FOREST WORKER

May, 1932

Issued bimonthly by the FOREST SERVICE
UNITED STATES DEPARTMENT OF AGRICULTURE

CONTENTS

Announcements

Allegany School of Natural History Announces Courses

The sixth annual session of the Allegany School of Natural History, conducted by the Buffalo Society of Natural Sciences in cooperation with the New York State Museum, will be held July 5–August 24, 1932, in Allegany State Park, N. Y. Courses will be offered in field zoology, field geology, field botany, natural history of birds, and nature study. Enrollment is limited to 50. Correspondence regarding registration should be addressed to Harold T. Clement, Curator of Education, Buffalo Museum of Science, or to Robert E. Coker, Director, Allegany School of Natural History, Box 950, Chapel Hill, N. C.

American Association for the Advancement of Science

The American Association for the Advancement of Science and a number of its associated societies will meet at Syracuse, N. Y., June 20–25, 1932. Interesting programs are scheduled in botany, zoology, mathematics, physics, chemistry, geology, psychology, economics, medicine, engineering, and agriculture. Dean Hugh P. Baker of the New York State College of Forestry is arranging the program for a symposium on land use. Field trips are planned to the Geneva Experiment Station, the New York State College of Agriculture at Cornell University, and many interesting places around Syracuse.

The FOREST WORKER is published by the Forest Service, United States Department of Agriculture, Washington, D. C. Jean Kerr, editor. Material offered for publication in the FOREST WORKER should be addressed to the editor.

Because the free edition is necessarily limited, this periodical can be distributed without charge outside of the Government service only to such persons and organizations as State forestry and conservation officials, State agricultural extension directors, faculties and libraries of forest schools, and forestry associations. Others desiring to obtain copies of the FOREST WORKER can do so by sending 5 cents for a single copy or 25 cents for a year's subscription to the Superintendent of Documents, Government Printing Office, Washington, D. C. Foreign subscriptions: Yearly, 35 cents; single copies, 7 cents.

FOREST WORKER

Washington, D. C. MAY, 1932 Vol. 8, No. 3

State Forestry

Maine Tests Indicate Control Method for White Grubs

By H. B. PEIRSON, State Entomologist, Maine

During the past year 11 nurseries cooperated with the Maine Forest Service in working out a satisfactory control for white grubs. A total of 107 plots were treated with crude arsenic in quantities varying from 100 to 1,500 pounds per acre. Seedlings and transplants of 11 coniferous species were used in the experiments. The plots included three types of soil—fine sandy loam, sandy loam, and sandy silt loam.

The results strongly indicate that 200 pounds of crude arsenic per acre should be used the first year of application. In following years 150 or 100 pounds per acre will usually prove satisfactory. In plots treated for the first time with 200 pounds of crude arsenic per acre, the grubs killed an average of only about 2 per cent of the trees, whereas on untreated check plots they killed as many as 63 per cent. No species of tree experimented with was immune to damage. The heavy soils appeared to be most favorable to grub damage, and the nurseries most subject to grub injury were those using manure as a fertilizer. It is believed that manure attracts the beetles.

Crude arsenic costs about 7 cents a pound. The required quantity is mixed with either dry soil or commercial fertilizer and broadcast evenly over the plot, then harrowed or spaded into the soil.

A series of potted Norway pine trees were carried through the past winter to determine how much arsenic trees can stand in the soil. Quantities of from 585 to 37,484 pounds per acre were tried. Nearly all trees in soil treated with 4,500 pounds or more per acre died, and one series treated at a rate of 2,343 pounds per acre were killed. An analysis of needles from trees that had died showed relatively large quantities of arsenic present.

The appearance of trees injured by arsenic is very distinctive in the early stages, in that the needles are brown at the base while still green at the tip.

One plot of Scotch pine seedlings which had been treated with crude arsenic at the rate of 1,500 pounds per acre showed possible signs of burning. This was the only arsenic injury found in the field. There appears to be some danger of the accumulation of excessive quantities of arsenic in soil that is treated with heavy doses year after year. Quantities which we have found satisfactory should cause no injury. The arsenic is quite soluble and leaches out. In several nurseries what was termed "arsenic injury" was in reality due to other causes.

The results from the past season's work are inconclusive owing to the great variation in the numbers of grubs present in different plots. This year we are not asking any nursery to continue this work. Instead we plan to run a series of control plots in which known numbers of grubs are present, using known quantities of arsenic.

New York Conducts Planting Experiments on Areas Specially Reserved

Continuing its work of establishing experimental forest plantations, in the spring of 1931 the New York State Conservation Department set aside exclusively for experimental planting an area of about 70 acres in the town of Charleston, Montgomery County. This area, including about 45 or 50 acres of old fields, was chosen as typical of much of the land now being acquired by the department for reforestation in southern and central New York. It lies at 1,300 feet elevation near the crest of the formation known as "Oak Ridge," which divides the Schoharie Valley from the Mohawk, and is readily accessible from U. S. Route 20 at Sloansville or from the Mohawk Valley route at Fonda. The soil is principally of the Volusia series, a type on which occurs much of the abandoned agricultural land of this section.

One purpose in setting aside this area is to develop a forest arboretum in which can be grown experimentally a number of species other than those now being used generally in reforestation in New York and special strains of species such as Scotch pine. The half-acre has been selected as the smallest unit on which the conditions of a forest stand can be obtained. In 1931 arboretum plantings were made with *Pinus ponderosa* and its Rocky Mountain form, designated by some botanists *Pinus scopulorum;* with *Pinus sylvestris* (Scotch pine) of the Riga and Czechoslovakian varieties and of strains naturally reproduced at Boonville, N. Y., and Halsey, Nebr.; and with Asiatic chestnut.

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Parts of this area will be used for "indicator" plantings such as have been developed in previous years at Forestport, Oneida County, and on the Connecticut Hill State Game Refuge in Tompkins County. The object of these experiments is to test, side by side, seedling and transplant stock of the species commonly used in reforestation work in New York. The trees are planted 6 feet apart each way by the conventional method of making a slit with the grub hoe. In preparation for the planting the turf is stripped from half of each plot. On the Oneida County area some plowing has been done preliminary to planting.

The third type of experimentation for which the Montgomery County area is destined has to do with the behavior under field conditions of trees produced in the course of various nursery experiments. Trees will be planted here that are the product of tests with commercial fertilizers, different methods of sowing, and the use of paper mulch. Last year 94 lots of trees from experimental plots at the Saratoga nursery were set out on the area, including 3 and 4 year transplants of northern white pine, Norway pine, Scotch pine, Norway spruce, white spruce, and northern white cedar from plots that had been treated with mineral and organic fertilizers. In the treatment of these trees 10 different fertilizers had been used singly or in combination.

