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**The Col. William B. Greeley Lectures
IN INDUSTRIAL FORESTRY**

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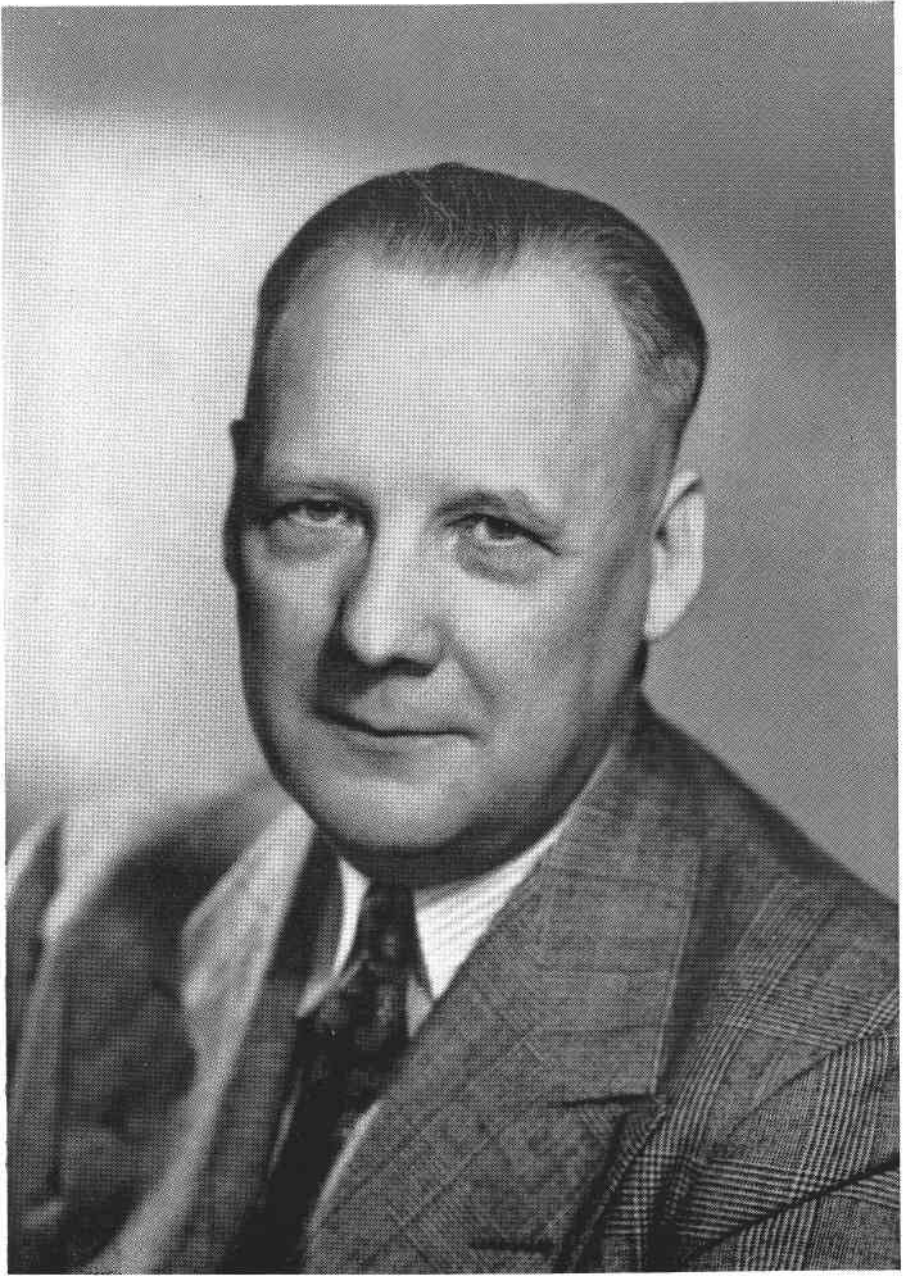
THE COLONEL WILLIAM B. GREELEY LECTURES
IN INDUSTRIAL FORESTRY

NUMBER ONE: *Development of Industrial Forestry
In the Pacific Northwest*

By Axel J. F. Brandstrom

UNIVERSITY OF WASHINGTON
COLLEGE OF FORESTRY

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Axel J. F. Brandstrom

FOREWORD

In 1956 the Industrial Forestry Association made a grant to the College of Forestry to provide for a series of lectures in industrial forestry. This grant was given as a memorial to the late Colonel William B. Greeley, who was one of the pioneers in industrial forestry and a founder and director of the Industrial Forestry Association. In making use of the grant, which extends over a five-year period, it was decided to select speakers from various sections of the country who could speak on the development of industrial forestry in their areas.

The first lectures were to cover the development of industrial forestry in the northwest and, because of his pioneer work in industrial forestry and his interest in it throughout the years, Mr. Axel J. F. Brandstrom was selected as the first Colonel William B. Greeley lecturer.

Mr. Brandstrom was born in Sweden. He came to the United States and entered the College of Forestry in 1915 and graduated in 1919. Upon completion of his college training he worked as a logging engineer and construction contractor both in Washington and Oregon. In 1928 he was called back to the University as Assistant Professor of Logging Engineering, which position he held for two years. In 1930 he was appointed senior forest economist by the U. S. Forest Service and attached to the Pacific Northwest Forest and Range Experiment Station.

From 1940 to 1946 he served as Chief Forester for the Crown Zellerbach Corporation at Portland, Oregon. In 1946 he left the Crown Zellerbach Corporation to enter business as a private consulting forester, and from 1946 to 1952 he confined most of his efforts to Washington and Oregon. However, since that time his activities have been centered primarily in British Columbia.

He is the author of many articles and publications on forestry and logging in the northwest. His "Analysis of Logging Cost and Operation Methods in the Douglas Fir Region," published in 1933 by the Charles Lathrop Pack Forestry Foundation and sponsored by the West Coast Lumbermen's Association, was a standard text in this field for many years. A similar publication was one he co-authored with Bert P. Kirkland in 1936 and published as a bulletin of the U. S. Department of Agriculture entitled "Selective Timber Management in the Douglas Fir Region."

His faith in the present and future of industrial forestry is exemplified not only by his work as a consulting forester, but by his ownership of cutover and second-growth forest land in the state of Washington. This treatise embodies the material which was delivered by Mr. Brandstrom in his series of four lectures given at the College of Forestry on February 27th, 28th, and March 1st and 2nd, 1957.

THE LUMBER INDUSTRY OF AMERICA IN THE DAYS BEFORE FORESTRY

The lumber industry is the oldest manufacturing industry in America. Its exact birthday and birthplace have been a matter of uncertainty, but according to a recent publication it appears to have had its start in Jamestown, Virginia in 1608—only a matter of months after the founding of that historic colony by Captain John Smith. In that year there were brought from England “eight Poles and Dutchmen for the purpose of erecting sawmills.”

The first shipment of manufactured goods to be exported from America consisted of lumber, pitch, and tar—all products of the forest—carried to England by a Captain Newport in 1608. Throughout the Colonial period, and for half a century or so beyond, a large element of America’s exports to the Old World continued to consist of forest products, mainly in the form of lumber, spars, masts, staves, and naval stores—pitch, tar, rosin, etc.—drawn from the forests of the Atlantic seaboard.

The sawmills of that early period were no mechanical marvels by our standards but they were better than no sawmills at all. They were as a rule driven by water power (in some cases by windmills) and were frequently combined with grist mills. The sawing rig itself consisted of an upright saw stretched taut in a frame (or “gate” or “sash”) drawn up and down by means of a connecting rod from a crank attached to the main shaft of the water wheel. This type was known as a sash saw (or “gate saw” or “frame saw”). Its output usually ranged from 2,000 to 3,000 board feet per day—about as much as could be loaded on an old-fashioned farm wagon and hauled away with a team of horses.

In course of time, some important improvements were made, through the introduction of several parallel saws in the frame (representing the early model of today’s gang saw), or through step-up of power and speed as in the “muley” saw, whereby production capacities of 6,000 to 8,000 board feet per day were attained. This, it appears, was about as far as the water-driven mills were able to progress toward higher production levels. By 1830 however, steam power came into use for sawmill operation. This development, together with the introduction and perfection of the circular saw, soon enabled the sawmills to step up their production to far higher levels.

Despite mechanical limitations, the lumber industry of the water-wheel era took root and grew. The loggers and the sawmills followed settlement to supply local needs, and they followed newly discovered or newly developed arteries of transportation for build-up of larger scale commercial enterprise, including the export trade.

Large scale production along these lines began to build up most notably around the port of Bangor in Maine, and for about two hundred years Maine held the lead in production. However, by 1850—which takes us into the steam-power age,—the lead had shifted to New York State, an event that heralded the start of the industry’s historic migrations over the length and breadth of America. By 1860, the lead had passed from New York to Pennsylvania. By 1870, as the prairies were opened up for settlement and the main line railroads were extended toward the west, the lead passed on to the Lake States—Michigan, Wisconsin, and Minnesota—which held that position for over two decades. In the meantime, the tide of production had begun to shift toward the South—the land of the Southern Pines—which came into the peak position by 1895 and held that position for about twenty-five years. Before the end of

TABLE 1

*The wooded area of the United States (by states) prior to settlement and corresponding wooded areas at the end of 1899 (Twelfth U.S. Census). Re-compiled from Table A, page 284, and Table B, page 286, of *History of the Lumber Industry of America*, by D. E. Defebaugh.

