations of the Forest Service. During the field seasons the park rangers are augmented by additional park rangers, sub-professional aids for forest fire control, insect and disease suppression and other categories depending upon the extent and nature of work to be accomplished.

Fire Control

Forest fire control in the National Park Service involves protecting slightly more than 11 million acres of parklands. Forest fires include all fires originating within park boundaries as well as those on outside adjacent lands which threaten or may enter the parks. The extent of land involved in fires outside the park boundaries is greater than the area of park lands protected. The National Park Service also has a structural fire control organization for the protection of human life, Federal property and its facilities as well as concession facilities within the parks.

The normal fire control needs of each park are ascertained by detailed studies by fire control planners. From time to time a re-analysis is made to bring the fire plans up to date. The Service recognizes the disastrous effects of fire and the importance of keeping the trust assigned to it so that future generations may enjoy the parks.

During the 1951–1960 decade 3,788 fires, which burned a total of 121,385 acres, were suppressed on lands administered by the Service. During this period 80% of these fires occurred on forested lands although 75% of the area burned during this same period consisted of grass and brush land. Approximately one half of the fires during this period were lightning caused and the remainder were man caused. Smokers started 21% of the fires and in descending order other causes were from camping, miscellaneous, debris burning, incendiary and machines. During this same decade Service personnel extinguished 576 outside fires adjacent to the park boundary that threatened to enter the park 646 or 81% of these fires were mancacused and the remainder, 112 or 19% were lightning caused. During the 1951–60 decade approximately 90% of the Nation's forest fires were mancaused.

There appears to be no direct relationship between the incidence of mancaused fires and lightning caused fires. Between 1950 and 1960 public travel to the areas administered by the Service increased 98%. This is an annual rise of 6.7% per year in public use which carries with it a potential for an increase in mancaused fires. However, the actual incidence of mancaused fires during the same period declined at an average annual rate of 2.2%. This overall reduction indicates

increased effectiveneess in the field of fire prevetion. Lightning caused fires for the same period indicate a different trend. During the first half of the decade lightning caused fires averaged 147 per year; over the last five years the average increased to 230 fires per year. Perhaps the most logical explanation for this change in lightning fire occurrence is due to the subnormal precipitation which was prevalent in the west during the last four years of the decade.

The Park Rangers ånd the Fire Control Aids constitute the first line group of personnel responsible for forest fire control. Although fire suppression takes precedence over all other activities except the saving and safeguarding of human life, the park rangers have other collateral responsibilities that must be performed during the fire season and when fires occur. During periods of high fire danger fire control forces are increased. All other park personnel are subject to fire suppression duties. Pre-season plans and arrangements provide for rapid dispatching of personnel between parks and regions as the situation demands. Cooperative fire suppression agreements with other agencies provide for additional assistance during emergencies. In recent years the National Park Service, in cooperation with other Federal and State agencies, has

Helicopters are extremely useful for delivery of fire fighters and supplied in the rugged terrain of Olympic National Park.

trained and developed two groups of fire fighters known as the Southwestern Forest Fire Fighters and the Montana Indian Forest Fire Fighters. These fire fighters are organized into 25-man crews consisting of a crew boss, 3 squad bosses and 21 fire fighters. They have been used on many of the major fires in the western states since their inception and have become very skilled and proficient in initial attack on forest fires.

The National Park Service conducts training schools for all classes of its fire control personnel for both forest and structural fires. Service conducted training is provided to seasonal as well as permanent employees. In addition, Service personnel receive training in schools conducted by other fire control agencies. Emphasis is placed on fire behavior, fire weather, initial attack, fire detection and organizing for suppression of large fires. The increased use of aircraft in fire control has introduced the need for specialized training in aerial detection, paracargoing, helitack and allied aerial operations.

Aircraft, both fixed-winged and rotary types, are widely used by the Service in forest protection work and particularly in fire control. This use requires highly trained and especially equipped personnel, such as smoke jumpers, helijumpers, and air operations officers. New tools and equipment have been developed and conventional fire fighting gear modified for aerial fire control operations. The aerial application of chemical fire retardents and water on critical parts of forest fires assists the suppression crews in controlling them. Each year improvements are made in this field and the practices are extended to more parks.