A piece of forest-preserve land about 63 acres in extent in Essex County has been reserved for experimental use. This area, lying at 1,700 feet elevation and typical of much of the abandoned farm land in the Adirondacks, is well adapted for testing species and strains of five-needled pines for hardiness and resistance to the white pine blister rust. Here 1,000 trees each of northern white pine (*Pinus strobus*), western white pine (*Pinus monticola*), and limber pine (*Pinus flexilis*) were planted in 1931.

In the fall of 1931 a 60-acre plot of State land in Saratoga County was made available for experimental planting in connection with pathological investigations at the Saratoga nursery. Here trees that develop pathological conditions in the nursery will be set out at a safe distance from plantations of healthy trees in order that the progress of disease or of the trees' recovery may be observed.

Planting experiments which the conservation department has under way on other lands include the propagation of Japanese black pine (*Pinus thunbergii*), which is believed to be especially well adapted for growing under the maritime conditions that prevail on a great part of the area of Long Island. The actual planting of this species is being supervised by the Long Island Park Commission.

By order of the Oregon Tax Commission, classification as reforestation land was recently extended to 348,354 acres of land in Clatsop, Columbia, Coos, Tillamook, Marion, Linn, Lane, and Deschutes Counties.

Relief Agencies Chosen as Medium for Recruiting New York's Spring Planting Forces

Plans adopted by Conservation Commissioner Henry Morgenthau, jr., for reforestation work in the spring of 1932 on lands recently acquired by the State of New York provided that all the labor used should be employed through unemployment relief organizations. This involved employing about 3,000 men through relief organizations in the 15 counties where State lands were to be reforested. All men engaged were to be given six full days' work each week, when weather conditions permitted, for from three to eight weeks. The expense of the work, approximately $150,000, was to be met from the department's regular appropriations, not from a special relief appropriation.

Of the $20,000,000 which the New York Legislature made available to the State's temporary emergency relief administration, the conservation department received $400,000. Much of this has been used on State parks, where men so employed have carried out not only cleaning and clearing operations but much improvement work of a permanent character such as building trails, planting trees and bushes, and leveling recreational areas. Allotment of $70,000 of this fund to gipsy-moth control made possible the employment of extra men for this purpose during the period, between leaf fall and the accumulation of snow on the trees, when gipsy-moth clusters are most easily detected. Officials of the conservation department have expressed satisfaction with the quality of the work done by men employed with relief funds.

Minnesota Patrolmen's School

One patrolman at large from each forestry district of Minnesota attended a patrolmen's school held by the State forest service at Grand Rapids March 3–12, 1932. Morning sessions, held in city hall in rooms of the city council, were devoted to instruction in various phases of State forestry work and discussion of district problems and forest-service policy. A representative of the State attorney general's office gave instruction in legal matters. Each student had his turn as a speaker and six students engaged in a debate. Afternoons were given over to practice of field methods.

Hawaii's forest reserve system was enlarged by 42,117 acres in the year ending June 30, 1931, reaching a total of 1,021,314 acres. The Territory owns 65 per cent of the lands included in the reserves on the five largest islands, and completely controls 13 areas, totaling 21,439 acres, of privately owned land within the reserves. One-fourth of the total land area of the Territory is now under forest protection.

Forest-Protection Surplus Enables Maine to Reduce Tax

When Maine had spent $196,929 on the protection of its forestry district in 1931, there remained on hand $151,992 of protection funds for the district. Accordingly landowners have been allowed a 30 per cent rebate on their 1932 assessments.

Fire-protection expenses for 1931 in the forestry district, which is a 10,000,000-acre area constituting roughly the northern half of Maine, included $105,072 for personnel, $27,662 for improvements, and $46,157 for tools and supplies. The 86 fires that occurred during the year were held to an average of 6.5 acres each, and less than 0.006 of 1 per cent of the district's total area was burned over. In the 5-year period 1925–1929 fires had covered yearly an average of 0.038 of 1 per cent of the district's area.

In the 11 organized towns in southern Maine where a cooperative forest-protection system was put into effect in 1931, involving a total area of 5,000,000 acres, the system has given general satisfaction. Fires reported during the year numbered 134 and covered a total area of 4,275 acres. In each of the towns a county warden was employed at State and Federal expense. Each warden was equipped with a small patrol car and with sufficient fire-fighting tools for 18 men. The State and the towns cooperated in buying 332 portable 5-gallon back pumps and 281 fire-fighting tools. Six steel lookout stations were erected.

The 992 forest fires recorded in 1931 by the Connecticut Department of Forestry burned an average of 13½ acres each, as compared with an average of 35½ acres for the past 11 years. Fires that were confined to areas of less than 10 acres each composed 62 per cent of the year's total.

For the Lower Peninsula of Michigan the lapse of time between the sighting of a forest fire from a State lookout tower and the arrival of a State fire-fighting crew at the scene of the fire averaged 39.7 minutes in 1931. For the State as a whole the "elapsed time" averaged 53 minutes. Fires recorded during the year by the State division of forestry totaled 4,133.

Rhode Island Club Plans State Forest Purchase

The Edgewood Women's Club, of Rhode Island, is leading a movement for the purchase of Rhode Island's first State forest. The club has taken an option on a woodland area of 125 or 150 acres in the township of Glocester adjacent to the Putnam Pike, an improved State highway. This land, which is stocked chiefly with young hardwoods, is so located that hundreds of acres of similar adjoining land could be added later at small cost. It is planned to dedicate the projected State forest as a memorial to George Washington and to use it for forestry demonstration. At the invitation of the Edgewood club various patriotic and civic groups and several individuals have each contributed $25 toward the purchase.

Acceptance by the State of gifts of land or money to be used for forest demonstration or experimentation purposes is authorized by a Rhode Island law enacted in 1931.

Maritime pines planted two years ago on grounds of the naval radio station on the north side of Coos Bay, Oreg., as an experiment in sand fixation showed a survival of about 75 per cent when inspected recently by S. L. Miller, of the State forester's office, and J. A. Walsh, district warden of Coos County. Native beach grass was planted on the area in rows about 2 feet apart a year before the pines were planted. The trees were set out 6 feet apart each way. The planting covers about 100 acres.

The number of trees planted on Hawaii's forest preserves in a single month reached its peak in October, 1931, when 49,764 trees of 46 species were planted. During the same month 36,955 trees were distributed from the Territorial forest nurseries to farmers. The George Washington bicentennial grove at Mokapu Game Farm was enlarged by the planting of the second 1,000 coconut trees.

Pine trees were planted on 20,000 acres of Michigan's State forests in the fall of 1931. The total acreage reforested by the State during the year was 31,667. Michigan State forest areas on which trees have been planted now total 129,600 acres, or about one-fifth of the acreage of the 12 State forest units.

State-grown forest trees that were planted in Pennsylvania in 1931 numbered 8,624,985. Of this total 605,300 were set out on State forests, 262,000 were planted by 13 mining companies, and 250,000 were used by 32 municipalities on watershed, forest, and park areas. The State's income from the sale of forest trees in 1931 was $15,301.09.