States and Groups	Total Land Area in Acres	Original Wooded Area in Acres	Original Wooded Area in % of Total Land Area	Wooded Area in 1899 (From 12th U.S. Census) in Acres	Wooded Area in 1899 in % of Total Land Area
Maine	19,132,160	18,560,000	97	15,168,000	79
New Hampshire	5,795,840	5,760,000	99	3,328,000	58
Vermont	5,832,960	5,760,000	99	2,496,000	43
Massachusetts	5,144,320	5,120,000	99	2,688,000	52
Rhode Island	691,840	640,000	93	256,000	40
Connecticut	3,068,160	*3,072,000	100	1,216,000	39
New York	30,519,680	*30,800,000	100	11,968,000	39
Pennsylvania	28,594,560	28,160,000	98	14,720,000	51
New Jersey	4,770,560	4,480,000	94	2,069,760	43
Delaware	1,260,160	960,000	76	448,000	36
Total for Eastern Group	104,810,240	103,312,000	99%	54,357,760	52%
Michigan	36,819,200	35,200,000	96	24,320,000	67
Wisconsin	35,274,880	30,080,000	85	20,320,000	58
Minnesota	51,198,080	38,400,000	75	33,408,000	66
Total for Lake States Group	123,292,160	103,680,000	84	78,048,000	63
Ohio	26,062,720	25,600,000	98	5,952,000	23
Indiana	22,950,400	19,840,000	86	6,912,000	30
Illinois	35,842,560	16,000,000	45	6,528,000	18
West Virginia	15,570,520	15,360,000	99	11,776,000	73
Kentucky	25,534,720	24,320,000	95	14,208,000	53
Tennessee	26,679,040	25,600,000	96	17,472,000	65
Missouri	43,795,840	32,000,000	73	26,240,000	60
Total for Central Group	196,444,800	158,720,000	81	89,088,000	45
Maryland	6,320,000	5,760,000	91	2,816,000	44
Virginia	25,552,000	24,960,000	98	14,976,000	58
North Carolina	31,342,080	30,080,000	96	22,592,000	73
South Carolina	19,494,400	17,920,000	92	13,120,000	68
Georgia	37,664,000	36,480,000	97	26,880,000	71
Florida	35,072,640	28,800,000	82	24,128,000	70
Alabama	32,657,920	32,000,000	98	24,512,000	74
Mississippi	29,685,120	28,800,000	97	20,672,000	70
Louisiana	29,055,360	25,600,000	88	18,112,000	62
Arkansas	33,543,680	32,000,000	95	28,800,000	84
Texas	168,300,840	48,000,000	29	40,960,000	24
Total for Southern Group	448,688,040	310,400,000	69	237,568,000	53
California	99,969,920	29,120,000	29	28,608,000	28
Oregon	61,277,440	35,200,000	57	34,752,000	57
Washington	42,746,880	30,720,000	71	30,528,000	71
Total Pacific Coast Group	203,994,240	95,040,000	47	93,888,000	46
Colorado	66,348,160	21,760,000	33	21,440,000	32
Idaho	53,293,440	22,400,000	42	22,400,000	42
Indian Territory	19,714,560	14,080,000	72	12,800,000	65
Iowa	35,646,080	5,120,000	14	4,480,000	13
Kansas	52,382,720	4,480,000	9	3,648,000	7
Montana	93,593,600	27,200,000	29	26,880,000	29
Nebraska	49,137,280	1,600,000	3	1,472,000	3
New Mexico	78,428,800	14,528,000	18	15,168,000	19
North Dakota	44,910,080	640,000	1	384,000	1
South Dakota	49,206,400	1,920,000	4	1,600,000	3
Utah	52,541,440	6,400,000	13	6,400,000	13
Wyoming	62,433,280	8,000,000	13	8,000,000	13
Arizona	72,792,320	16,320,000	22	16,000,000	22
Oklahoma	24,718,720	2,816,000	11	2,816,000	11
Nevada	70,336,640	3,904,000	6	3,904,000	6
Total Miscellaneous Group (Prairie, Range, and Mountain States)	825,483,520	151,168,000	18	147,392,000	18
GRAND TOTAL—UNITED STATES (Exclusive Alaska and Hawaii)	1,902,416,000	921,600,000	49	700,341,760	36

*Inconsistencies in these figures are the result of rounding out original data to the nearest 1,000 square miles.

the century, however, the Far West—made accessible through completion of the transcontinental railroads—was forging ahead at a rapid rate; by 1920 it took the lead, which it still holds.

These are but a few of the highlights of the growth and development of the U. S. lumber industry from its inception at Jamestown in 1608 to the end of the last century. During this three-hundred-year period it grew from a tiny start to a gigantic industry, producing at the rate of 35 billion board feet per year—about the same as it is producing today—and equivalent to approximately one-third of today's total annual world production of lumber.

Throughout this three-hundred-year period, the lumber industry and the forests that stood behind it had an important function to fulfill, namely to furnish low-cost fuel, shelter, and a wide assortment of building materials for a rapidly expanding agrarian nation. This they did in generous fashion. Nowhere else in the world had there ever been unfolded such a bountiful supply of timber suitable for homes, churches, schools, stores, barns, fences, factories, ships, furniture, bean poles, toothpicks, railroad ties, and what-have-you as that which the pioneers found in their slow but epic march of progress from the shores of the Atlantic to the prairies; and, at a later date, from the shores of the Pacific toward the Cascades, the Sierras, and the Rockies. The happy position of vast expanses of these splendid forests with relation to vast areas of potentially valuable, but at that time unbroken or forest-covered farm lands, was, of course, an important factor in the successful settlement and development of America, from border to border, and from coast to coast.

During this three-hundred-year period of pioneering and land settlement there was not much talk or thought devoted to industrial forestry, or to forestry of any kind. The time for these end-products of forest depletion and population growth had not arrived. The problem before the pioneers and the subsequent streams of incoming settlers who were exploring and developing the farming resources of America was not how to preserve, protect, perpetuate, or manage all of the forests in sight, but rather how to get rid of enough of these forests to enable them to put plow to land and to make room for a prosperous, livable, and well-balanced rural America. At the start, there was far too much forest and practically no tillable land. Looking westward from the shores of the Atlantic there were forests practically everywhere—an almost unbroken forest wilderness extending inland for hundreds and hundreds of miles. Millions of acres of these lands were potentially good farm lands, but forests stood in the way as a hindrance and barrier to the pioneers' dream of a secure life. In the march of settlement and progress most of these lands had to be cleared of their forest growth and converted into farms.

And so it was that the ax and the saw and the waterwheel of the lumberman, and the ox team and the plow of the farmer, were in effect teamed up for nearly three hundred years in the vast undertaking of carving a new country out of the wilderness. At the start of this three-hundred-year period, the total wooded area of what is now the United States (excluding Alaska and Hawaii) amounted to 921 million acres and represented roughly 49 per cent of the total U. S. land area; at the end of the period, in 1899, the corresponding wooded area amounted to only 700 million acres, representing only 36 per cent of the total U. S. land area.*

* Today the corresponding figure is 34 per cent, representing a total wooded area of 648 million acres. Of this, 485 million acres are classified as commercial forest land, while 163 million acres are non-commercial forest lands (included in which are National Parks and other permanent reservations where timber harvesting is prohibited).

Table 1 presents further details on this situation, including corresponding data by individual states and groups of states. Of special interest here is the fact that in the case of the Eastern group of states where most of the early developments took place, 99 per cent of the total land area was originally wooded, but that by 1899 nearly half of this acreage had been deforested in the process of settlement and development. The stranger who now sets eye on this attractive Eastern countryside would never guess that when the pioneers first came it was almost a total forest wilderness, with practically no open lands, no rolling fields, no pleasant contrasts between cultivated areas and nature in the raw.

Table 1 totals reveal that in the course of this three-hundred-year period, the total wooded area was reduced by 221 million acres. This is larger than the total land area of Washington, Oregon, and California combined—an expanse sufficient to very radically reshape the forest-cover map of the United States.

It is true, of course, that not all of this 221 million acres was covered by merchantable-type forests, for a good deal of it, no doubt, consisted of open woodlands of unmerchantable type.

And not all the merchantable timber from the merchantable stands found its way to the sawmills. Due to the lack of transportation facilities, or lack of markets for the logs, much of it, no doubt, was burned and disposed of on the site.

And not all of these 221 million acres of deforested lands ended up as improved farmlands. Much of it, no doubt, remained unimproved and unproductive, and some it may have reverted to forests subsequent to 1899.

But whatever adjustments or interpretations may be in order along these lines, the fact remains that the timber harvest obtained in the process of deforesting these 221 million acres of wooded lands constituted the principal source of logs for the lumber industry during those years and represented a surplus of timber from lands that were not destined to be managed as forest lands.

It was this situation that so completely stopped forestry, as we think of it today, from coming into the picture. Forestry had no creative function to perform with respect to the 221 million acres that were being deforested for conversion into farms or other nonforest use. It was from these lands that the industry was getting practically all of its logs, under pioneer conditions that naturally made for cheap logs and valueless stumpage. Forestry as a commercial undertaking offers no attraction when timber is overplentiful and stumpage is cheap or valueless. That was the situation throughout the pioneering and land settlement period, when the population was small, when the forests seemed inexhaustible, and when the timber currently available for sawmills was in constant over-supply. And that was the situation that kept forestry from developing on these shores, until the dawn of the Twentieth century.

THE START OF THE FORESTRY MOVEMENT; THE LUMBER INDUSTRY'S EARLY MOVES TOWARD FOREST PROTECTION AND FOREST MANAGEMENT

The inference might be drawn from the foregoing remarks that everything that has been done in forestry in this country has been done since the beginning of this century. This, of course, is not literally true. Some of the be-

ginnings of forestry on the local level, and especially in the Eastern states, go far back into history; and some of the beginnings of forestry on the national level go back beyond the start of the century.

By and large, however, these can well be considered matters of local interest only; or matters of purely historical interest. In a broad sense it is substantially true that the forestry developments that now count, and especially so here in the West, have virtually all come about since the turn of this century.

To people of my age class this means that the progress that has been made has nearly all occurred within our lifetimes. During this period the rate of progress has varied extensively, ranging from a complete standstill, or worse, to the full-speed-ahead pace of the last 15 years. The sum total of progress, however, has been surprisingly great.

Interest in forestry on a nation-wide scale was aroused to a high pitch around the turn of the century when it became apparent that the forest resources of the United States—contrary to stubbornly held popular concepts of earlier years—were not inexhaustible.

The accumulation of factors which began to stir the emotions of the conservation-minded, and to stimulate the minds of the socially responsible, were: (1) the drastic reduction of the forested acreage through conversion into farms or other nonforest use; (2) the rapid growth in population, with attendant upward trend in lumber production which, as noted above, reached the 35 billion foot mark in 1899 and then swept on to its all-time high of close to 45 billion in 1909; (3) the heavy losses from forest fires, including catastrophies like the great Hinckley fire of 1894; (4) the sobering fact that the migrant lumber industry in its Paul Bunyan-like wanderings around the continent had now started to cut heavily into its last great timber stand—the Pacific Coast Forest.

It seemed clear that in order to ensure the future timber supply of this fast-growing nation, it would be necessary to protect and manage the remaining forests along sound forestry lines. The European countries had been doing so for generations, in some cases for centuries. Now it was America's turn to do the same.

As usually happens in great movements of this kind, the pendulum swung far and wide; in this case from the extreme of an "inexhaustible timber supply" to the other extreme of a fast-coming "timber famine." In the ensuing debates, political maneuverings, and propaganda campaigns, excitement sometimes ran high, but the dust of battle soon settled. When the air had become clear and still, some extremely important forward moves for forestry had been made: the creation of the National Forests and the reorganization of the old Bureau of Forestry into the Forest Service; the start of most of our present forestry schools; the establishment of co-operative forest fire protective associations; the enactment of more effective state laws governing forest fire protection; in general, the awakening of the public conscience and the industry's own conscience to the importance of forest management.

THE NATIONAL FORESTS

In the setting aside and organization of the National Forests, the big moves were made by the Theodore Roosevelt-Gifford Pinchot team soon after the turn of the century. By 1909 a total of 150 National Forests, embracing 172 million acres, had been set aside by Presidential Proclamation and turned over to the newly organized Forest Service. Through subsequent additions and

acquisitions, this has since been expanded to a total of 181 million acres, including 21 million acres in Alaska and Puerto Rico. This, as everyone now recognizes, was a tremendously important and timely move from the point of view of the nation, and even more so from the point of view of the Western states where most of these forests are located.

THE FORESTRY SCHOOLS

With regard to the establishment of forestry schools, the first to be organized were in 1898 at Cornell University and Biltmore, both of which have been discontinued. Cornell was discontinued in 1903, and Biltmore in 1913. The oldest now functioning is the Yale Forest School, a graduate school, which was established in 1900. Others soon followed—Michigan at Ann Arbor in 1902; Michigan State, Minnesota, and Maine in 1903; Iowa in 1904; Georgia, Pennsylvania, and Oregon State in 1906; and New York State, now the largest forestry school in this country, which was organized in 1911.

Our own school here at the University of Washington was organized in 1907, Idaho in 1909, California and Montana in 1914.