Fire suppression equipment consisting of hand tools, fire hose, pumpers, tankers, chain saws, radios as well as camp and mess equipment, parachutes and paracargo are placed at strategic locations throughout the areas administered by the National Park Service. Regular maintenance equipment such as large trucks, bulldozers and tankers are available if needed. Due to the increased use of aircraft, rapid mobility of equipment, supplies, and personnel is possible. It has permitted in some instances a reduction in the size and number of fire caches.

Research in fire control provides the National Park Service with improved methods and techniques in prevention, planning and suppression of fires. As refinements are made in forecasting fire weather and fire danger, the fire fighter is provided with advance notice of hazardous or critical fire conditions and is thus able to do a better job in fire control.

During past years the Service has suppressed a number of large fires that swept over considerable areas and left large accumulations of debris and snags which were extremely hazardous. To reduce the fire

hazard several extensive projects have been completed in which snags were felled and volume of the material on the ground reduced. When economically practicable, considerable forest products were salvaged.

The fire control procedures followed by the National Park Service are similar to those used by other forest protection agencies. To detect incipient fires promptly, the Service operates approximately 68 primary lookouts and supplements them with secondary lookouts and with ground and airplane patrols.

Communication facilities used by the Service's fire control personnel consist of both radios and telephones, but radios are expected eventually to replace most of the ground lines.

The Service maintains approximately 7,235 miles of primary and secondary roads and 8,364 miles of trails and manways that are means of access for suppression personnel. The road and trail network within the national parks and monuments is not as extensive as is found in forested areas administered by other protection agencies. Maintenance of the areas in their natural state, consistent with human use, prohibits the construction of the maximum means of access. To overcome this limitation, the Service locates protection personnel in remote areas and utilizes smokejumpers.

The smokejumpers are highly trained and specially equipped fire fighters who operate in units of one to four men. They are air-dropped on forest fires in back-country areas of such parks as Yellowstone and Glacier in order to control the fires while they are still small. Without smokejumper service, such fires could only be reached after long and arduous travel which would result in fires that are large in size and costly to control.

To insure that suppression forces will attack and suppress fires with the proper techniques, including both tactics and use of tools and equipment at hand, the National Park Service conducts annual fire control training schools which are attended by approximately 3,000 seasonal and full-time employees annually. In addition to forest fire control training, structural fire control training is given to the majority of the personnel of both the Service and its concessioners. Within the national parks and monuments there are approximately 6,600 government structures, conservatively valued at $68,322,000. Among these structures are over 400 historic buildings of high intrinsic value. Also, there are many other structures, with a replacement value of over $50,000,000, owned and operated by concessioners to provide meals, lodging and other necessities for visitors. The safety of the occupants of these structures, both federally and privately owned, plus the protection of investments and historic values, requires well trained and

equipped fire brigades. Many of the structures are located in forested areas which would be threatened in event of conflagration.

The forest fire control training also includes large fire organization and suppression. At times, circumstances preclude the suppression of fires while they are small, and, as a result, large fires must be fought. This training tends to eliminate the confusion that sometimes exists during the suppression of large fires.

The Service cooperates very closely with adjacent forest protection agencies, both Federal and State. Forest fires do not recognize boundaries and a fire on the lands of one agency may, in a short time, spread to the lands of the adjacent agency. During the 19-year period, 1940–1958, the Service suppressed or assisted in the suppression of an average of 56 forest fires per year that burned wholly outside, but adjacent to, park boundaries. During the same period an average of 45 fires per year were suppressed that originated outside but burned inside park boundaries. To provide for these situations, cooperative fire fighting agreements are entered into, designating which agency will make the first attack, who will be in charge of suppression after both agencies are on the fire, and how the suppression crews will be handled. In addition, annual meetings are held where personnel of the cooperating agencies discuss and solve problems that have developed in joint agency fire activities.