In beginning a new series of broadcasts over radio station KOAC this spring the Oregon State forestry organization chose to discuss principal forest trees of the State, telling something about the discovery and naming of the species and giving some identifying characteristics of each.

Oregon Fires of 1931

The 1,621 fires that occurred in 1931 on Oregon lands patrolled by the State and by forest-protection associations burned over 188,494 acres of forest land. The total area burned included 32,007 acres stocked with mature timber, of which 156,125,000 board feet is estimated to have been destroyed. In addition it included 71,735 acres stocked with young timber. Incendiarism was identified as the cause of 548 of the fires and smokers were charged with starting 415 of the remainder. Lightning fires were fewer than in any other season since 1916, numbering only 85.

Funds expended during the year in fighting fires on State and private land in Oregon totaled $211,124. The total amount expended during the year for protecting these lands from fire, including expenditures on improvements, was $611,353.

A natural arboretum discovered in 1931 in a side gulch of Makua Valley, Oahu, Hawaii, contained within a radius of 200 yards no less than 42 different kinds of native Hawaiian trees. The native kolomona was found here to attain a height of 38 feet.

The city of Newnan, Ga., recently planted 27,200 tree seedlings on 48 acres of its town forest at an average cost of $3.62 per acre. The trees included 22,000 longleaf pines, 2,200 black locusts, and 2,000 black walnuts.

Education and Extension

Forestry at the University of Arkansas

Two forestry courses are now offered by the University of Arkansas, under the direction of J. R. Cooper, professor of horticulture and forestry: one in farm forestry, stressing the place of forestry in farm economy, which is required of all agricultural sophomores; and one in elementary silviculture, both theoretical and applied, which is an elective open to all agricultural students with sophomore or higher standing.

As summer work the university's department of horticulture and forestry and its department of agricultural economics are making a study of farm forestry on marginal lands in Arkansas, with the cooperation of the Southern Forest Experiment Station. Throughout the year physiological and morphological research is being conducted under the supervision of Lewis M. Turner, assistant professor of forestry.

Maine Students Occupy New Forest Camp

Senior forestry students of the University of Maine encamped during the past winter on Indian Township, near Princeton, Me., where they had the use of new buildings erected in 1931 for permanent use by the university. Authority to permit the university to erect and maintain a forestry camp on Indian Township, which is State property, was granted by an act of 1930, which provided that logs for building the camp might be taken from the township without charge. Curtis M. Hutchins, of the Passamaquoddy Land Co., enabled the university to take advantage of this offer by giving $1,000 for construction expenses. A site was chosen just north of the junction of the Grand Lake Stream road with the Houlton road. The completed camp consists of four buildings of solid log construction, on concrete piers. The cook-camp, which includes an assembly room, is 30 by 60 feet, and there are four bunkhouses 18 by 24 feet.

While in camp during the past winter the students traversed roads, ran lines, and made plot estimates of the standing timber. A detailed topographic map was prepared for the areas covered, together with a type map of the present stand. Sample plots for the study of growth and yield were laid out, and a careful tally was made of the present timber stand.

Ultimately it is expected to put Indian Township under permanent forest management on a sustained-yield basis.

Beginning with the fall of 1932 the forestry department of the Michigan State College plans to offer opportunity for specialization in municipal forestry. A series of courses designed to meet the special needs of men engaging in municipal, county, and public-utility forestry will be available to juniors and seniors.

Of the 657 living graduates of the New York State College of Forestry whose occupations are known to the college, 67 per cent are engaging in work of the type for which they received training at the college. The total number of men to whom the college has granted degrees since it was founded in 1912 is 698 and the living graduates number 685.

Twenty-nine North Carolina firms that will buy veneer logs direct from farmers are named in a list circulated by Extension Forester R. W. Graeber. The list indicates in most cases what kinds of logs the firm will purchase.

Forest Service Notes

Marks of Fire on Bark of Southern Hardwoods Afford Measure for Internal Wounds

By measuring in the field the external discoloration left by fire on the trunks of southern mountain hardwoods, silviculturists are now able to estimate fairly accurately the size of the wounds which the fire has left in the inner bark. The correlation of size of exterior discoloration with size of interior wound and the simplified field method for measuring discoloration that permit this are the work of R. M. Nelson and I. H. Sims, of the Appalachian Forest Experiment Station. The data on which their findings are based were obtained by examining 350 trees, from 4 to 28 inches in diameter at breast height, on an area at McFalls Creek, Va., that was burned in the spring of 1930. These trees showed no crown damage and no other abnormalities aside from bark discoloration.

Of the five important tree species present on the area examined, for a given diameter and a given area of discoloration, yellow poplar showed the smallest wound and scarlet oak the largest. White oak, chestnut oak, and black oak ranked in different orders somewhat according to the particular diameters and areas of discoloration chosen as the basis of comparison.

On the average, in the case of trees 10 inches in breast-height diameter, when fire causes 5 square feet of discoloration on the outer bark it leaves an inner wound of 1½ square feet on yellow poplar, 3 square feet on chestnut oak, 4 square feet on white oak, 4½ square feet on black oak, or 7½ square feet on scarlet oak. The correlation in size between the scorched area and the internal wound was fairly high except in the case of scarlet oak. This species is so susceptible to injury that in some cases the inner bark had been killed to a height of 20 feet above the highest point of discoloration on the exterior bark.

An attempt to classify the trees according to the intensity of heat to which they had been subjected by dividing the discolored areas into three classes—scorch, char, and burn—led to a slight gain only in correlating external discoloration with internal wound.

Experimental methods have been devised for comparing the insulating properties of different barks at different seasons. An increase of as little as one-tenth inch in bark thickness has been found to alter very decidedly the length of time required to kill the cambium.

Preliminary observations made on the McFalls Creek burn within a year after the fire indicated no correlation between severity of basal wound and abundance of basal sprouts.

Further studies have been undertaken to determine the effect of basal wounds on growth and on the entrance of heart-rotting fungi. Like other burned-over hardwood areas in the region, the McFalls Creek burn showed an abundance of fungus fruiting bodies the second summer after the fire. The investigators estimate that about 90 per cent of the butt rots in hardwoods of the Southern Appalachians enter through fire wounds.

The Colorado National Forest, in northern Colorado, has been renamed the Roosevelt National Forest, in commemoration of President Theodore Roosevelt. This forest, having a gross area of 1,101,958 acres, lies on the eastern slope of the Continental Divide and extends from Clear Creek to the Wyoming State line.

Operation to Control Douglas Fir Beetle on the Shoshone

By J. A. Donery, United States Forest Service

During the summer of 1931 forest officers on the Shoshone National Forest, in northwestern Wyoming, found that the Douglas fir beetle (*Dendroctonus pseudotsugae* Hopk.) had attacked Douglas fir on areas where the timber had been damaged by the spruce budworm (*Cacoecia fumiferana* Clem.). Members of the Bureau of Entomology, after examining the timber on several drainages to ascertain the extent to which beetles were present, recommended that the infested trees be felled and cut into logs to be skidded, decked, and burned. Because of the fact that the insect passes the winter in adult form and because of the thickness of the bark, it is necessary that the bark from the infested portion of the tree be completely destroyed.