It may be of interest to note here that the first few crops of forestry graduates from the older schools were almost entirely absorbed by the Forest Service, which was then setting up the administrative organizations for the newly created National Forests, and by the newly founded forestry schools which were then organizing or expanding their teaching staffs. This limitation in the fields of work open to the forestry graduates of that early period is in sharp contrast to the situation today, in which industrial forestry has opened new and very active fields for foresters. At the present time approximately 7,400 forestry graduates, representing 45 per cent of all foresters employed in this country, are employed by, or serve as consultants to, the forest industries. Currently about 60 per cent of the graduates go into private employment.

ON THE FIRE PROTECTION FRONT

A most important development around the turn of this century was the move toward better forest fire protection in nearly all parts of this country. Stung into action by the disastrous Hinckley fire of 1894, both Minnesota and Wisconsin enacted effective forest fire-warden laws shortly before the beginning of this century. Other states in the East and Middle West also improved their protection efforts and protection laws.

Here in the West—and from here on we shall confine our discussions mainly to the West—it was the 300,000-acre Yacolt fire of 1902, and a series of other exasperating and very costly fires of lesser extent, that caused the lumber industry of this region to spring into action with the formation of co-operative forest fire protective associations. These organizations joined forest land owners of a given district in order to prevent and fight forest fires, regardless of the ownership of land on which fires started.

The first organization of this kind was formed in 1904 in Linn County, Oregon. In the same year, in Idaho, two similar associations were formed: the Southern Idaho Timber Protective Association, and Coeur d'Alene Forest Fire Protective Association. In the following year two more Idaho Associations were formed: the Clearwater Timber Protective Association, and the Potlatch Timber Protective Association. The formation of similar associations or protection groups soon followed in California, Washington, and Montana. Within

a few years, private protection districts of this kind had been organized throughout nearly all timbered areas of the West.

As a move toward broader organization, there was formed in 1908 the Washington Forest Fire Association. This was a state-wide organization, with activities in three directions: toward better fire protection, toward promotion of sound forestry practices, and toward sound forestry legislation at the state and local levels.

The following year (1909) the lumber industry of California followed suit by organizing the California Protective Association. In 1910 Oregon did the same, forming the Oregon Forest Fire Protective Association. Both had the same scope and purpose as their Washington prototype. In 1909 there was also formed what later became known as the Western Forestry and Conservation Association, a region-wide organization which takes in five Western states (Washington, Oregon, California, Idaho, and Montana) and the Province of British Columbia. Here the underlying purpose was to set up a clearing house for exchange of ideas and for full co-operation, on a region-wide basis, between state, federal, and private agencies, for promotion of better forest protection (against insects and disease as well as fire) and better forestry practices; and also for support of sound forestry legislation at the federal, state, and local levels. During the first few years this association concentrated its efforts on fire protection; from then on it broadened out more and more into the other fields.

These associations did much to place forest fire protection on a sound basis. They were soundly conceived and soundly administered. With the passing of the years their contribution toward forestry, beyond the field of forest protection, has become increasingly obvious and impressive.

THE AWAKENING OF FORESTRY CONSCIOUSNESS AND FORESTRY MINDEDNESS

In this realm also, the above-mentioned associations have helped push the load. Others that were active in this field during this early period were the American Forestry Association, incorporated in 1897 (but actually formed in 1875), and the Society of American Foresters, founded in 1900; both of national scope. Region-wise, as far as the West is concerned, *The Timberman*, founded in 1897, and *The Lumberman*, founded in 1889, have helped spread forestry knowledge and forestry mindedness. The influence of these timber trade journals on fire protection and in other forestry fields has been substantial.

EARLY FORWARD MOVES BY THE FOREST SERVICE AND THE STATES

Along with the early-day forward moves of the lumber industry, the Forest Service and the states did their share in their own domains. For the National Forests this included the introduction of well-organized fire protection, the start of forestry research, the establishment of forest nurseries and plantations, and the inception of working plans for sustained yield management—forestry efforts that were far ahead of corresponding private industry efforts during those early years. For the states it meant making financial provision for the state-supported forestry schools, the setting up of State Forestry Departments with emphasis on fire protection, and the enactment by the State Legislatures of better forest protection laws.

Among such state laws, the first of importance was the Idaho Forest Law of 1907. By 1911 Oregon had enacted effective forest fire laws to replace earlier laws which had failed because of lack of penalties and enforcement. In the same year, under prodding from the private associations, Oregon set up its State Board of Forestry which is still functioning and "going strong." In 1913 Oregon enacted a Compulsory Forest Patrol Act. This required all land owners to provide protection against fire for their forest lands, either by providing for protection of their own property, joining with other forest land owners in associations for mutual protection against fire, or in the event they elected to do nothing, requiring the State Forester to protect their properties, charging them for the cost on the state tax rolls. In due course this constructive act was adopted by the other Western states.

And so it is seen that during the early part of this century an important forward push was made toward forestry in the Western states, as far as the organizational, educational, promotional, and fire protection aspects are concerned. In the case of National Forests, progress was also made in other forestry fields. Particularly impressive was the rapid course of events in organizing and in getting under way during the formative years of the first decade. By comparison, the history of the second decade seems dull and uneventful. This was due in part to the fact that the agencies involved had settled down to work along lines already mapped out, and in part to the fact that by 1916 and 1917 the effects of World War I were slowing down civilian activities.

With due allowance for this, it is only fair to say that this twenty-year period from 1900 to 1920 was one of commendable progress in the transition toward forestry. It should be recognized, however, that on industry's part, progress in forest management at this early stage was confined to fire protection. The industry's progress in the other fields of forest management, as far as actual application in the field was concerned, was strictly for the future.

INDUSTRIAL FORESTRY IN THE PACIFIC NORTHWEST FROM 1920 TO 1940

WHAT IS INDUSTRIAL FORESTRY?

The term "industrial forestry" was not in common use back in 1920. Any special forestry work by private operators at that time would probably have been referred to as private forestry.

Sometime along in the early 1920's, however, when the forest industries did start to move into forestry fields other than fire protection, the term industrial forestry got into circulation. In December, 1927, at the San Francisco meeting of the Society of American Foresters, the main topic of discussion was "Industrial Forestry in the West." This indicates, first, that by that time the new term had begun to take hold, and second, that enough interest had been aroused in this subject to make it the central theme at the annual meeting of this nation-wide society.

The January, 1928, issue of the *Journal of Forestry* came out with a stimulating editorial under the heading "What is Industrial Forestry?" From this the following excerpts are taken: "A new slogan has come into our midst to conjure with: *Industrial forestry*. Two widely separated conferences, one in Chicago representing the business interests of the country, and another in San Francisco representing foresters, were devoted to the discussion of the problems of industrial forestry. . . ."

“ . . . the term ‘industrial forestry’ did not come into being all of a sudden, like Minerva out of the head of Jupiter. Like most ideas, it is the result of slow evolution, with remnants of the early conceptions still clinging to it. The term has a history back of it. It is a close relative of *private forestry*, *commercial forestry*, and *conservative lumbering*. It is an attempt to give an expression to a type of forest practice consistent with business interests and with profitable undertaking by timber operators. It reflects a wide range of ideas of different operators as to the extent to which they can adopt measures for future regrowth under present economic conditions of market and utilization. Some do not see beyond mere fire protection; others are beginning to realize the advantages of selective logging, the leaving of seed trees, or even artificial planting.”

“Industrial forestry in its simplest terms means nothing else but *treating timber-growing as a business enterprise*. There is more substance to this definition than may appear on the surface. The admission that *timber-growing* may be considered a business enterprise is a new, revolutionary idea. A few years ago anyone who would mention timber-growing as a business would be laughed at. Timber-growing as a mere fad, to be engaged in by some land owner from an altruistic or patriotic motive, as repentance for past destruction, *yes*, but as a business, *no*.”

“For the first time in our history, lumbermen as a group begin to look upon timber-growing as a business enterprise, as an industrial pursuit, as something that may yield profit. . . .”

Today’s definition of industrial forestry, as phrased by W. D. Hagenstein, Managing Director of the Industrial Forestry Association, is: “The growing, protecting, harvesting, manufacturing, and marketing of forest crops. As such, it is a business conducted along orderly lines in the biological, engineering, and economic sciences. Its objective is continuity with maximum returns from each of these five forestry functions.”

This takes in a somewhat wider scope of activities than those implied in the 1928 definition, but is otherwise the same in principle.

THE ECONOMIC OUTLOOK IN THE EARLY 1920’s

In the early 1920’s the times began to look auspicious for a start toward industrial forestry in the Pacific Northwest. The economic outlook for the West Coast lumber industry was good. The trans-Pacific markets, principally Japan and China, were expanding. The Panama Canal—completed in 1914 but not utilized fully for lumber shipments until after the first world war—was ready to carry West Coast lumber to the East Coast or to other Atlantic Coast markets at low, water-transportation rates. The South had passed its peak of lumber production and was on the decline, suggesting correspondingly expanding market opportunities for West Coast lumber. The West had taken the lead in lumber production, with the state of Washington in the national top position, and with Oregon safe in her hopes that she would be next.

Reflecting their confidence in the lumber future of the West, several concerns from the Middle West and the South came out West to the pine region, as well as to the Douglas fir region. Here they built new plants, three of them of mammoth dimensions, and one of them, in fact, easily outranking anything that had come this far westward before. Not to be entirely outmaneuvered in this fast-moving expansion game some of the concerns already established in this region undertook expansion, or built bigger or better plants of their own.

These were very stimulating developments at that time, signifying that the forest industries were anticipating better times ahead. Prosperity was around

the corner, "big money" was being invested, stumpage prices seemed likely to head upward, and assurance of the storied "Texas type" was in the air.

It was in this cheerful atmosphere that industrial forestry, still in diapers but breathing strong, for the first time was let outdoors to find its place in the woods and on the cut-over lands. To further brighten the situation for infant forestry, the Clarke-McNary Act was passed in 1924. This important law provided for co-operative forest fire prevention and suppression involving federal, state, and private agencies, whereby federal aid up to 25 per cent of total cost and state aid up to 25 per cent of total cost could be obtained for approved fire protection projects involving privately owned lands as well as public lands. This permitted substantial strengthening of the fire protection organizations, which has proved to be such a basically important requirement for successful forest management in this region.

THE EARLY BEGINNINGS OF INDUSTRIAL FORESTRY

In some cases where large timber owners became interested in industrial forestry, the logical take-off was to make surveys for classification and appraisal of their cut-over lands. This in itself was not too simple a matter because, in the early 1920's, effective techniques for this type of work had not been developed. Standardized procedures for site and stocking classifications, for example, had not been set up, and aerial photography and related techniques were not as far advanced as now. As a result, the early surveys of this type often involved a good deal of probing and uncertainty, and some wasted efforts in the field.

The largest and most significant cut-over land survey of the early 1920's was undertaken by Weyerhaeuser Timber Company. In 1924 they set up a new corporation, the Weyerhaeuser Logged-off Land Company, capitalized at \$1,000,000, the purpose of which was to take over the management of the parent company's cut-over lands. Lands suitable for timber-growing only, would be protected and managed with that purpose in view. Other lands, suitable for farming or grazing or other purposes, would be so classified and disposed of in due course.