Due to the geographic distribution of areas administered by the National Park Service, a fire problem is present in some individual area every month of the year. In spite of this and the heavy public use, the man-caused fire occurrence record is favorable. During the 19-year period mentioned, the Service suppressed an average of 364 fires per year that originated inside or entered park boundaries. Of this average, 149 were lightning-caused fires and the remaining 215 resulted from man's carelessness. The efficiency of the protection organization is partially shown by the number of Class A and Class B fires (less than 10 acres in size). Fires of these classifications average 320 per year or 88 percent. The remaining 12 percent, composed of larger fires, were not necessarily due to the weakness of the organization, as a number of these fires were already large before they reached the park boundaries. The average annual acreage burned inside park boundaries for the same period was 15,757 acres. This acreage is less than 0.2 percent of the vegetated area requiring protection from fire. Of the total average annual acreage burned, 5,680 acres are classed as forest land, 1,573 acres as brush land, and 7,929 acres as grass land. Much of the latter type was burned over in Everglades National Park in Florida where organized fire protection is recent. A number of

Giant Sequoia Grove, Yosemite National Park. Largest and some of the oldest living things are the giant sequoias.

large fires have swept into this park as a result of uncontrolled burning on adjacent agricultural lands.

The National Park Service now maintains an inventory of fire control equipment valued at approximately $780,000. Included in this inventory are hand tools sufficient to equip 20,500 men for fire line construction, approximately 66 miles of fire hose, 105 vehicles equipped with pumps and water tanks, 18 trailer pumps, 155 portable pumpers, and 2,041 backpack pumps. In addition, there are hundreds of miscellaneous items such as camp and mess equipment, horses and mules with riding and pack saddles, cargo and pickup trucks, radios, portable telephones, and detection equipment. Regular maintenance equipment such as trucks or bulldozers is also available if needed. All of this equipment is distributed throughout the areas in sufficient quantity so that individual areas have adequate equipment for first attack on potential fires.

Protection of Forests from Diseases and Insects

The forests of the parks are subject to many of the same destructive tree diseases and forest insects as are those of other wildland managing agencies. Similar direct and indirect controls are applied in suppressing them.

Tree Diseases

The control of white pine blister rust *(Cronartium ribicola),* an introduced disease of foreign origin which infects five-needle pines, has been undertaken in 15 areas administered by the Service. Protection of all the five-needle pine from the rust has not been undertaken. The Service has selected representative five-needle pine forests for preservation and in addition has included within these, control units, in which the loss of the five-needle pines would seriously affect the scenic and recreatioal aspects of the parks. The species of pines being protected in the control work are sugarpine, foxtail, limber, whitebark, and the eastern and western white pines. It is possible that in the future some of these may well be the only remaining forests of non-commercial five-needle pines in the United States.

The first control done by the Service for this disease was at Acadia National Park in 1921. During the days of the Civilian Conservation Corps additional projects were initiated in both eastern and western parks. At the present time the gross acreage included in the control units is 375,546. Early work was accomplished by eradiccating Ribes in the control areas. Research on the spread of the rust and the de-

velopment of new controls has led to a re-evaluation and re-programming of the control work in the parks. Ecological studies of the rust behavior in California indicate that Blister rust in California parks south of the Merced River will not become a major hazard in the foreseeable future. Accordingly, the Ribes eradication program in the parks south of the river has been deferred. Actidione, an antibiotic, has been developed and is a specific for destroying rust infections on western white pine and obviates the necessity of ribes eradication. This has permitted treatment of rust infected trees where formerly it was felt nothing could be done to control the rust. Indications are that antibiotics will be developed that will destroy rust infections on other species of five-needle pines and that they will also act as immunizers against rust infections.

Control of the oak wilt *(Ceratocystis fagacearum)* that infects native oak species has been undertaken in Effigy Mounds National Monument and Shenandoah National Park in Virginia. Suppression work is continuing against the oak wilt in these two park areas.

Eradication of dwarf mistletoe *(Arceuthobium vaginatum)* on ponderosa pine in the intensive public use areas in Grand Canyon and Bryce Canyon National Parks was undertaken in 1950. Eradication was accomplished by pruning infections and by removing or poisoning infected trees that were non-prunable. The control areas are on a maintenance basis and require checking and re-working about every five or six years. The dwarf mistletoe control areas in these two parks approximate 2,500 acres. At Craters of the Moon National Monument a project to control dwarf mistletoe was initiated in 1961 on approximately 300 acres of limber pine. Eradication methods are similar to those used for dwarf mistletoe infections in ponderosa pine.