Beetle infestation was found on 12 areas ranging from 128 acres to 1,280 acres and totaling 5,786 acres, located along the North Fork of the Shoshone River and its tributaries, from Eagle Creek eastward for a distance of approximately 15 miles. These areas consist largely of very rough, steep, rocky slopes. Narrow strips of level land border the streams, and occasionally areas of gently sloping bench land are found at the bottom of the steep slopes.

The timber on the areas covered by control work consisted almost entirely of Douglas fir, with only an occasional Engelmann spruce or limber pine tree. Two of the larger areas had been rather heavily cut over during the period 1927 to 1930 in an effort to salvage the merchantable timber that had been killed or seriously damaged by the spruce budworm. On the greater

part of the total area worked over the trees were thrifty in appearance; if they had not been weakened by the attacks of the spruce budworm it is possible that they would have withstood the beetles. The trees attacked by the beetles were of fair size, those treated ranging from 5 inches to 42 inches in diameter with an average diameter of 14 inches. In fact, a large proportion of the infested timber was suitable for the production of sawed railroad ties and lumber.

A marking crew composed of an entomologist and two rangers inspected each tree on the timbered portion of the drainages for evidence of beetle infestation and marked the infested trees for cutting, using 4 by 6 inch muslin tags. Each tag bore a number. This number was later entered in a scale book with the diameter of the tree. After the tree had been cut, the number of logs obtained was entered. The log scale and tree volume were later computed from volume tables and a complete record made.

The cutting and burning operation was directed by a logging engineer assisted by a ranger experienced in logging methods. His crew consisted at first of 15 men and 2 teams but was later increased to 38 men and 3 teams. The operation was begun October 5 and was completed December 31.

Sawing crews of two men each felled the trees and cut the infested portions into logs. The sawyers were followed by swampers, usually one swamper to two crews, who limbed out the logs and cut skid trails. As a rule the swampers peeled the bark from the stumps and placed it on the log decks to be burned. At times the bark was placed on the ground with the inner side upward in order that the adult beetles and larvae might be eaten by birds or rodents or otherwise killed by exposure. Along roads and trails the brush from the tops of trees was piled and burned. Elsewhere the tops were left untrimmed where they fell.

Skidding and decking crews followed the swampers, each crew consisting of a teamster and team, a chain tender, and a deck man equipped with a cant hook. When the logs had been skidded to a convenient point they were rolled into decks by means of skids. The decks varied in size according to the number of logs available at each location; skidding distances were held to a minimum consistent with the need of obtaining a sufficient number of logs in each deck to insure complete burning. Burning of the decked logs was begun as soon as there was sufficient snow on the ground to prevent the spread of fire, and from that time on the decks were burned as they were completed. On portions of the areas where the slopes were too steep to permit the use of teams, crews of from three to six men skidded and decked the logs by hand. On slopes so steep that decking of any kind was impractical the logs were hand-skidded to a point where they could be reached by the teams and were then skidded, decked, and burned in the usual manner.

A total of 2,427 man-days and 134 team-days were spent on the work, the average number of trees treated per man-day being 5. The work-week consisted of 44 hours (Saturday was a 4-hour day). The men received $3 (teamsters $3.50) for an 8-hour day and board. The cost of board amounted to $1 per man per day. A total of 12,038 trees were disposed of, the tree volume being 2,132,000 board feet. Approximately 21,000 logs were cut from the 12,038 trees, with a volume of 1,687,000 board feet, log scale. The cost of the work amounted to $11,938, averaging $7.08 per 1,000 board feet, log scale, or $0.98 for each tree treated.

A sawmill camp located near the center of the area to be worked over was available for use, so that it was not necessary to construct camps or to use tents. The camp was located on the highway that traversed the area, and this made it possible to transport the men to and from work in trucks. More than two-thirds of the trees cut were within 3 miles of camp, and the presence of roads in several of the drainages helped greatly in getting men to the job without loss of time.

The season was very favorable for conducting work of this character, as little snow fell during the time operations were in progress. The snow was never deep enough to interfere with the logging operations; in fact, skidding was accomplished more easily where there was snow than where the ground was bare.

Local men were employed on this project. While very few of them could be classed as having experience in woods work, most of them were willing workers and their output increased as they gained experience.

Photographic Recording of Forage Production Now Practical

Photographic methods of recording forage production and vegetational changes on sample plots have been brought to a practical stage through several seasons' experimental work on the national forests of Colorado. C. A. Kutzleb, who has had direct charge of this work, has developed a technique by which meter-square plots can be photographed at moderate cost in time and money. The camera is suspended from a tripod and the exposure is made at a point directly above the center of the plot, at a uniform height from the ground. To photograph an average plot requires only about 30 minutes. As improved by Mr. Kutzleb the equipment is so compact that it can easily be carried by one man. To express the quantity of growth produced by different plots as shown by the photographs, the tufts or clumps of plants are outlined and their perimeters are measured according to scale.

This method of recording forage production will undoubtedly prove useful in combination with charting and listing in the field. As compared with a map developed by charting, the photograph has the great advantage of constituting a complete record of conditions. A chart, even though perfectly satisfactory for its immediate purpose, can not be expected to include

all the detail that may be called for by the subsequent development of research interest in growth features other than those for the study of which the chart was made.

Difficulties are encountered in using this method where forage plants growing in mixture can not readily be segregated. Photography promises to supplement other methods of recording changes in vegetation rather than to replace them.

Northeastern Station Moves to New Haven

Headquarters of the Northeastern Forest Experiment Station will be transferred about June 1 from Amherst, Mass., to New Haven, Conn. Quarters at Amherst, which the station has occupied under a cooperative agreement with the Massachusetts Agricultural College ever since its establishment in 1923, are no longer available. Under new arrangements the station will have the use of offices and laboratories in the Farnum House, Yale University. Headquarters of the United States Forest Service district inspector for the Northeastern States will likewise be changed from Amherst to New Haven.

Memberships in the International Union of Forest Research Organizations have been taken out by the Forest Service for its Washington office, for the 11 forest experiment stations, and for the Forest Products Laboratory, official contribution to the union's work having been made possible through a proviso in the agricultural appropriation act for the fiscal year 1932.