This forward step by Weyerhaeuser attracted wide attention. It occurred at a time when public interest in reforestation had been aroused to a considerable degree through a series of widely publicized natural resource conferences, including speeches by President Coolidge. When the Weyerhaeuser announcement came on top of all that, the press throughout the state of Washington virtually bubbled over with editorial comments. *The West Coast Lumberman*, in November 1924, reproduced a whole series of these press comments, some touching on the reforestation problem in general, others on the Weyerhaeuser announcement as well. The following quotes are excerpts from one of the newspaper editorials, reproduced in full in *The Lumberman*:

"At last a start is to be made in practical reforestation. The Weyerhaeuser Company points the way and makes the beginning . . .

"A new company . . . will take over the lumber and timber company's logged-off lands, classify them, and begin to reforest all that are not fit or available for agriculture or settlement.

"Doubtless other companies will follow in programs somewhat similar. This offers a practical solution of the logged-off land problem, provided the state and county authorities are willing to co-operate. This co-operation must eventually take the form of some sort of concession or exemption in the matter of taxes.

"No crop grows as slowly as timber. It is doubtful if, even in this moist and

generous climate (i. e., the Douglas fir region), as much as 150 board feet of lumber can be grown per year per acre. If stumpage a hundred years hence, on this second growth, could be made to average \$10 a thousand, which would make the price of lumber practically prohibitive for general use, the crop would only be worth \$1.50 per year per acre, with nothing for interest on idle investment or to cover insurance for that long, unproductive period . . .”

These quotations are worthy of analysis. The last paragraph, particularly, makes interesting reading today. Thirty-two years ago, when this editorial was written, high-quality yellow fir stumpage was in the \$2.00 to \$4.00 per M. value range, utilization standards were very low, and young second-growth timber, with the exception of well-situated, road-side truck-logging shows in the vicinity of the cities, was looked upon by the loggers as unloggable “scrub” or “brush.”

It was difficult for practical men of those days to envisage future utilization standards that would bring much merchantable timber out of restocking lands or young second-growth stands, even if carried to a one-hundred-year rotation. Today, we agree that in this region, on the basis of *present* utilization standards, a yield of about *one hundred fifty cubic feet* per acre per year is perhaps a reasonable average for well-managed, privately owned, second-growth forests. Thirty-two years ago, the writer of the above quoted editorial felt he was stretching his imagination in assuming a harvestable yield of one hundred fifty *board feet*—not *cubic feet*—per acre per year; and in order to get a yield of this magnitude, he reasoned one would naturally have to sit back and wait for one hundred long years with no income, but with a lot of out-go in the meantime.

It was this line of reasoning, plus the natural inability of mortal man to foresee “the shape of things to come,” including the amazing advance in utilization standards which came as a companion of rising timber values and changing logging and manufacturing techniques, that made investments in logged-off lands or young second-growth stands look so utterly insecure and uninviting.

In this appraisal of the situation, the writer of the above quoted editorial was not alone. He was merely reflecting the concensus of opinion of bankers, lumbermen, business men, foresters, and the general public of that period. This explains why there was no grand rush at that time to pick up bargains in well-selected young second-growth lands, even though such lands were then beginning to drift into county ownership at a fairly rapid rate for non-payment of taxes, and could be purchased “for a song.”

ARTIFICIAL PLANTING OR SEEDING

The Weyerhaeuser logged-off land program did not include immediate provisions for artificial planting or seeding, although this came into the picture at a later date. Their early moves were directed toward improvement of their fire protection setup, and toward working out logging plans that would provide for quicker and better reseeded of the cut-over lands. Other operating companies, who also became interested in cut-over land forestry, started to work along the same lines.

Artificial planting certainly was not a phase of industrial forestry which was deemed practical by established lumber companies of the early 1920's. Nor did foresters consider planting to be a logical starting move in industrial forestry. The forester's viewpoint in this regard is revealed by the wording in an editorial carried in the January, 1928, *Journal of Forestry*, in which artificial planting is placed last on the list and, so to speak, with a question mark

behind it.* In short, artificial planting was more or less an exotic idea, or at least a low-priority idea in industrial forestry thinking at that time.

However, it was not completely neglected. The largest pulp company of this region had started planting long before 1920. Another pulp company got under way with a planting program in 1920. A few years later some of the lumber companies also tried their hand at planting. In the following we shall review these cases, one by one.

THE CROWN ZELLERBACH CASE

Back in 1893, the Crown Willamette Pulp and Paper Company, predecessor of Crown Zellerbach Corporation, established a sixty-acre black cottonwood plantation on a small island in the Willamette River near Harrisburg, Oregon. Cottonwood, at that time, was rated as a particularly valuable wood for pulp-making. Since the virgin supply of this species was rather limited and was rapidly disappearing through land-clearing operations by farmers, this company decided that the safest thing to do was to raise its own.

During the ensuing thirty years or so, a total of approximately one thousand acres of similar cottonwood plantations were established on low-lying cottonwood lands along the Willamette River or its tributaries. Practically all of these plantations turned out well. One fine stand, planted in the 1890's, was harvested in 1922 and 1923, and yielded a large percentage of high quality logs which were made into veneer for furniture manufacture. By that time cottonwood had become a less essential requirement for Crown's pulp-making, but "Circassian Walnut" furniture made out of fast-grown young cottonwood was in good demand!

By 1926 Crown Zellerbach's planting program shifted to conifers, about 90 per cent Sitka spruce and 10 per cent Port Orford cedar. In order to obtain planting stock, the company had to put in its own forest tree nursery and seed-extraction plant, which was established on one of its cottonwood plantation areas near Oregon City. Six acres of a plantation established in 1905 were cut down to make room for the nursery. The yield from this cutting was approximately forty cords per acre, representing a mean annual growth of two cords per acre per year.

Approximately four million seedlings produced in this nursery were planted on the company's cut-over lands near Seaside and Cannon Beach, and in other locations in the fog-belt area of the Oregon Coast. In the planted areas, abandoned railroad spurs and some of the "skyline" roads were seeded or planted to red alder for fire breaks. Despite these precautions, there were substantial losses from fire. In such cases the fire-killed areas were replanted.

A total of 4,689 acres were planted from 1926 to 1933. By that time the gloom of depression days brought a temporary halt to Crown Zellerbach's planting program. However, planting was resumed on a still larger scale in 1941 when the tree-farm movement got under way. Except for the unexpected fire losses in the fog-belt plantations, Crown Zellerbach's plantations during the period discussed have turned out very well.

THE EVERETT PULP AND PAPER COMPANY CASE

This operation, now owned by Simpson Paper Company, with its plant near Everett, Washington, started as a small soda-process mill using cottonwood and Douglas fir. For better security of cottonwood supply, the company ac-

* "What Is Industrial Forestry?" Vol. XXVI, No. 1, p. 1.

quired a considerable acreage of cottonwood lands, mainly along the Skagit River. The following is a condensation of a memorandum furnished by James C. Hayes of the Simpson Paper Company.

"In 1920 a definite program was set up to systematically replant all company-owned cottonwood lands as soon as practical after logging. This was carried out faithfully until 1941, when the acute man-power shortage of the war period forced temporary abandonment of the planting program, while at the same time heavier-than-normal logging had to be done on the company-owned lands, due to difficulty of obtaining cottonwood from outside sources. As a result, the planting program fell behind logging.

"In 1944 and 1945, when the man-power shortage eased, a determined effort was made to catch up. In some cases the brush had made too much headway, but generally speaking, most of the areas were brought back into cottonwood production. After the war, enough market cottonwood logs to supply all the mill's requirements became available. Since then, little or no logging has been done on company lands, and therefore there has been no further replanting.

"In 1944 and 1945, approximately twenty acres of cottonwood planting, representing a part of the acreage planted in 1922, was harvested. The site was not one of the best, and the survival of slips was below normal because the area was one over which cattle had grazed soon after planting. Nevertheless the twenty acres of twenty-two-year-old timber yielded 450 standard cords on a premature cutting, when the land involved was exchanged for more desirable property. With few exceptions, the other plantations are intact.

"Growth has been quite variable, depending on site, damage from cattle, and density of stocking. In the earliest plantings, 1,200 slips per acre was the rule. This proved to be too dense, resulting in a mild stagnation until the weaker trees were killed out. At a later stage planting was dropped to 800 per acre, and finally to 500 per acre. In the latter case, survival has been almost 100 per cent. However, the densely stocked plantations did, on the average, produce cleaner-looking trees with tall, limb-free trunks."

THE MERRILL & RING CASE

This represents the first attempt at planting and seeding by a lumber company in the Douglas fir type. It was carried out on an experimental basis only.

The area in which these plantations were established is now known as the Pysht Tree Farm. The following is quoted in part from a letter from Charles Tulloch, Manager of Merrill & Ring's tree farm: "The first work was done in 1924 when a two-acre area was planted to redwood, and a ten-acre area was broadcast-seeded to Sitka spruce. These areas were swept by fire the following year. Only two redwood trees survived on the planted area. Very little spruce survived on the seeded area.

"In 1925 another redwood plantation was established, but I have not found any sign of it. In 1926 two more redwood plantations were established, one consisting of a single row of 1-1 stock, few of which remain; the other, six acres in size, included some Port Orford cedar. The six-acre plantation has been doing quite well, except for considerable damage from bear and also from last winter's freeze. The average D. B. H. of the redwoods is 19 inches; the average height 60 feet. The few remaining Port Orford cedars are short and scrubby. In the same year (1926) two small plots were broadcast-seeded with Sitka spruce; and a three-acre area was planted with spruce.

"At some later date, ten one-acre plots and one six-acre plot were seeded to Douglas fir and Sitka spruce, using both broadcast and seed-spot methods, in amounts varying from one to ten pounds per acre. I have a map showing the locations of all plantations and seed areas mentioned above, but as yet have not located many in the field. Some have been burned and some have apparently been supplemented by natural seeding, since they lie in stands of second growth covering a much larger area."

THE LONG-BELL CASE

This represents the first case in this region where a lumber company in the Douglas fir belt went into planting on a large scale. Prior to their decision to plant, they tried direct seeding experimentally, but this proved unsuccessful. They could find no effective poisons to control the voracious rodents. The following has been condensed from information furnished by John B. Woods, who was in charge of Long Bell's forestry department at that time.

"Long-Bell's reforestation program began with the establishment of a large nursery and seed-extraction plant near Ryderwood, Washington, in 1926. Actual planting, using 2-0 and 1-1 stock, was begun in 1928. During the ensuing four years, a total of over eight million seedlings—Douglas fir, Port Orford cedar, and redwood—were raised. A total of 13,330 acres of company-owned lands were planted. In all planted areas, the abandoned railroad spurs were seeded or planted to red alder for fire breaks. These proved effective the first time a fire came through, but the alder was usually killed by a second fire. In some of these plantations fires came through several times. Species-wise, the results of these plantations were variable. Douglas fir did well until destroyed by fire; Port Orford cedar did well; redwood froze back repeatedly.

"Long-Bell's reforestation program went full speed ahead until the end of 1931. By that time, financial circumstances brought on by the deepening economic depression brought the reforestation program to a halt. There had been fire losses up to that time, and more followed later. In fact, the great scourge in Long-Bell's planting project was fire. The Company's logging operations were on a very large scale and under increasing pressure as the depression wore on. The woods crews, although fire conscious and on their toes as far as protection of standing timber and logging machinery were concerned, were no great respecters of 'brush.' The small planted trees, in their eyes, were part and parcel of the brush.

"In those days the logging boss and the men in the woods were not the 'defenders of the reforestation faith' as many of them are today. Add to this situation a share of bad luck, and perhaps some other imponderables, and one has the formula that brought so much disaster to Long-Bell's planting program. Out of 13,330 acres planted, only 5,400 have survived. The rest were wiped out by fire. It turned out to be a case of planting before the fire problem had been licked."