A number of smaller control projects have been undertaken in some of the eastern parks for the control of Dutch elm disease.

Forest Insects

The National Park Service attempts to maintain in an endemic status infestations of certain barkbeetles and defoliators which if not suppressed, would cause abnormal losses of trees. Suppression of infestations is performed in such a manner as to prevent large-scale outbreaks. Some of the principal problem insects for which suppression measures have been necessary are the barkbeetles, i.e., mountain pine, southern pine, western pine, Jeffrey pine, spruce, Douglas fir, and the Black Hills. Engraver beetles attacking white fir, pinyon pine, and elms also have required suppression measures. Sporadic outbreaks of defoliators occur from time to time against which suppression measures by the application of insecticides has been necessary. Some of

the most commonly occurring ones are gypsy moth, fall webworm, elm spanworm, balsam wooly aphid, forest tent caterpillar, sawfly, cankerworm, golden oak leaf miner, lodgepole pine needleminer, elm leaf beetle, pinyon scale, white fir needle miner and oak looper.

Individual Tree Protection

The problem of individual tree protection and preservation in areas of intensive development and use is one of relatively recent consideration which has been brought about by rapid changes and acceleration in park use. For example, until very recent years camping was largely an individual matter which concerned relatively few people. They selected their own camp sites, often in areas of superb beauty and provided their own facilities. The desirability of these sites only attracted more people. Camping increased until hundreds and even thousands were camping in somewhat close proximity to each other, and as a result the vegetation declined. To protect vegetation and to permit new growth to become established, remedial measures were taken. These improvements involved the laying out of organized individual camp sites in a restricted but agreeable manner so that damage by use was prevented or minimized.

In the East, a mobile maintenance or tree preservation crew has been operating for the past several years. This crew works the year round, working in the northern areas during the summer and moving south in the winter. A similar crew is being activated for this work in the western parks.

Bureau of Sport Fisheries and Wildlife

History

THE FIRST national wildlife refuge, established in 1903, was set aside for the protection of colonial nesting birds, and the character of this area, as well as subsequent refuges set aside during the succeeding 20 years, included very little upland habitat. With the passage of the Migratory Bird Conservation Act in 1929,[37] provision was made for establishing a systematic pattern of national wildlife refuges in each of the four major waterfowl flyways. This program necessitated the acquisition of areas suitable for restoration and development, as well as units of existing habitat in key locations. In the years that followed, thousands of acres of land were purchased to meet the requirements of the national refuge program. The acquisition of buffer lands required for protecting refuge water and marsh areas resulted in the addition of a considerable acreage of forest land. In some sections of the country, as in the lower part of the Mississippi Valley, bottom-land hardwoods, subject to annual overflow during the fall and winter months, offered large quantities of mast and other food for waterfowl and other wildlife.

Between 1932 and 1938, the Federal program for the retirement of submarginal land resulted in the purchase of partly wooded areas suitable for wildlife management and some of these properties were later transferred to the Fish and Wildlife Service (now, in part, the Bureau of Sport Fisheries and Wildlife). As the opportunity permitted, ecological units, representative of broad forest types, have been set aside as wildlife refuges, with the objective of determining practical methods of producing a sustained-yield of indigenous wildlife. Thus, the acreage of forest land in national wildlife refuges gradually increased to about 2,506,000 acres, and now represents approximately 8½ percent of the total holdings.

The number of national wildlife refuges administered by the Bureau of Sport Fisheries and Wildlife on June 30, 1961, was 284, with an aggregate of 28,521,405 acres. All types of wildlife are protected on these refuges, but many refuges were especially established for the conservation of one or more species—216 (3,505,785 acres) for migratory

[37] 45 Stat. 1222.

waterfowl; 44 (3,708,033 acres) for migratory birds in general; 14 (5,518,409 acres) for big-game; and 5 (4,604,178 acres) for game ranges, and 3 (11,185,000 acres) for wildlife ranges.

Slightly over one million acres of refuge forest land is of commercial importance. Cutting operations are based on wildlife management requirements, and have little economic significance except locally. During 1960, the annual cut was 14,657 feet board measure. The potential annual cut on acreage now administered by the Bureau of Sport Fisheries and Wildlife is estimated at 40,000 MBF by 1970, 100,000 MBF by 1980, and 247,000 MBF by 2000.