Mortality in Old Field Loblolly Pine

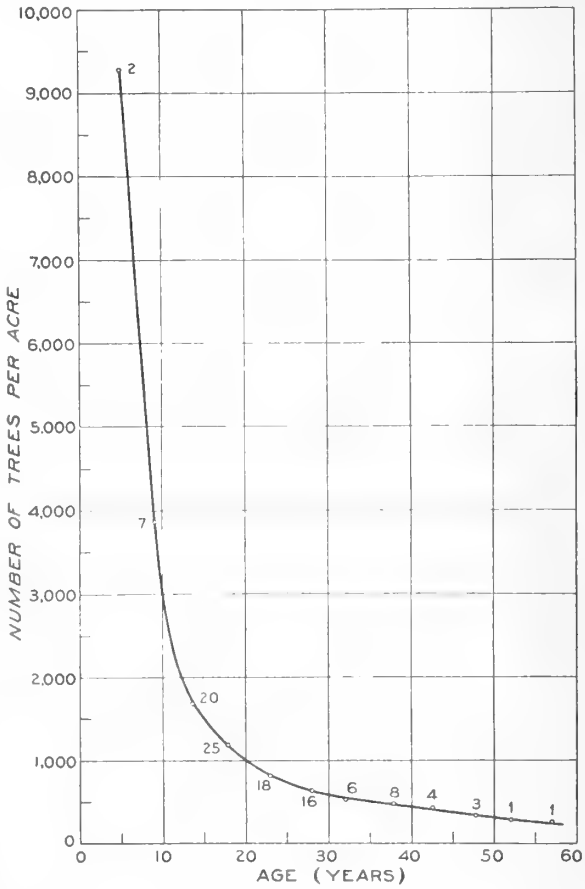
By G. Luther Schnur, United States Forest Service

On the Eastern Shore of Maryland loblolly pine seeds in naturally on abandoned fields, good seed-bed conditions and abundant supplies of seed from adjacent stands of timber facilitating full stocking of these areas. Ten thousand trees to the acre is not uncommon at the inception of the stand. Growth is very rapid and the fight for light, food, and water begins early. During the first 10 years mortality is very high; literally hundreds of the trees are crowded out on each acre.

From 34 permanent sample plots established in 1906 on private property in Worcester County, Md., and remeasured at 5-year intervals, the Allegheny Forest Experiment Station has 111 individual plot measurements. The density of stocking on these plots ranges from 70 to 100 per cent. The average site index of the dominant and codominant stand at 50 years is 75 feet, the total site index range being but 10 feet. Measurements at 5-year intervals were continued until natural conditions were disturbed by the owners. The numbers of plots measured are as follows:

1906	34	1925	9
1910	23	1930	5
1915	23		
1920	17	Total	111

The stands on the individual plots were sorted into 5-year age classes. The average number of trees per acre in each class was plotted and expressed by a smooth curve, shown in the accompanying figure. The average



number of trees per acre was found to have dropped from 9,270 to 3,000 during the period between the ages of 5 and 10 years, a loss of 68 per cent. This initial period of rapid adjustment was followed by a 15-year period during which the rate of mortality gradually decreased. In this intermediate period the number of trees fell from 3,000 to 700 per acre, a loss of about 24 per cent. The total loss between the ages of 5 and 25 years was 92 per cent. Between 25 and 50 years a steady decrease occurred, amounting to 400 trees, or 5 per cent. The total loss at 50 years is, therefore, 97 per cent.

An Aid for Measuring Mine Props

By R. A. CHAPMAN, United States Forest Service

The great quantities of wood used by the mining industry of Pennsylvania are drawn mostly from local sources. Because these products are sold in small quantities and by a variety of measures it is difficult for the seller or the buyer to appraise them, unless he is skilled in timber estimating. To aid the unskilled buyers and sellers the Pennsylvania State College and the Allegheny Forest Experiment Station have cooperated in publishing a 24-page bulletin entitled "The Measurement of Mine Props: Linear Foot, Top Diameter, Weight, and Volume Tables." The authors are Arthur C. McIntyre and G. Luther Schnur.

Charts from which most of the tables were derived are included in the bulletin. They are of a type that to most laymen would, at first sight, seem very complicated. The authors have devoted some space to explaining the use of these charts; since the bulletin is meant for an audience largely unfamiliar with charts, it seems that more space might well have been given to this explanation.

The authors estimate that the mining industry of Pennsylvania uses annually about 75,000,000 cubic feet of forest products.

Copies of this bulletin can be obtained from the Pennsylvania State College, at State College, Pa.

General Forest News

Fire Resistance of Trees of Northeast United States

By T. J. STARKER, Pennsylvania State College

In each region of the United States some one tree species is reputed among foresters to be the most fire resistant. The Pacific Northwest has its Douglas fir, the South its longleaf pine, the Northeast its pitch pine, the northern Rockies the thick-barked western larch, and California perhaps possesses the grand sweepstakes champions in the Sequoias. After the outstanding tree is named, there is no such unanimity of opinion as to the order in which other species follow. With this in mind an endeavor has been made to list 22 species in the order of their resistance to fire for the Eastern States north of the Mason and Dixon line. The data collected are almost entirely of an empirical character.

A questionnaire was mailed to 48 of the leading foresters familiar with this region and was answered by 41 [1] of them. The questionnaire asked for an opinion as to the relative fire resistance of 40 to 80 year old trees of the various species, the opinion to be based on a consideration of bark thickness, root habit, branch habit, canopy cover, and degree of inflammability of foliage. Some of the replies were complete in every detail, listing the 22 trees in order according to the opinion of the writer, while others were merely comments on a few trees with which the author was especially familiar.

Compilation of the 41 answers resulted in the following ranking of the species: 1, pitch pine (*Pinus rigida*); 2, chestnut oak (*Quercus montana*); 3, Norway pine (*Pinus resinosa*); 4, black oak (*Quercus velutina*); 5, white oak (*Quercus alba*); 6, scarlet oak (*Quercus coccinea*); 7, northern white pine (*Pinus strobus*); 8, eastern hemlock (*Tsuga canadensis*); 9, sugar maple (*Acer saccharum*); 10, red maple (*Acer rubrum*); 11, tamarack (*Larix laricina*); 12, yellow birch (*Betula lutea*); 13, red spruce (*Picea rubra*); 14, black cherry (*Prunus serotina*); 15, Norway spruce (*Picea excelsa*); 16, gray birch (*Betula populifolia*); 17, paper birch (*Betula papyrifera*); 18, aspen (*Populus tremuloides*); 19, white spruce (*Picea glauca*); 20, eastern red cedar (*Juniperus virginiana*); 21, northern white cedar (*Thuja occidentalis*); 22, balsam fir (*Abies balsamea*).

This compilation of opinions based on observation applies to a very extensive area, with varied site conditions and a great range of mixtures. No claim can be made, of course, as to its reliability. It is hoped that concrete data will be forthcoming such as will serve to amplify and correct it. Such data would be useful from the standpoint of forest planting, of forest management, and of forest fire insurance.