SUMMARY OF PLANTING AND SEEDING EXPERIENCES

From the above review it can be concluded that the cottonwood plantations of the two pulp companies turned out well, although high agricultural values of the land and proximity to civilization and to its cattle created special problems here and there. Crown Zellerbach's conifer plantations in the fog belt suffered some unexpected fire losses, but did well otherwise. By and large, the lumber companies which tried planting and seeding in the high-hazard Douglas fir belt met with disaster. The lesson learned was that in high-hazard territory

it was certainly unwise to go ahead with planting until a far higher standard of fire protection could be provided for reforested lands. In the case of direct seeding, the additional requirement of rodent control was also a must.

THE ECONOMIC DEPRESSION AND ITS CONTRIBUTIONS TO THE DEVELOPMENT OF INDUSTRIAL FORESTRY

The great depression of the 1930's which brought these planting and seeding projects to a halt, excepting those of Everett Pulp and Paper Company, was a development wholly unforeseen in the early 1920's when the lumber industry was getting prepared for expected bigger markets and better prices. When these seemingly reasonable expectations turned into shrinking markets and falling prices, this industry was headed for real trouble. From 36 billion board feet in 1929, total U. S. lumber consumption dropped to 13 billion in 1932. The rapid expansion of mill capacity here in the Pacific Northwest, in the form of new plants, new and faster machinery in old plants, and other props of progress which had been the pride and joy of this region in the 1920's, had now become a millstone around the neck of a sick and weakened industry.

Much of the mill capacity expansion was heavily financed on borrowed capital, creating pressures for increase of production at a time when the market was falling off disastrously both in volume and price. As the depression wore on, large quantities of timber held by debt-ridden owners were offered for sale at bargain prices as a desperate alternative to forfeiture for nonpayment of taxes, or relinquishment to creditors for nonpayment of interest or matured loans. These were developments which brought ruin to many concerns, drastic reorganization to others, and which kept the industry as a whole in a constant state of overproduction until the economic upsurge of the 1940's.

During this long period of trouble and gloom there were intervals of recovery and progress, notably under the lumber code of the N. R. A. days (National Recovery Act). This gave a temporary price lift to the industry and a permanent gain to industrial forestry, as the industry voluntarily retained the minimum forestry requirements after the demise of N. R. A. These forestry requirements constitute the cornerstone of present-day forest management. Among the forest industry leaders who formulated the Forest Practice Rules were Elias T. Clark, Norman G. Jacobson, D. S. Denman, C. S. Chapman, Arthur K. Roberts, Russell Mills, and Warren Tilton.

Throughout the depression period there were influences at work and developments under way which in due course helped in bringing solutions to some of the industry's basic problems, and at the same time helped industrial forestry on its way toward the position it now holds. One important development in this direction was the placement of certain large timber areas under the cutting restrictions of sustained yield programs. The first large, privately owned timber area so dedicated was the St. Helens Sustained Yield Unit, which was set up to provide a permanent timber supply for Weyerhaeuser's mammoth forest industry developments at Longview, Washington. Another very important dedication to the sustained yield formula involved the 50-billion-foot government-owned O & C timber lands, which was the revested Oregon and California Railroad Land Grant. These areas, unlike National Forest timber, had been open to unrestricted cutting up to that time, *circa* 1937.

The transfer of these huge timber areas, plus many smaller ones that followed, from the category of timber open to unrestricted cutting to timber regulated by sustained yield, was psychologically an important step in straightening out the current timber-supply situation in this region. The depletion of some

of the weakly held timber through cutting, and the transfer of other weakly held timber to stronger hands, worked in the same direction. In this manner, the industry's vexing problem of a huge surplus of hard-pressed, weakly held, speculatively held, or otherwise uncontrolled timber, constantly overhanging a limited market, was moving ahead step by step toward a permanent solution.

Another basically important development of the depression period was the revolution then taking place in the mechanics of logging and log transportation. Prior to the depression, the dominant feature of log transportation in the Pacific Northwest, in the pine region as well as in the Douglas fir region, was the logging railroad. At the end of the depression, the dominant feature was the truck road, either for direct truck haul to mill or to transfer point at railroad for the long rail haul to mill.

Prior to the depression the general procedure in woods operations of the Douglas fir region was widespread clear-cutting by cable-logging methods such as high-lead and skyline logging. In many cases there was no restriction on the size of areas logged except the size of the ownership, be it a quarter-section, a section, or a township. At the end of the depression, the dominant features were: (1) clear-cutting, followed by cable-logging methods, but with size of cutting areas limited to moderate dimensions to permit quick restocking from surrounding seed blocks and to reduce fire risks; or (2) selective logging with tractors. In the pine region the shift to selective cutting was fairly complete.

These developments brought opportunities for great progress in all phases of forestry management, including the feasibility of constructing well-planned permanent road systems, which are essential to forest management. Also developed was the opportunity to work out the best methods for intermediate cuttings or final cuttings, as the case might be, and the opportunity to get on top of the fire protection problem which is a prerequisite to successful reforestation of cut-over lands.

The motorization of the logging industry, as exemplified by the motor truck, the bulldozer, the logging tractor, the mobile loaders and so on down the line, gave the industry the flexibility it sorely needed to permit it to do a good forestry job. It is difficult to see how the forestry progress which has taken place in the big-timber regions of the West could have come about without breaking away from the mechanics of predepression days, when railroad logging and unrestricted clear-cutting ruled the roost.

The early beginnings of these motorization developments came well before the start of the depression, and its further evolution continued thereafter. It is incorrect, therefore, to say that the depression brought about these changes, since they already were under way and would no doubt have kept on developing, depression or no depression. But the depression certainly served to hasten these changes far beyond the pace of normal times. It was under the strain of hard times and "tough going" that the need for flexibility and selectivity in logging operations made itself felt so acutely that many operators quickly discovered that they had to adopt new ways in whole or in part in order to survive. When the depression days were over, the industry as a whole had quite generally discontinued the old system of railroad logging and unrestricted broad-scale clear-cutting. With that much accomplished, the foundation had been laid for much of the industrial forestry development that was to follow.

INDUSTRIAL FORESTRY IN THE PACIFIC NORTHWEST FROM 1941 TO THE PRESENT

THE BIRTH OF THE FIRST TREE FARM AND THE BROOD THAT FOLLOWED

June, 1941, marks an important milestone in the progress of Industrial Forestry. It marks the birth of the first industrial tree farm, and starts from "Mile O" on the road traveled by the Tree-Farm Movement. This event took place at Montesano in Grays Harbor County, Washington. The object of attention was a 120,000-acre tract of cut-over land which on that significant occasion was dedicated with appropriate ceremonies as the "Clemons Tree Farm."

As far as outward appearances were concerned there was nothing outstanding about this cut-over area to justify special attention. It had originally been a heavily timbered Douglas fir area, in typically rough country, where logging operations had been carried on for over fifty years. Most of the cut-over had restocked fairly well, but due to recurring slash fires, about twenty thousand acres were nonstocked or poorly stocked. There were occasional patches of older timber which had been passed up as unloggable in the old days and which had been serving ever since as seed sources for the surrounding lands; and there were large areas of second growth that had reached the seed-bearing stage, thus expanding the seed source areas.

All in all, this area represented a fair sample of Western Washington cut-over lands. It was typical of the harvested timberland which during preceding years had been "going back to the counties" by the thousands of acres for nonpayment of taxes. However, on this day of formal dedication, the thing that made the tract so outstandingly different from other cut-over lands was this; the owner, Weyerhaeuser Timber Company, had not only kept taxes paid up, but were now officially dedicating the corporation to an active program of timber-growing and to expenditure of the money required to do a real job.

A prime requisite for successful timber-growing on this tract was to prevent fire; however, to the extent that fire protection alone could not bring all the lands back into production, artificial planting or seeding was to be included in this tree-farming program.

A start had already been made on a fire-protection program. The abandoned railroad spurs had been gone over with bulldozers and converted into truck roads; "shooffies" had been built around dilapidated old wooden trestles; new, low-cost connecting roads for fire-season travel had been built to connect dead-end spurs; several fire trucks with large reels of fire hose, fire pumps, and other equipment were stationed at the tree-farm headquarters ready for quick attack on fires; and water holes had been bulldozed out here and there near creek crossings to provide quick access to water.

In short, the initial facilities required for a motorized, quick-action forest fire department had already been provided and funds for its operation had been set aside.

The cost of this protection program, excluding capital investment in road reconstruction, building, and water holes, was estimated at 25 to 30 cents per acre per year. This was an unprecedented expenditure, because at that time the normal cost for fire protection was only about five or six cents per acre per year. However, experience and statistics had clearly shown that the normal protection effort, at such low annual costs per acre, was wholly inadequate for satisfactory protection of high-hazard, cut-over lands. The company for-

esters, after considerable study of the timber-growing potential of these lands and the requirements to be met for reasonable fireproofing, had recommended that the protection budget be raised to the 25 to 30 cent level. With this degree of protection, Weyerhaeuser Timber Company felt reasonably sure that fire losses could be held down to less than 0.25 per cent per year—a target which they set up as the maximum loss rate that could be tolerated under a successful tree-farming program.

The word "tree farm" was officially introduced for the first time in this dedication ceremony. Like all new things it caused some raising of eyebrows here and there, but the term took hold and soon became a part of forestry language.

The introduction of this new term had a definite purpose, which was to enlist public support for the high standard of fire protection required for successful growing of timber crops. Colonel William B. Greeley, on the occasion of the tenth anniversary of the tree-farm movement, had this to say, among other things, regarding tree farms: ". . . Weyerhaeuser Timber Company posted the Clemons tract with Tree-Farm signs in 1941 to tell its neighbors on Grays Harbor that this was not just another cut-over timber property, but an area devoted to forest culture and planting. It asked the help of the hunters, fishermen, and berry pickers in keeping out fire. Every American child knows what a 'farm' is. 'Tree farm' tells the whole story of forest protection and growth; of a new crop of wood following every harvest. Carelessness with matches or cigarettes in wild, untenanted lands is a carry-over from the reckless generations who thought there were no limits to our forests. But carelessness on a man's farm, with growing crops about you, is something quite different."

Soon after the dedication of the Clemons Tree Farm, further developments in industrial forestry began to get under way. One was the installation of a large, industry-wide forest tree nursery at Nisqually, Washington, which was organized late in 1941 and which produced its first crop of seedlings—over four million of them—in the fall of 1942. The planting program set up for the Clemons Tree Farm was supplied with seedlings from this nursery, beginning in 1942, as were several other tree farms which by that time had come into the tree-farm picture. From 1942 to the present, over 75 million seedlings have been produced in this nursery for planting on tree-farm lands in the Douglas fir region. The rate of production is now set at eight million trees per year, enough for planting of 12,000 to 15,000 acres of nonstocked lands annually.

In December, 1941, the Joint Committee on Forest Conservation of the West Coast Lumberman's Association and the Pacific Northwest Loggers Association—predecessor of the Industrial Forestry Association—initiated a tree-farm program for the Douglas fir region and set up administrative facilities for official enlistment and registration of Certified West Coast Tree Farms.