The statutory authorities under which the national wildlife refuges are administered afford the necessary latitude for sound management of timberlands in attaining the primary objectives of wildlife conservation, and provide for resource utilization. The multiple-use principle governs where applicable.

Wildlife management requirements, while paramount, are wholly compatible with the sustained-yield forest management. Long range programs for management of refuge forest lands are based on a regulated cut patterned to maintain forest wildlife populations at an optimum level. Light selective cutting under a short rotation, as needed in maintaining wildlife habitat, has aided in supporting local industry.

Local administration is directed through resident managers having technical and practical training in the general field of operations and who are conversant with practices relating to an integrated land use program. Project management is conducted in accordance with approved plans based on policies formulated at the central and regional office levels. Broad authority exists for independent latitude in planning and executing field programs in accordance with basic management plans. Protection, inventories, management planning timber sales and other features of the work are carried out under the general supervision of professional foresters.

Close intrabureau and interagency relations are maintained with respect to local field programs, as well as on regional and national levels, in order to take full advantage of research findings and management experience pertinent to conducting timber management on national wildlife refuges at a consistently high professional level.

The present forest management policy of the Bureau of Sport Fisheries and Wildlife is based upon the results of intensive field studies directed toward determining the best means of maintaining food supplies of major importance to forest wildlife. There is a direct correlation between the degree of canopy opening and the abundance of ground cover and shrub growth. Heavy cutting results in a profuse growth of vegetation, much of it having limited value, whereas a greater supply of food can be developed and will be available for a

longer period of time as a result of light selective cutting to produce about a 30 percent opening in the forest canopy. The maintenance of a good distribution of key food plants on the forest floor and in the shrub understory is the primary criterion governing the management of forest lands on national wildlife refuges.

Forest Policy

Forest lands administered by the Bureau of Sport Fisheries and Wildlife are managed (1) to demonstrate the practical means of developing and maintaining optimum game populations, (2) to produce removable surpluses of wildlife species for restoration projects undertaken by Federal and State agencies, (3) to evaluate the practical application of research findings in the management of forest habitat, (4) to explore means of managing wildlife populations for removal of annual increment through regulated public hunting, and (5) consistent with these objectives and in accordance with sound forest management practices, to obtain the maximum yield and return from refuge timberlands.

Those species of wildlife requiring special consideration, nationally or regionally because of limited numbers, exacting habitat requirements, limited range or other significant reasons, are given primary

Winter mallards on the White River National Wildlife Refuge, Arkansas, feed extensively on flooded timberlands on acorns and emergent plants.

Bureau pioneer "Greentree reservoir" development on Noxubee National Wildlife Refuge, Mississippi, supports thousands of wintering waterfowl.

consideration in the management of cover types and units of refuge forest lands best suited to that purpose. Thus, in the Southeast, wild turkeys generally have priority; in the Northeast, in cover types adaptable to management for their best welfare, woodcock come first. Grouse, deer, moose, and elk are accorded similar consideration in keeping with their relative importance in the conservation needs of a particular region.

The character and intensity of forest management for wildlife within the limits of the general policy are governed by local conditions. Objectives such as production of wild turkeys to be live trapped for restocking would require intensive treatment of cover and development of food patches on some units of the refuge or other practices that may not fit into the normal economy of land use. In general, however, the rule is the extensive treatment of forest habitat on a sound economical basis in keeping with good land use practices, with the objective of maintaining an optimum game population with an overflow onto adjoining lands or the increment to be removed through public hunting.

Each and every acre of refuge forest land is not suited to the same degree of management. Some of the forest land may adjoin private

holding where circumstances would nullify the best efforts to increase game population. Again, it may be advisable to manage buffer strips on the periphery of the refuge so as to discourage the outflow of game. In these instances, the limited acreage in question could be managed specificially for economic utilization consistent with the overall policies and objectives.

A block of timber consisting of fifty acres or larger, as may be expedient, and representative of each climax or major type on the forested refuges is excluded from timber operations and preserved permanently in an unmodified condition. Thus, each forested refuge reserves units of cover types reflecting as far as possible pristine conditions. These units have aesthetic value, and are important for comparative purposes in analyzing some phases of habitat management on the balance of the refuge.