Data collected by O. M. Wood, of the Allegheny Forest Experiment Station, on number of trees 6 inches or larger in diameter killed on 11 south Jersey fire-damage plots of 1930 are as follows:

	Total trees	Trees killed	
		Number	Per cent
Shortleaf pine	44	8	18.2
Pitch pine	107	29	27.1
Chestnut oak	13	7	53.8
White oak	92	52	56.5
Scarlet oak	68	43	62.2
Black oak	7	7	100.0

[1] The helpful cooperation of the following is acknowledged: R. D. Forbes, O. M. Wood, S. T. Dana, Leslie S. Bean, Ellwood Wilson, Edward C. M. Richards, W. G. Howard, E. B. Moore, Eugene C. Winch, G. K. Fenger, G. S. McIntire, C. E. Behre, C. R. Tillotson, M. Westveld, R. W. Stadden, E. O. Ehrhart, L. L. Bishop, W. R. Adams, John M. Briscoe, E. N. Munns, John H. Foster, L. J. Young, J. M. Sloan, Geo. S. Perry, S. N. Spring, S. S. Lockyer, H. J. Baldwin, C. L. Woodman, A. F. Hawes, T. Roy Morton, R. C. Hawley, A. B. Recknagel, P. T. Coolidge, E. F. McCarthy, H. O. Cook, Willis M. Baker, T. S. Woolsey, Geo. H. Wirt, John F. Preston, J. W. Tourney, T. C. Harbeson, and Ralph M. Nelson.

In a study of bark thickness on 1,163 oak trees from 2 to 20 inches in diameter A. C. McIntyre, of the Pennsylvania State College, found that chestnut oak led in thickness of bark, followed by black oak, red oak, scarlet oak, and white oak in that order. It will be seen that the questionnaire material agrees rather closely with these two sets of data.

Weevil Does Little Harm to Riga Pine

Examining 19 plots in New York and Massachusetts plantations of the so-called "Riga" strain of Scotch pine, H. J. MacAloney and J. W. Johnston, of the United States Bureau of Entomology, found that the number of leaders dead as a result of white pine weevil attack was very much less than the number in which weevil eggs had been laid. Of the 3,386 trees examined, 1,110 had been attacked, but only 39, or 1.15 per cent of the total number, had died as a result.

In the opinion of the investigators the apparent ability of this pine to withstand weevil attack is probably due to the vigor of the trees and their consequently heavy flow of sap. Weevil attack takes place in the second year of the trees' growth. At the time of attack many of the leading shoots are nearly an inch in diameter at the base, and by the end of the season some of them are as much as 1½ inches in diameter at the base.

Pitch droplets exuding from feeding or egg punctures are the first evidence of attack. The leaders that are killed have the wilted appearance characteristic of weeviled northern white pine leaders. On those that survive, the bark usually has a more or less roughened appearance and sometimes the feeding gallery of a larva is rather plainly outlined.

In recent years the "Riga" strain of Scotch pine has been planted rather extensively throughout the Northeastern States.

The final report of the Society of American Foresters' committee on forest types is now available for distribution as a 48-page paper entitled "Forest-Cover Types of the Eastern United States." Copies may be obtained at 50 cents each from the Society of American Foresters, Hill Building, 839 Seventeenth Street, Washington, D. C.

Foreign Notes

Canadians Use Aerial Photographs in Reporting Fires

Aerial photographs are being used experimentally by the Canadian Department of the Interior as a means of reporting the location of forest fires. Stereoscopic oblique photographs were taken of four of the principal valleys in Banff Park, Alberta, from airplanes flying at an average height of 12,000 feet. A continuous series of 300 overlapping pictures was taken of the Bow, Cascade, Spray River, and Lake Minnewanka Valleys. The two sides of each of the first three valleys named were photographed separately, so that in series the pictures represent a strip of territory 110 miles long. The photographs are the standard 7 by 9 inch size. Under a strong glass they show details of the terrain very distinctly. The use of a stereoscope developed by the topographical survey of the Department of the Interior makes it possible to study changes of elevation and difference in forest types and to distinguish old burns, windfalls, and variations in the density of the forest stands.

One complete set of the pictures was retained at Ottawa, one was sent to Banff, and a third was divided among the wardens so that each warden has pictures of the area which he patrols. Each office and warden was supplied also with a celluloid grid the size of the photograph, divided into inch squares which are numbered along the top and lettered down the sides. Each photograph is individually numbered, and the corresponding numbers are shown on a contour map of the park. Thus a warden locating a fire can state the position in a few words by giving the photograph number and the cross reading of the grid. Use of the grid also facilitates reference to the location of water supplies, good fighting points, and means of approach for fire fighters, and makes it possible to report the progress of a fire to park headquarters or to Ottawa quickly and completely in a minimum of words.

A forestry department has recently been created in the University of Stellenbosch, South Africa, headed by E. J. Neethling, a member of the 1923 class of the Yale School of Forestry. A school for the training of officers for the lower division of the South African Forest Service has been opened, likewise, at Saasveld, under the direction of S. J. Meiring. Mr. Meiring is a Yale forestry graduate of the 1926 class and has heretofore had charge of the Bloemfontain forestry district of South Africa.

A Belgian law promulgated in December, 1931, empowers the Minister of Agriculture to limit the cutting of timber on private property when he considers this necessary for such purposes as to prevent soil erosion, to protect dunes, to safeguard public health, or to maintain water supplies. In the case of an even-aged mature forest the owner may be required

to leave standing half the stand by volume, or at least 75 cubic meters of timber per hectare, and in the case of coppice with standards he may be required to leave 40 per cent of the stand by volume, or at least 25 cubic meters of timber per hectare.

Saskatchewan has created a commission on water conservation and afforestation and has made plans for a 10-year tree-planting program.

Individually paid memberships in the Canadian Forestry Association increased in 1931 by 2,001, although the number of memberships paid for in bulk fell off. The total number of members, which had stood at 32,008 in 1930, was 27,064 at the close of 1931.

Bark percentage at one-tenth tree height was found to be a better basis than bark percentage at breast height for determining the bark type of Scotch pine stands, in studies reported by Ivar Heijbel in Skogsvårdsföreningens Tidskrift (1929). Bark percentage at one-tenth tree height was constant for different size classes and was comparable between trees in different stands. The height at which rough bark gave way to smooth bark varied with bark thickness but not with tree diameter.

The task of compiling lists of the trees and shrubs to be found in various parts of the British Empire is being carried forward by the Imperial Forestry Institute, Oxford University. The project is one of great magnitude, owing to the vast number of the tree species present in the tropical territories of Africa and Asia. The Federated Malay States alone are said to contain more than 2,500 tree species.

Wood has been used to the exclusion of any other construction material in all radio towers erected in Germany in the past two or three years, it was stated at the February, 1932, meeting of the Deutscher Forstverein. Native Scotch pine and spruce are the species used. Besides having technical advantages owing to the insulating properties of wood, wooden towers cost about 20 per cent less than those of steel.