In response to this move, recruitment into the ranks of certified tree farms got off to a good start. In 1942, a total of 20 large tracts, including the Clemons Tree Farm, were officially certified by the Joint Committee. Following is the list:

- Clemons Tree Farm (Weyerhaeuser Timber Company)
- South Olympic Tree Farm (Simpson Logging Company)
- Cathlamet Tree Farm (Crown Zellerbach Corporation)
- Neah Bay Tree Farm (Crown Zellerbach Corporation)
- Pacific County Tree Farm (Crown Zellerbach Corporation)
- Row River Lumber Co. Tree Farm
- The Booth-Kelly Lumber Co. Tree Farm

Shellstrom Lumber Co. Tree Farm
 Lewis Lumber Co. Tree Farm
 C. D. Johnson Lumber Corp. Tree Farm
 Ostrander Railway & Timber Co. (Molalla) Tree Farm
 Willamette Valley Lumber Co. (Black Rock) Tree Farm
 Willamette Valley Lumber Co. (Snow Peak) Tree Farm
 Tillamook Tree Farm (Crown Zellerbach Corporation)
 Astoria-Seaside Tree Farm (Crown Zellerbach Corp., Clatsop)
 Florence Tree Farm (Crown Zellerbach Corp., Tahkenitch)
 St. Paul & Tacoma Lumber Co. Tree Farm
 Vail Tree Farm (Weyerhaeuser Timber Co.)
 Mt. St. Helens Tree Farm (Weyerhaeuser Timber Co.)
 Snoqualmie Falls Lumber Co. Tree Farm

These twenty are, as it were, the charter members of Alpha Chapter of the American Tree-Farm Movement. Their areas total 1,620,533 acres, representing an average of about 81,000 acres per farm. The growth of the tree-farm acreage from 1942 to the present is shown in Table 2.

TABLE 2
 WEST COAST TREE FARM STATISTICS FOR THE DOUGLAS FIR REGION
 (Data furnished by the Industrial Forestry Association)

Year	Tree Farms Certified		Tree Farms Cancelled		Acreage Added to Existing Tree Farms	Tree Farm Total at Year End	
	No.	Acreage	No.	Acreage		No.	Acreage
1942	20	1,620,533				20	1,620,533
1943	3	211,597				23	1,832,130
1944	28	212,041				51	2,044,171
1945	7	2,484				58	2,046,655
1946	18	238,911	4	88,716	-20	72	2,196,830
1947	6	100,681			227,182	78	2,524,693
1948	11	405,780			83,668	89	3,014,141
1949	13	256,588	2	37		100	3,270,692
1950	11	144,792	7	18,108	280,334	104	3,677,710
1951	14	259,050			73,542	118	4,010,302
1952	14	42,157	3	448	33,037	129	4,085,048
1953	63	95,817	2	545	70,156	190	4,250,476
1954	59	145,743	3	29,616	48,827	246	4,415,430
1955	60	190,946	2	960	40,927	304	4,646,343
1956	100	207,303	7	43,905	21,936	397	4,831,677

According to this table, the total tree-farm enrollment in the Douglas fir region expanded from 20 in 1942 to 397 at the end of 1956 and the total area from 1,620,533 acres to 4,831,670. During the starting years only large, company-owned areas came into the picture, but since 1944 many small, individually held properties, including small farm woodlots, have been enrolled.

During the first couple of years the requirements for certification as a West Coast tree farm were: (1) stability of forest land ownership, (2) adequate forest protection, (3) common sense timber harvesting to assure the starting of new crops, and (4) furnishing information on progress of the tree farm and providing opportunity for inspection. In October, 1944, a further requirement of the submission of a five-year management plan was added.

Paralleling the rapid growth of the tree-farm movement within the region of its birth, is its equally rapid spread throughout the rest of the country. This began soon after the initiation of the West Coast Tree Farm program, when upon recommendation of the West Coast forest industry, the National Lum-

ber Manufacturer's Association picked up the program and made it nationwide in 1942. The promotion of this program was later shifted to American Forest Products Industries, Inc. which keeps a country-wide register of certified tree farms. By the end of 1955 the tree-farm movement had been extended to 36 states, with a total registration of 6,100 certified tree farms, comprising a total forest land area of 34 million acres.

Paralleling this growth of the tree-farm movement, is the growth of the "Keep Green" movement, which started in 1940. This was directed toward enlistment of the general public in the cause of forest fire prevention. It has helped to make the public forestry conscious and fire conscious, and has contributed substantially to the lowering of fire losses over these years.

THE ECONOMIC UPSURGE OF THE POSTWAR PERIOD

The outbreak of World War II created a heavy demand for lumber and other forest products. Lumber values recuperated sufficiently to bring a stiffening of stumpage prices and to cause some withdrawals of timber sales offerings. However, for several years after this country entered the war, wartime price controls held stumpage prices fairly well in check.

Since the end of the war, when price controls on lumber and other forest products were removed, an amazing upswing in stumpage values has taken place in this region. There are many reasons for this, including (1) the monetary inflation in general; (2) the postwar expansion in the construction industry, particularly in home building; (3) the rapid expansion of the plywood and wood-fiber industries, principally pulp and paper, which has brought competition to lumber mills for logs and standing timber; (4) the rapid expansion of by-products utilization, notably pulp chips from sawmill waste, which in many cases has added materially to the recovery value of saw logs and has in turn reacted on stumpage values; (5) the development of large, fully integrated forest-industry centers, which has tended to create specialty values on various categories of wood supply; (6) local competitive situations featuring too many timbershort wood users for the available wood supply; and (7) the workings of the federal income tax laws and other artificial factors. To the above list, experts in this field could probably add many more.

Prior to World War II a typical, recurrent West Coast forest industry situation would start with a strong rise in the lumber market, a surprisingly quick step-up in production, with relatively huge quantities of cheap, "quick-liquidation" stumpage aiming to get in on the rise, resulting before long in heavy overproduction and consequent collapse of prices. This sad story has not been repeated to any serious extent since the beginning of World War II, at least not sufficiently to cause major reversals in the great upsurge of timber values that came in the postwar period. The correction of the West Coast timber supply situation, which was going on through the depression period, had apparently fulfilled its mission well before the great upsurge came. The average situation since then has included a demand in excess of current offerings of timber.

Those who have studied this situation closely, with due attention to expanding world demand for forest products and its relation to the available timber supply, apparently do not expect any serious blackouts in the picture. This broad outlook has been a backbone of strength in support of the high stumpage price level of this period at moments of declining demand for lumber or plywood. Pulpwood demand has shown no serious weakness during the entire postwar period.

Table 3 presents an illustrative example of the value rise that has taken place over the period here discussed. This example shows the stumpage prices actually paid for O & C timber in Western Oregon from 1939 to the present time.

TABLE 3
Average appraised price and bid price for Oregon and California
revested lands and Coos Bay wagon road grant lands 1939-1956

Fiscal Year	Timber Volume Sold (in M Board Feet)	Average Appraised Value (Dollars per M Board Feet)	Average Bid Price (Dollars per M Board Feet)
1939	No Data	No Record	1.96
1940	No Data	No Record	2.29
1941	No Data	No Record	2.22
1942	No Data	No Record	2.81
1943	No Data	No Record	3.80
1944	368,500	No Record	3.46
1945	435,200	No Record	4.22
1946	345,400	No Record	4.35
1947	448,700	No Record	6.88
1948	398,300	9.57	10.46
1949	262,600	9.96	11.06
1950	392,600	8.91	12.19
1951	394,800	18.69	22.01
1952	390,700	21.64	25.41
1953	518,200	20.09	22.97
1954	580,500	15.03	18.82
1955	603,600	17.16	29.15
1956 through October		19.67	35.28

Source: Area Office, Bureau of Land Management, Portland, Oregon.

As shown in this table, the upward movement of stumpage prices was rather moderate during the war years, but shot up sharply after price controls were removed in 1946. Over the ten-year period from 1941 to 1951, prices increased tenfold. From 1951 to the present, there has been a further rise in bid prices, although the appraised values have shown no definite upward trend.

The remarkable rise in timber values, as illustrated by the O & C figures, has created the economic incentive for the amazing progress that has been made in industrial forestry during this period. For the first time in the Pacific Northwest's timber history, a value level has been reached which makes timber-growing a sensible business undertaking. And with profit as the mainspring of progress, forestry has gone forward as never before.

1. UTILIZATION PROGRESS IN THE WOODS

One of the important developments in the postwar March of Progress is the advance which has been made toward closer utilization of old-growth timber. Back in 1929, when Allen Hodgson reported on his comprehensive, region-wide study of "Logging Waste in the Douglas Fir Region",* 27 per cent of the gross volume of timber, including breakage but excluding defective material, was being left on the ground as logging waste. The percentage varied widely, the maximum being 75 per cent, which occurred in an area running heavily to white fir and hemlock. All operations involved were clear-cutting, using conventional cable-logging methods.

Three or four years after Hodgson's field studies, the great depression started in earnest. In response to falling log and lumber prices, utilization standards necessarily followed to lower levels. In 1931 and 1932, in connection with a region-wide series of logging cost studies conducted by the writer, it was found that the average harvest in clear-cutting operations in this region had

* "Logging Waste in the Douglas Fir Region," Allen H. Hodgson, Associate Forester, U. S. Forest Service, Portland, Oregon. *West Coast Lumberman*, January 1930 (Reprint, 42 pp.)

dropped to 49M. board feet per acre gross volume (or about 42M. net), as contrasted with Hodgson's average of 79M. This indicated that the average waste factor, including breakage but excluding defective material, probably had moved up to 55 per cent as contrasted to Hodgson's 27 per cent.

It was not uncommon in those days to find clear-cutting operations in areas running heavily to hemlock and white fir, in which timber actually removed from the land amounted to less than one-third of the total gross volume, leaving the other two-thirds for disposal by slash burning. In one case, in a pure hemlock stand, a whole setting was felled and bucked ready for high-lead yarding; but before yarding was started, the market price had dropped below anticipated out-of-pocket costs of yarding, loading, hauling, and common-carrier railroad transportation. As a result, logging was postponed, hoping for a better price. The better price did not come soon enough to prevent the loss of the felled timber from sap rot and other decay. Here was a case where clear-cutting during the depression period ended up with 100 per cent logging waste as contrasted with Hodgson's predepression maximum of 75 per cent.

It was during this difficult period that selective logging with tractors became very popular in this region, and particularly so in areas running heavily to hemlock and white fir. Selective logging made it possible for an operator, intent on liquidating his timber investment, to take out about the same net volume and the same net value as he would normally take out in clear-cutting, but without tearing down and destroying the unwanted (minus value) portion of the stand, a portion that in many cases made up to 60 to 80 per cent of the total gross volume. This unwanted timber could be left standing, with its roots in the ground and its green limbs in the sky, to await a better market.

For the last ten years this region has had that long-hoped-for better market. It came much sooner than expected and moved to a much higher level than was anticipated. It has actuated an upward movement to a much higher standard of utilization than was visualized.

Today, we find many cases in which utilization standards have progressed to the point where practically all of the sound volume falling within the utilization limits defined by Hodgson is being taken out of the woods, excluding some of the breakage losses, such as shattered logs and short chunks, which were included in the gross stand volume. Moreover, today's utilization standards have in many cases progressed to the point where much of the defective materials, which Hodgson did not include in the gross volume inventory, is being taken to pulp mills or other manufacturing establishments, under the title of "wood logs" or similar designations. In other words, there are cases today where actual utilization performance, in primary logging, prelogging or relogging, probably has gone well past the 100 per cent mark envisaged as the ultimate potential in Hodgson's studies.