A buffer strip not less than 300 feet wide is maintained in a natural condition at points where refuge timber lands are contiguous with primary roads within the refuge boundary. Sometimes possible danger of windthrow or other factors requires wider buffer strips or limited cutting to remove decadent timber within these strips. These cuttings are held to an absolute minimum and conducted under close supervision to assure proper slash disposal and to keep stump heights at a practical minimum. Judicious application of this policy aids in the more economical maintenance of telephone lines and assists in holding fire hazards to a minimum.

The preservation of aesthetic values by maintaining buffer strips of suitable width around picnic areas, refuge lakes, and any portions of the refuge land or water areas which figure prominently in recreational use requires careful planning in the management of the timber resources in order to avoid damage to timber left standing, such as from windthrow. The buffer strip in these instances may have to be 500 or more feet in width, depending upon local conditions. In no instance, however, is the buffer strip less than 300 feet wide.

The objectives of each timber operation are to direct the ecological succession so as to provide food, shelter, and other habitat requirements of the species of wildlife accorded primary consideration. Consistent with this, other wildlife should be benefited also.

The broad timber types are units of wildlife habitat. The varying stages of forest succession from cutover land to the climax type provide the essentials of a balanced habitat for forest game. To maintain the proper balance of the forest succession required to sustain an optimum population, it is necessary to determine the relative values of each stage of succession and the optimum carrying capacity of the area as a whole. Until these data are secured for each refuge, a con-

Beautiful Forests of Little Pend Oreille National Wildlife Refuge in eastern Washington provide substantial wildlife, recreation, and economic benefits.

tinuous study and analysis is made of the plant communities in each forest type and the role of these plant groups in the wildlife management plan.

The forest type constitutes the ecological unit of management. Within the forest type there are several ecological features, such as ground cover and shrub growth, which are important in supplying food and meeting other wildlife requirements. The manipulation of these environmental factors is the backbone of the timber management plan. Thus, their relationship to canopy openings, age classes of timber, site factors, type margins, etc., must be analyzed carefully in preparing management plans. Many factors of secondary or minor importance in management of forest lands for maximum production of timber may be of primary importance in determining the best management of these lands for wildlife. Accordingly, each aspect of the plant community must be evaluated in the light of its relationship to the whole community.

The refuge forest management plan considers all of the policies and principles outlined above and the operational details are based accordingly in the preparation of the plan. In the final analysis the plan is simple, direct, flexible, and is maintained and revised to meet chang-

Continental divide forests on Red Rock Lakes National Wildlife Refuge, Montana, protects valuable water resources, including the home of the rare trumpeter swan.

ing conditions. All timber management is conducted in accordance with an approved plan.

Management of cover types is predicated on maintaining uneven age classes which includes and favors, in cutting practices, tree species recognized as important in meeting food and cover requirements of wildlife. The criterion in marketing trees for removal is "how will the cutting benefit wildlife" rather than the economic return. A "weed tree" can be regarded as a plant out of place. Many trees classed as weed species in commercial forestry are essential in a balanced forest wildlife habitat.

Optimum wildlife populations can be maintained only through providing a balanced habitat. The forest management plan must recognize the essential units of wildlife range required to maintain the desired population of species accorded primary consideration and so plan cutting cycles to provide a continuity of habitat. In general, this can be accomplished by short cutting cycles. Light, selective cuts at frequent intervals give a wider latitude in habitat management and will be followed insofar as practicable.

Management is in accordance with good silvicultural practices for the region and forest types, providing wildlife habitat conditions are benefited. Detailed management or regulatory policies are prepared locally on the basis of field examination and knowledge of ecological conditions applicable to the restoration or maintenance of wildlife habitat.

All timber harvest is regulated on the basis of applicable silvicultural considerations as a means of restoring or maintaining wildlife habitat. Important silvicultural factors, such as age classes, reproduction, stocking in relation to type or site capacity, and species composition, is considered in the management of wildlife habitat.

The forest canopy requirements for desirable wildlife habitat, with reference to priority species involved, is a determining factor of silvicultural management methods. Ground cover as to density and composition, growth, and ecological trends is given careful consideration as a basis for timber harvest plans.