Personals

William W. Ashe, United States Forest Service inspector in the eastern district, died on March 18, 1932. In his sudden passing the service has lost one on whom it greatly relied. When the acquisition of land in the Eastern States for the establishment of national forests was first begun in 1911, Mr. Ashe's wide knowledge of forest conditions in his native South was immediately brought into the service of this project. Since that time his judgment has had a very large measure of influence in framing acquisition policies and determining the location of units to be purchased. Mr. Ashe's forestry career of 40 years began with training in the University of North Carolina and in Cornell University, and was identified with Government work from 1899. In the earlier years he made a number of silvicultural studies and assisted in preparing management plans for private timberlands. His whole career was pervaded by an intense interest in dendrology. Particularly in regard to the hardwoods of the South, he contributed in a very distinctive manner to the existing knowledge of American forest species. He was the author of many publications covering a wide range of forestry subjects, including, together with dendrology, forest management, utilization of forest products, and the effect of forests on streamflow and erosion. His bulletin on loblolly pine, published in 1915, is of outstanding value. In its completeness and authoritativeness it is typical of his work in each of the fields of his activity.

Three Americans and two Canadians have been selected by the Charles Lathrop Pack Forest Education Board to receive fellowships awarded by the board for the year 1932. They are Weston Donehower, graduate student, department of forestry, Cornell University, who will make a study of the management of red spruce for pulpwood production in the Northeastern States; John Edward Liersch, junior forester, British Columbia Forest Service, who will demonstrate, through cooperation with lumber companies, the practicability of selective cutting in the Douglas fir region; Ralph Melvin Lindgren, graduate student, University of Wisconsin, who will study phases of forest pathology; Harold John Lutz, graduate student, Yale University, who will continue ecological study of the "plains" areas of southern New Jersey which he began under a Charles Lathrop Pack fellowship awarded in 1931, with particular reference to the possible influence of soil conditions on vegetational development; and Louis Rene Scheult, graduate student, University of Toronto, who will make a study of the use of motor trucks in woods operations, with special reference to conditions in Eastern Canada.

Paul H. Roberts, for several years supervisor of the Sitgreaves National Forest, Ariz., has been transferred to the Washington office of the United States Forest Service as administrative assistant in the branch of research.

Sinclair A. Wilson has joined the staff of the Pacific Northwest Forest Experiment Station as a senior forest economist to conduct a study of tax-delinquent lands in Washington and Oregon. Mr. Sinclair was trained as a forester at the Oregon State College and has had special training in law and economics. He was president of the First National Bank of Linnton for 12 years. For some time he has served as chairman of the forestry committee of the Portland Chamber of Commerce.

E. L. Mowat, who has engaged in advanced work at the University of California while on leave from the Lake States Forest Experiment Station, has now been transferred to the Intermountain Forest Experiment Station. His new work in the intermountain region has to do with the management of ponderosa pine.

F. G. Miller, dean of the school of forestry, University of Idaho, is spending a semester of sabbatic leave in European study and travel. After studying at the Dresden Technological University he planned to visit forest schools and forest regions in Germany, Switzerland, France, Sweden, Finland, and England.

Harold F. Morey has been transferred from the Allegheny Forest Experiment Station to the Northeastern Forest Experiment Station. Mr. Morey has been studying the growth of Allegheny hardwoods, and his work in the Northeast will be in large part a continuation of this activity.

G. M. DeJarnette has been transferred from the Missoula, Mont., headquarters of the United States Forest Service to the Northern Rocky Mountain Forest Experiment Station for work in connection with the Forest Survey.

William Hallin, junior forester on the Deschutes National Forest, Oreg., has been transferred to the California Forest Experiment Station to assist in the redwood and pine silvicultural studies.

C. B. Williams, lecturer in agricultural and forest entomology in the University of Edinburgh, has been appointed head of the department of entomology at the Rothamsted Experimental Station, England.

R. C. Hall is now assigned to the Central States Forest Experiment Station as consulting forest entomologist. The major project on which Doctor Hall is now working is a study of the locust borer.

Sir Roy Lister Robinson, technical commissioner in the British Forestry Commission, has been appointed to succeed Sir John Stirling-Maxwell as chairman of the commission.

Richard R. Fenska, formerly professor of forest engineering in the New York State College of Forestry, is now district manager for the F. A. Bartlett Tree Expert Co. at Northampton, Mass.

Bibliography

Stickel Reports on Fire-Weather Study

By G. H. Lentz, United States Forest Service

The results of five years' investigation of fire-weather conditions at Cranberry Lake, N. Y., have been published by the New York State College of Forestry, at Syracuse, as Technical Publication No. 34.[2] The study was a joint project of the college and the Northeastern Forest Experiment Station. In its first year, 1925, it was financed in part by the Empire State Forest Products Association. Paul W. Stickel, associate silviculturist at the experiment station, organized the work in 1925 and closely supervised the work of the men who later made observations daily throughout the fire season—May to October, inclusive. During the years 1926 to 1929, inclusive, fire-weather reports based on these observations were telegraphed daily to the New York State Department of Conservation, at Albany.

[2] Stickel, Paul W.: The Measurement and Interpretation of Forest Fire Weather in the Western Adirondacks.

Stickel has admirably combined a technical description and discussion, of interest mainly to research agencies, with a presentation of facts and methods that have an immediate practical application. He describes in detail the methods and instruments used in the study, and explains how an organization engaged in preventing and suppressing fires may equip a field force to gather the data needed for forecasting periods of fire hazard. Our forest experiment stations have sometimes been criticized for not working on problems the solution of which would have an immediate practical application. The practicality of this experiment is well proved by the fact that several agencies are already applying its results.

It was found that the moisture content of duff and other forest fuels is an accurate index of their inflammability. When the duff moisture content is above 30 per cent there is usually no danger of fire, but when it drops below 10 per cent the fire hazard is serious. When the moisture content of the top layer of duff is 22 per cent or less there is great danger that discarded matches will start a fire; when it decreases to 16 per cent or less,

pipe heels readily start fires; and when it sinks to 6 per cent or less, there is danger of fires being started by cigarettes.

To determine fire hazard at a given time is not always so simple a matter as measuring the duff moisture content. The net results of the actions and reactions of six interdependent meteorological elements—temperature, humidity, precipitation, air pressure, wind velocity, and cloud formations—were studied, and are discussed by Stickel under the following headings: 1, Temperature factors—(*a*) air temperature, (*b*) duff temperature, and (*c*) soil temperature; 2, psychrometric factors—(*a*) relative humidity, (*b*) depression of dew point, and (*c*) vapor pressure; 3, solar radiation; 4, air pressure; 5, wind velocity and direction; 6, precipitation; 7, cloud formation; 8, evaporation; and 9, other elements. The effect of forest canopy on duff moisture content also was studied and is discussed.

By means of graphs, the relation of each of these factors to duff moisture is portrayed. With one exception these graphs are easily read and understood. In Figure 3, page 27, an attempt was made to put too many graphs on one page, with resultant loss of effectiveness; if the horizontal scale could have been doubled, the reader's eye might have followed the interwoven lines more easily.