Outstanding examples of this can be found in Crown Zellerbach's and Weyerhaeuser's operations, and probably in others. The prerequisite for this high standard of utilization is a market for pulpwood or for other wood fiber of a type which permits economic utilization of certain kinds of defective material. Large diversified concerns like Crown Zellerbach and Weyerhaeuser are in the best position to take the lead in these significant developments. Close access to large integrated manufacturing centers such as Longview, Eugene, Tacoma, and Portland, tends to open the way for other operators who do not have pulp, or other wood-fiber, plants of their own.

In districts lacking economic access to wood-hungry pulp mills, utilization standards are necessarily lower. This applies to portions of the Douglas fir

region and to large portions of the pine region. In many of these areas, the utilization standards set by local back-country sawmills are still quite low.

And so it is seen that progress in utilization has been variable, depending on local conditions. On the average, in comparison with the prewar situation, the forward move has been of massive proportions and has changed the figures of regional old-growth timber inventory to a very marked degree. As a footnote to this, it should be remarked that any statistics on stumpage price increase, such as the O & C data in Table 3, should obviously be re-evaluated in the light of advancing utilization standards. In this respect, Table 3 gives only the upward move of the average price per M. Paralleling this has been an upward move in the loggable volume per acre, based on an increased rate of utilization, which in turn has resulted from rising values.

2. PROGRESS IN WOOD UTILIZATION AT THE MILLS

A great step in wood utilization was made in the early 1940's when whole-log hydraulic barking and whole-log chipping were developed at various pulp mills here on the Coast. Hydraulic barking permits clean, efficient removal of the bark without loss of wood, and whole-log chipping obviates the need for breakdown of the logs into cants before chipping. Compared with previous methods of converting unbarked pulp logs into chips, the new method probably saves from 10 to 15 per cent of the total wood volume. Hydraulic barkers were also installed in some of the larger sawmills, permitting them to produce bark-free slabs and edgings for conversion into pulp chips. Such installations, however, have been too expensive for smaller mills.

In recent years there have been developed efficient mechanical barkers, capable of doing a good bark-removal job with little loss of wood. This type of equipment is less expensive, permitting installation in smaller mills, and resulting in the production of increasing volumes of pulp chips from bark-free slabs and edgings (i. e., from mill waste). Contributing further to this use of leftovers are hydraulic slab barkers, which accomplish the same result, although with less efficiency.

These developments have made an important contribution to the wood supply of this region. Several large sulphate pulp mills in Washington, including Longview Fibre Company's huge plant, Weyerhaeuser's new mill at Everett, and Crown Zellerbach's plant at Port Townsend, are running almost 100 per cent on chips made from sawmill waste. Approximately one-third of the total pulp tonnage produced in this region is made from pulp chips of this class. Prior to World War II, most of the wood from which this pulp is now being made would have been disposed of in sawmill waste burners, or would have been used as fuel.

Bark utilization is another inspiring development in timber utilization which belongs to this dynamic period. The principal development along this line has been evolved by Weyerhaeuser Timber Company.

Great progress has also recently been made in developing new wood-fiber products such as soft board, chip board, and particle board. New plants for the manufacture of these products have been established in various parts of this region, and have widened the opportunities for mill-waste utilization.

3. PROGRESS IN SECOND-GROWTH STAND MANAGEMENT

The early beginnings in thinning young, second-growth stands on a commercial basis occurred about ten years ago. This practice has gradually developed to the point where fairly substantial volumes of thinnings are produced in various parts of the Douglas fir region.

Notable progress in this field has been made by St. Paul and Tacoma Lumber Company, Simpson Logging Company, Weyerhaeuser Timber Company, Crown Zellerbach Corporation, Port Blakely Lumber Company, Booth Kelley Lumber Company, and T. J. Starker Tree Farms.

This year, Crown Zellerbach's operations in Oregon are scheduled to produce the equivalent of 30 million board feet of thinnings from stands averaging about sixty years of age. Expansion to 50 million by 1960 is contemplated by this corporation.

This production corresponds closely with predictions made by Burt P. Kirkland in *Forest Resources of the Douglas Fir Region*, published by American Forestry Association, July, 1946. Kirkland predicted that if cutting in this region were directed toward more complete utilization, a general thinning of young stands, beginning at 30 to 40 years and continuing until about ninety years, could yield annually an additional 2.5 billion board feet in small logs and pulpwood.

In a foreword to this publication, the Joint Committee on Forest Conservation, representing Pacific Northwest Loggers' Association and West Coast Lumbermen's Association, urged West Coast operators to take Kirkland's figures seriously, and to try out his suggested methods of management.

4. PROGRESS IN REFORESTATION

With respect to natural reforestation in clear-cut, logged-off areas in the Douglas fir region, better results are being obtained because of closer utilization in logging operations, which leaves cleaner and better seedbeds and facilitates fire protection. Further progress has been made through closer attention to seed sources and to size of clear-cut areas, whereby quicker and denser restocking is being obtained.

With regard to artificial reforestation, industry-wide progress has been impressive. This is indicated in part by the history of the forest tree nursery at Nisqually which, as already noted, has been stepped up to a production schedule of 8,000,000 plants per year. Beyond this, great progress has been made in recent years in artificial seeding, mainly by aerial methods, using both airplanes and helicopters, accompanied by effective poison-baiting for control of rodent population. Furthermore, baiting for rodent control has recently been applied to areas which are in the process of natural restocking but which face failure on account of excessive rodent population.

As an inspiring example of how rapidly forestry is moving, let us sink our teeth into the actual performance record of the Crown Zellerbach Corporation. This company, as heretofore mentioned, started reforestation in 1893. During the ensuing 30 years they planted approximately one thousand acres of cottonwood. This is not a large acreage in present day terms, but it was one thousand acres more than had been planted anywhere else in this region. During the fifteen-year period between 1926 and 1941, much of which was inactive because of the depression, Crown reforested 4,689 acres by planting conifers. During the fifteen-year period between 1941 and the present, reforestation performance on Crown's tree-farm lands was as follows:

1. By planting	27,825 acres
2. By hand seeding	1,961 acres
3. By aerial seeding	15,275 acres
4. By rodent control seeding	10,795 acres
Total	55,856 acres

This is approximately ten times the area reforested from 1893 to 1941.

5. PROGRESS IN FIRE PROTECTION

Fire protection was the No. 1 problem at the time initial steps were taken toward industrial forestry around the beginning of this century. The protection standards then established represented a major advance toward effective protection of virgin timber resources of the Pacific Northwest. As time went on, more and more cut-over lands entered the picture. It became increasingly evident that protection efforts which were fairly adequate for protection of standing timber were not adequate for protection of reforested cut-over lands, as the fire hazard on such lands was several times as high as in timbered areas.

The tree-farm movement included a drastic step-up of fire protection standards and costs. These standards have proven effective. They have brought fire losses (burning ratios) down to the level where industrial tree farmers of today feel entirely safe in spending money for planting, seeding, or other forestry measures which may be required for effective tree farming. The original target was a burning ratio not to exceed 0.25 per cent for any given tree-farm property. This has generally been attained or improved upon. The industry-wide burning ratio for the last several years has been kept below 0.1 per cent. This means less than one acre per year visited by fire for each 1,000 acres of tree farms.

A shining example of progress in fire protection is shown in Table 4. This table presents the forty-five-year fire record for a million-acre area in the Clearwater basin of Idaho. A part of this area falls under the jurisdiction of the Clearwater Timber Protection Association; the rest under the Potlach Timber Protective Association. As previously noted, these associations were formed in 1905; although their systematic recording of fire statistics started with 1911. This million-acre area is a part of an exceptionally high-hazard territory where lightning is the principal cause of fire.

The fire record for this area was furnished to the writer by Mr. A. B. Curtes, Chief Fire Warden of the two associations. It consists of detailed data listed by individual years from 1911 to 1955, and kept separate for each association. For the purpose of this discussion the writer has combined the data of the two associations, and has set up four different subperiods in order to bring out the trend of fire losses over the period involved. The first column of Table 4 presents the fire record for the entire forty-five-year period, followed by corresponding records of subperiods in four separate columns. The first of these subperiods covers the 20 years between 1911 and 1930, which we shall refer to as a period of old-fashioned protection. The main emphasis during these two decades was on good detection by means of numerous lookout towers, good communications by means of well-maintained telephone lines, and access to remote areas by means of pack trails and foot trails.

Next comes the ten-year period of 1931–1940, the prewar depression period which in many forest districts led to a definite let-down in fire protection standards and ensuing worsening of the fire record, due to lack of funds and to other adversities. Not so in this Idaho case, where the year 1931 marks the beginning of a modern protection setup. This began with the use of bulldozers, which were selected as the right equipment for quick and low-cost construction of fire-protection roads to open up the back country for truck and tractor transport and so provide the means for quick and massive attacks on fires. With this idea in mind, they pushed ahead aggressively with a far-flung road development program, which in the course of the last 25 years has given them access to virtually every part of this million-acre area. The effect of this program on

the fire protection record began to show up very plainly during the depression period, and this improvement has continued up to the present time, as clearly shown by the record for the five war years (1941-1945), and finally for the ten-year postwar period (1946-1955).

TABLE 4

Summary of fire records pertaining to a 973,000 acre forest area in Idaho

	Fire Record for Entire 45-year Period 1911-1955	Fire Record by Subperiods			
		20-year Period 1911-1930	10-year Period 1931-1940	5-year Period 1941-1945	10-year Period 1946-1955
Average number of lightning fires per year	81	91	60 ¹	96 ²	72
Average number of man-caused fires per year	52	60	77 ³	25	27
Average area burned per fire—acres	20	32	15	2.3	0.6
Average total area burned per year—acres	2,679	4,874	2,096	292	64
Burning ratio	0.28%	0.50%	0.22%	0.03%	0.006%

¹This lower-than-average figure may be due to absence of reports from lookouts left unattended during parts of the fire season for lack of funds. (The depression period.)

²This higher-than-average figure may be due in part to greater alertness by lookouts and other fire-reporting staff attached to the air-raid warning service during the war.

³This higher-than-average figure is in part due to an increase in incendiary fires during the depression years.

Contributing in an important degree to this continuous improvement has been the introduction and increasing use of tank trucks, fog nozzles, fire hose, water holes, radio communication, audio equipment, and airplane patrol; in other words, constant progress in all directions based on an ever-improving access-road system. Through these developments they are now able to function much the same as the fire department of a modern city, with fire reports being acted upon quickly and with sufficient force to hit hard before fires go far out of bounds. In this manner they have succeeded in bringing down the size of the average fire from 32 acres for the 1911-1930 period to a mere 0.6 acres for the ten-year period just ended and the corresponding average of total burned area from 4,874 acres per year to 64 acres per year.

No one would have dared predict back in the early thirties that anything like this could be accomplished, especially in so short a time. It is the more remarkable as it represents a particularly high-hazard district. Here, of all places, they have attained a burning ratio of 0.006 per cent, which represents only one fortieth of the acceptable burning ratio for West Coast tree farms.

THREE-AND-ONE-HALF CENTURIES OF FOREST TRANSITION

No industry in our country is as much a part of the story of America as the lumber industry. Trace its growth and you trace the progress of a pioneering people, intent on carving their nation and their way of life out of a forest wilderness.