Protection

Comprehensive plans for fire detection and suppression are operative on each refuge. Tower, telephone, and radio systems are maintained, and essential fire-fighting equipment is available on each field project where there is a substantial acreage of forest. National Wildlife Refuges are tied in with State and local protection organizations wherever possible.

Incipient insect and disease attacks are reported to supervisory personnel, and prompt action taken toward technical appraisal of the problem through the services provided for under the Forest Pest Control Act.

Management Improvement

Consistent with the governing forest management policy, an active planting program is in operation and directed toward the eventual development of productive forest cover on all refuge lands classified for forest management.

In accordance with a specific program for management analysis, field studies are conducted to determine the effect of forest management practices on wildlife and the modifications needed to maintain optimum food and cover conditions in a manner consistent with local economy and sound land use practices.

Sustained-Yield Forest Management

THE TERM *sustained-yield* is used quite frequently in this bulletin. It may not be clearly understood, hence this chapter is devoted to an explanation of the term.

The technical definition of sustained-yield as approved by the Society of American Foresters is:

"As applied to a policy, method, or plan of forest management, implies continuous production with the aim of achieving at the earliest practical time an approximate balance between net growth and harvest either by annual or somewhat longer periods.

"As applied to forest management, implies measures which will maintain the productive capacity of the land.

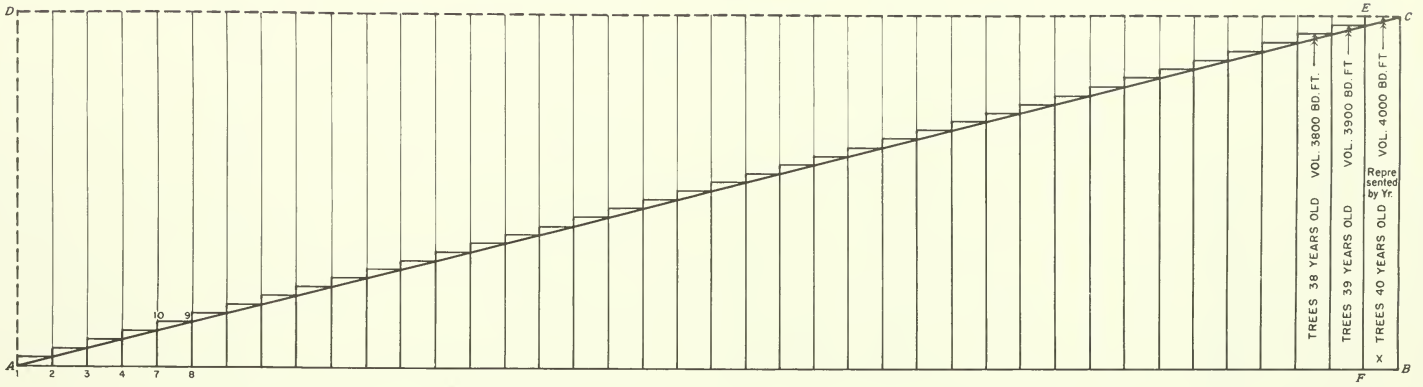
"As applied to a forest, refers to one which is on sustained-yield management.

"As applied to a forest region, implies an approximate balance for the region as a whole between growth and drain."

Sustained-yield forestry is the management of a specific forest or a definite district thereof in such a way that the annual or periodic cut of forest products is equal to or in balance with the current net growth of the lands so that annually or periodically the lands will yield approximately a given volume of forest products. For example, the forest products could be either Christmas trees, pulpwood, posts or poles, or saw timber, or a combination of such products. Protection of the forest from fire, insects and diseases and of forest reproduction after logging or fire are absolutely essential to sustained-yield; but maintaining the annual or periodic cut in harmony with continuing productive capacity is the special criterion which differentiates sustained-yield from other phases of forest management practices.

There follows a diagrammatic representation of a forest managed on a sustained-yield basis under a clear-cutting system, together with explanatory notes.

A DIAGRAMMATIC REPRESENTATION OF A FOREST MANAGED ON A SUSTAINED-YIELD BASIS UNDER A CLEAR-CUTTING SYSTEM



Notes:

Assume that the rectangle ABCD above represents the "elevation" view of one side of a square area 40 acres in extent with the height of the trees, as indicated by line BC, greatly exaggerated. There are 40 strips above. Assume each of the strips is two rods (33 feet) wide and that such strip runs backward the depth of the 40-acre tract which would be 80 rods (or 1,320 feet). Then each strip would comprise one acre ($2 \times 80 = 160$ square rods). In a virgin forest all of the trees on the 40 acres, represented by the rectangle above, might be of the same age and the same height, namely BC or AD. Assume further that this 40-acre forest is to be put under ***Regulation*** so as to secure a ***sustained-yield*** annually. Assume a rotation of 40 years with the cutting of one acre each year and assume also that the average annual growth per acre under management is 100 board feet. Then as soon as ***Regulation*** has been accomplished the acre at the right hand side of the rectangle above, designated as "X," would contain trees 40 years of age with the height "BC." This acre which has been growing 40 years (since it was cut) at the rate of 100 board feet per acre per year would contain 4,000 board feet. The tops of these trees would theoretically reach the dotted line at the top of the rectangle ABCD. The volume of 4,000 board feet would be represented by the block BCEF. The trees in the acre represented by the space directly to the left of "X" would be 39 years of age and the volume within this acre should be 100 board feet $\times$ 39 years or 3,900 board feet. The trees in the acre represented by the space next to the left would have their tops at the point indicated by 🌲 in the 3d column and would be 38 years of age with volume $100 \times 38 = 3{,}800$ board feet. The space "1—2" at the extreme left of the diagram represents the acre on which the trees are only one year of age. The space "3—4" represents the acre that was harvested three years ago. The space 7–8–9–10 at the left side represents the tree growth on the acre cut five years ago. The straight, unbroken line AC represents in a general way the height of the trees in successive years and the successive blocks bounded by rectangular lines may be assumed to represent the volumes on the separate acres, from the one with trees 1 year old to the one cut 40 years ago. The regulated 40-acre tract would have one acre with trees 1 year old, one acre with trees 2 years old and so on up to the acre with trees 40 years old, being cut currently, and would be represented by the triangle ABC. Thus the triangle ABC would represent the Growing Stock of timber at any given time. However, during any 40-year period each one of the 40 acres would produce 4,000 board feet and the 40 acres would produce $40 \times 4{,}000 = 160{,}000$ board feet. This total production during 40 years on the 40 acres is represented by the rectangle ABCD. Let "G" represent the "Growing Stock" and "r" the "rotation" (or 40 years). The volume of Growing Stock at any one time is represented by the triangle which is one-half of the rectangle.

$$\text{Growing Stock} = \frac{160{,}000}{2} = 80{,}000 \text{ board feet.}$$

The volume on one acre 40 years of age (represented by "yr") equals the annual cut, i.e. the ***sustained-yield***. The trees on the entire area represented by the rectangle ABCD would reach the height BC or AD and attain the volume ABCD (160,000 board feet) in 40 years, and they would reach ½ of this height and attain ½ of this volume (80,000 board feet) in ½ of 40 years $\left(\frac{40}{2} \text{ or } \frac{R}{2} = 20 \text{ yrs.}\right)$. The annual growth on the entire 40 acres must therefore equal 80,000 board feet divided by 20 $\left(\text{or } \frac{R}{2}\right)$ or 4,000 board feet. Reversing the formula we have:

$$Yr \times \frac{r}{2} \text{ or } 4{,}000 \times 20 = 80{,}000 \text{ board feet.}$$

$$\text{The annual cut} = \frac{\text{Growing Stock}}{\text{½ of the Rotation}} = \frac{G}{½\,R} = \frac{2G}{r} = \frac{160{,}000}{40} = 4{,}000 \text{ board feet.}$$

The diagram above also illustrates the necessity of a larger annual cut on a fully stocked virgin forest than on a ***Regulated*** or ***Managed*** forest. The forest capital in the virgin forest (namely 160,000 board feet within the rectangle ABCD) is twice the amount of Growing Stock needed in the managed forest to produce the required annual yield. The excess, 80,000 board feet of forest capital, represented by the triangle in the upper half of the rectangle above, should be eliminated by means of over-cutting during the period in which the forest is brought into the condition of ***sustained-yield*** management.

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