For almost three hundred years, from the inception of the industry in 1608, at Jamestown, Virginia, to the closing years of the nineteenth century, this country got along without industrial forestry or forestry of any kind. The time for this attribute of forest depletion and population growth had not arrived.

America was in the process of pioneering and land settlement. The population was small; forest resources were seemingly inexhaustible. There were millions and millions of acres of potentially good farmland covered with forests, and the task before the land-seeking settlers was to get rid of these forests rather than to grow new ones. In that setting, forestry had no constructive function to perform.

Around the turn of the present century, this country's attitude toward its forest resources was undergoing a rapid change; some 200 million acres out of America's original wooded area of 900 million acres had been deforested for conversion into farms or other nonforest use. The population was growing at a rapid rate. Lumber production was heading upward toward an all-time high of 45 billion feet in 1909. Forest fires were taking a terrific toll. Out of all this came the conclusion that the time had arrived for this country to start looking after its remaining forests along sound forestry lines.

And so it was that during the first two decades of this century, a period of transition toward, or preparation for, forest management ensued. Among important developments of this period was the setting aside and organization of the National Forests, the creation of the Forest Service, the start of most of our present forestry schools, the establishment of co-operative forest fire protective associations, the enactment of better state laws pertaining to forest fire protection, and the awakening of the public to the importance of forest management.

The next major period of development falls between the two world wars; more specifically the twenty-year period from 1920 to 1940. The first of these two decades started off on an optimistic note for the lumber industry of the Pacific Northwest. This region had climbed to the lead position in lumber production; the South had started to decline. Prospects for expansion of markets for western lumber looked good. A great expansion in production capacity was underway, with new plants building and old ones being modernized and speeded up. Prosperity was around the corner and "normalcy" had been left behind.

It was at this stage that the term "industrial forestry" started to get into circulation. Several large concerns were seriously developing long-time operating plans, including proposed measures for management of their forest lands. Some concerns carried this beyond the talking stage, and a few even went so far as to undertake planting and seeding of cut-over lands.

A review of these early planting and seeding developments shows that some of them turned out well, but that others failed. These failures were severe and costly. The reason for failures was destruction by fire, and the lesson taught by these failures was that in the high-hazard Douglas fir belt it was wholly unsafe to practice artificial reforestation until a far higher standard of fire protection could be attained. By the same token, higher standards of fire protection were equally essential for naturally restocked lands, where fires were taking heavy tolls. The second decade of this twenty-year period coincided with the depression years. The industry's great hopes for market expansion and rising prices took an opposite turn toward disastrous decline in volume and a ruinous drop in prices. For almost a decade this industry, with its greatly expanded plant capacity and huge surplus of cheap, quick-liquidation timber, carried on under the handicap of practically constant overproduction for the limited markets available.

In the meantime, some of the visible signs of activity in industrial forestry, such as artificial planting and seeding, disappeared from view. However, the

short interlude of the N. R. A. days brought minimum forestry requirements into the picture, and these remained after the N. R. A. went out. In addition, there were some significant basic changes taking place which were not too evident at that time. One was the gradual removal of the over-burden of huge volumes of weakly held, speculatively owned, quick-liquidation timber, which had been the cause of this region's chronic overproduction troubles. The other was the revolution which was taking place in methods of logging and log transportation. When the depression came to an end, the logging industry had practically abandoned the old style of railroad logging and unrestricted clear-cutting, using huge, steam-driven, cable-logging machinery. Instead, the modern type of motorized logging, featuring motor trucks, bulldozers, logging tractors, tractor donkeys, and mobile loaders had come into the picture. This gave the industry flexibility which was needed for modern logging, and at the same time provided the permanent road system required for good forestry and for good fire protection. Thus the groundwork was accomplished for much of the industrial forestry development that was to follow.

NORTHWEST INDUSTRIAL FORESTRY TODAY AND TOMORROW

Finally we come to the present period, which dates back to 1941—the year when the industrial tree-farm movement began. Since that year, we have seen timber values advance from the low level of the depression period to the high level of the present decade.

For the first time in the timber history of the Pacific Northwest the industry has been able to absorb a strong, long-sustained rise in values without experiencing stoppage and reversal by a floodtide of overproduction based on huge quantities of cheap, quick-liquidation timber. The days of large surplus supplies of cheap timber are gone forever. And for the first time in the timber history of this region a value level has been reached which makes timber-growing a good, sound, profitable business—a good business for now, and a particularly promising business for the long-term future.

Backed by this amazing economic upsurge—included in which are the forces of invention, research, management skill, and forward-looking management policies—industrial forestry, during this period, has gone forward as never before. This forward movement has taken place along several different lines:

1. Progress toward closer utilization in the woods by prelogging, relogging, or closer prime logging. This varies from the most inspiring performance displayed by some of the better integrated forest industry companies to good-to-medium performance in cases where economic access to wood-hungry pulp mills is lacking. The over-all regional progress is impressive. The combined effect of more complete timber utilization is a remarkably great increase in the regional inventory of standing timber.

2. Progress in wood utilization at manufacturing plants. The important contributing factors here have been:

- a. Hydraulic and mechanical barking; permitting full wood utilization in the case of pulp logs, and important by-product utilization in the case of saw logs;
- b. The build-up of wood-fiber manufacture other than pulp, which serves to widen the opportunities for by-product utilization and to extend such opportunities to areas beyond economic reach of present pulp mills;
- c. Development in bark-utilization and wood-chemical fields.

3. Progress in second-growth stand management, chiefly in the form of thinnings, which has been pushed ahead remarkably in some cases. In a region-wide sense, however, it still has a long way to go.

4. Progress in reforestation, both by natural and artificial means. The sum total advance for the region as a whole has been impressive, to say the least.

5. Progress in fire protection. Here again, progress on a region-wide basis has been remarkably great. Fire losses have been reduced to the point where the industry has found it safe to go ahead with investments in artificial reforestation of tree-farm lands. This was not the case twenty years ago.

6. Progress in industrial forestry thinking. This, of course, is the force behind the forward move in industrial forestry. Prior to 1941, when timber values were discouragingly depressed and utilization standards were correspondingly low, forestry was not an attractive business. As timber values and utilization standards advanced, forestry as a business began to look more and more attractive. Perhaps the best over-all indicator of how fast industrial forestry thinking has been advancing on a region-wide basis is the rate at which values have been advancing on premerchanted second-growth lands—from the zero level of the depression period and prior years, to the amazingly high value level of today.

And so it is seen that progress of rather astounding proportions has taken place during the 15 years that have elapsed since 1941. Surely in the forestry history of the world there has been nothing that compares with the dynamic developments and swift course of events of this remarkable period.

This brings us to a turning point in this discussion, at which we cease to look back on events of the past to take a forward glance at "the shape of things to come." Here one could leave the firm ground of history and take off skyward along the misty paths of the prophets. But let us try to keep one foot on the ground as we venture ahead into the immediate future.

Further progress in utilization practices in the woods is not only a logical prediction, but one which appears inevitable. The best performance of today should be the average performance of tomorrow, and by tomorrow we mean, perhaps, the next 15 years. This may require a further rise in timber values, or further improvements in logging equipment and methods or it may require the establishment of wood-fiber manufacture in localities which now lack economic access to wood-hungry wood-fiber plants. The establishment of new plants in this field must necessarily be governed by marketing possibilities for the products involved, and this will probably be the most serious restraint on the rate at which progress may be made.

As a new field for progress in utilization in the woods, some thought should be given to whole-tree logging, as proposed by Koroleff. This involves yarding the trees, complete with limbs and foliage, to the load-out landing where the limbs and foliage would be put through a chipper and shipped to a manufacturing plant. There the limb-wood chips would perhaps go into particle board, or a similar product, while the foliage would go into extractives or other wood-chemical processing. Whole-tree logging, as I see it, holds its greatest promise for second-growth thinnings where the trees are short, and the limbs are short and flexible. It would have an important effect on cleaning up the woods, reducing man-hours of work in bucking and limbing, and reducing trunk injuries to residual stands.

In the fields of wood utilization and new products development at mills and manufacturing plants, the future certainly holds great promise for further progress. Research and development along these lines is constantly gathering

momentum. Hardly a month goes by without some new, potentially important development taking place.

In the field of second-growth stand management the future looks good and solid. The progress made during the last ten years has blazed the way. The best performance of today should be the average performance of tomorrow.

The same logical advance applies to fire protection and also to reforestation both by natural and artificial means. In this field the industry has come a long way during the last 15 years, but there is much unfinished work to do, and that's where the chance for further progress lies.

With respect to artificial reforestation, there is also the up-and-coming field of forest genetics to consider. Certainly nothing can be of much greater importance for the long pull than improvement of our forest trees to bring out superior strains, races, and crossbreeds whereby better qualities and greater quantities can be produced per acre of land.

On the list of possibilities for future progress we also have soil improvement; through the use of the trace elements, the use of fertilizers, and through drainage of swampy lands. Prior to 1941, when timber values were low and industrial forestry prospects even lower, any mention of possibilities of this sort would have met with a laugh or a sneer—and rightly so in the light of the economic prospects of that time. Today, as we try to evaluate these things on our higher-value plateau, we encounter less skepticism and more encouragement. And if and when we get the full facts as to the merits of these possibilities, and perhaps at the same time find ourselves on a basis of even higher values, we may indeed find the industry pushing ahead into these fields with the same vigor that has been displayed in the other fields.

"Nature abhors a vacuum," and the industrial forester of the future is likely to abhor the existence of any forest land within his area that is not properly covered with a fairly full stand of growing trees. Ultimately, as and if the value level pushes up further and further, he may abhor seeing any of his forest land carrying anything less than a full stand of superior breeds or races of trees.

Just how fast and how firmly industrial forestry in this region will progress into this expanding and improving future, no one can safely predict. So much depends on the trend of timber values as we move along into the future, and that in turn depends on many other trends, complexities, and imponderables that may arise.

To me, as a layman, it would seem that the most significant development which will surely have an important effect on future timber values in this region is the rapid growth of population in the Western states. The great handicap against the forests of this region has been the fact that home markets for the products have been small, and the distances and freight costs to the larger Middle-Western and Eastern markets have been very high. As population in Western states increases, there will be less need for shipping our products to distant points where we are handicapped by competition from the South, as well as from locally produced material.

According to Dr. Weldon Gibson of the Stanford Research Institute, the population of the Western states (California, Oregon, Washington, Idaho, Montana, Wyoming, Utah, Nevada, and New Mexico) has been increasing percentage-wise two-and-one-half times as fast as the national average. Today the population of these states is estimated at 23 million. Gibson's forecast for 1975 is 39 million, and his projection for the year 2000 is 75 million, or around 27 per cent of the forecasted U. S. population at that time. At this rate, how

long will it be before the forest industries here in the West will find that these Western states will need practically all of the forest products produced in the West? When that day arrives, it no longer will be necessary to hurdle the handicap of long, costly freight hauls on basically low-priced materials, which by all logic should not have to be shipped very far to reach markets.

Assuming that the Western states will eventually need the entire production of local forests, the position of this region as a step-child in the national forest products marketing picture will be changed; perhaps reversed. In other words, may it not be that instead of being producers in a region handicapped by high freight costs in reaching the best marketing areas of this country, the Western forest products producers may find themselves located in the best marketing area, with a decisive freight-cost advantage over competitors in the South, the Middle West, and the East? The year 2000, with a predicted Western population of 75 million, is only 43 years in the future—only about one-half of a crop rotation ahead, in terms of this long-term business of timber-growing.