The daily observations taken at 2 p. m. gave the most significant results; those taken at 11 a. m. were less valuable, and those taken at 8 a. m. and 5 p. m. were least valuable. If only one reading a day is possible it should be taken in the early part of the afternoon, but by all means it should be taken at the same time each day.

An analysis of the data showed that a satisfactory estimate of duff moisture content could be arrived at through a combination of three readily determined factors—evaporation per hour, hours since last measurable rainfall, and air temperature. Alignment charts based on these factors are presented.

It is well known that fires burn more readily on open or cut-over areas than in green or virgin timber. Stickel shows just how the forest canopy prevents a high fire hazard through its influence on temperature, wind, humidity, solar radiation, etc. This has a direct silvicultural application—on selectively logged areas the partial canopy left after the cutting keeps the forest fuels in a more moist condition, thus holding down the fire hazard.

In several appendices the various instruments used in the study are described and their purchase prices given. A bibliography lists 42 sources.

The bulletin contains 115 pages, including 13 tables, 10 plates, and 26 figures.

A partial list of references to published material dealing with soil erosion and its prevention has been prepared by Dorothy Graf, librarian, Bureau of Agricultural Engineering, United States Department of Agriculture, and has been mimeographed. Copies can be obtained by writing to Mrs. Graf.

Afforestation in Southern Lands

By L. S. Gross, United States Forest Service

As the author of Afforestation in Southern Lands, E. Maxwell writes: "The object of this work is that it may be a general guide towards successful afforestation operations in southern lands—New Zealand, Australia, and South Africa—but more especially in New Zealand." This book of 308 pages not only deals with methods of planting and with nursery practice, but also includes a considerable discussion of the costs, objectives, and results of forestry practice in general.

The author advocates planting on areas of good soil conveniently located as to markets and deprecates the theory that only the poorer land should be devoted to forestry. As essentials to the successful establishment of plantations he stresses discrimination in regard to source of seed, use of species mixtures, care in planting, close spacing, management of plantations (i. e., cleaning, thinning, pruning, protection from fire, etc.) and, above all, experimentation. Though laying down certain general rules for the conduct of the work, he feels very strongly that each individual situation should be studied carefully and handled in a way adapted to local requirements.

If northern white pine is to be used Mr. Maxwell recommends that a spacing of 4 feet by 4 feet be adopted. In general, he feels that any spacing wider than 6 feet by 6 feet is undesirable.

New Zealand was without any native conifers, but has obtained excellent results from planting a number of exotic conifers. Chief among those recommended are "Insignis" (Monterey pine), "Macrocarpa" (Monterey cypress), redwood, and "Oregon" (Douglas fir). Monterey pine and Monterey cypress in particular make extraordinary growth in New Zealand. It is especially interesting to note that such good results have been obtained in New Zealand, as also in Australia, with these two species which in their native California are insignificant trees confined to a very restricted range. Speaking of the Monterey pine Mr. Maxwell says: "Diameter growth continues, under favorable climatic and soil conditions, exceptionally until about the fiftieth year. At times as much as 8 feet vertical growth is made in one year, but for a number of years during the vigorous growing period 4 to 5 feet is a fair average." A number of native New Zealand and Australian hardwoods are recommended for planting. The book includes descriptions of all these and also of certain species not recommended.

Rotation ages vary from 25 to 40 or 50 years. A period of 100 years is thought entirely too long to justify the cost of planting.

Sawmill Waste and Its Utilization in British Columbia

By ALLEN H. HODGSON, United States Forest Service

The study of sawmill waste and its utilization in the forest regions of British Columbia that was commenced in 1928 by the Vancouver laboratory of the Forest Products Laboratories of Canada has recently been covered in a 56-page bulletin by J. H. Jenkins.[3]

For the purposes of the study the Province, containing a total area of 355,855 square miles of which some 156,500 square miles supports timber, was divided first into the coast region and the interior region and next into lumber-producing districts, namely, south coast, north coast, southern interior, and northern interior. In 1928 the total lumber production for the Province was 2,286,409,000 feet board measure, the product of 314 active sawmills. Production by districts was as follows: South coast, 1,908,002,000 feet; north coast, 89,569,000 feet; southern interior, 181,506,000 feet; and northern interior, 107,332,000 feet. The total log cut for 1928 was 3,206,904,000 feet, of which 1,604,941,000 feet was Douglas fir, 738,629,000 feet was cedar, 204,111,000 feet was spruce, 353,269,000 feet was western hemlock, and the remainder was made up of true firs, ponderosa pine, western white pine, jack pine, larch, and other species.

As a basis for comparison 13 sawmills and 4 cedar shingle mills in the coast region, 12 sawmills in the southern interior district, and 5 sawmills in the northern interior district were intensively studied from the standpoint of waste and its utilization.

The bulletin presents a large quantity of statistical data under the headings "Sizes of lumber, 4 feet long, recoverable from slabwood waste," "Percentage of clear lumber, 4 feet long, recoverable from selected sawmill waste," "Rectangular-shaped pieces of waste," "Volume of log converted into sawdust," "Percentage of log converted into slabwood and trims," "Kerf of saws in use at mills studied," and "Utilization of log in British Columbia sawmills," all of which data are summarized in the table "Average utilization in each region." This table shows that in the southern coast region the Douglas fir mills convert 71 per cent of the log into green lumber, 12.9 per cent into slabwood and trim, and 16.1 per cent into sawdust, and the hemlock mills convert 66.8 per cent of the log into lumber, 14.9 per cent into slabwood and trim, and 18.3 per cent into sawdust. The sawmills of the southern interior district, sawing largely ponderosa pine, Douglas fir, larch, cedar, hemlock, and Engelmann spruce, convert 68.3 per cent of the log into lumber, 15.7 per cent into slabwood and trim, and 16 per cent into sawdust, while the mills of the northern interior district, cutting Engelmann spruce, convert 66.8 per cent of the log into lumber, 17 per cent into slabwood and trim, and 16.2 per cent into sawdust.

[3] Canada Department of the Interior, Forest Service, Bulletin 83.

It is estimated (on the basis of the 1928 cut) that the yearly production of sawmill waste in the mills of British Columbia is 106,483,000 cubic feet of wood (solid measure), of which 48,275,000 cubic feet is in the form of slabwood and trim and 58,208,000 cubic feet is in the form of sawdust. In 1928 the logs sawed by these mills totaled 2,196,880,000 board feet (log scale), or 358,350,000 cubic feet.

In this study the red cedar shingle mills were found to convert 48.6 per cent of the log into shingles, 35 per cent into sawdust, 7.8 per cent into splints (waste), and 8.6 per cent into spalts (waste). The volume of wood used by the British Columbia shingle industry in 1928 is estimated at 36,544,000 cubic feet, of which 17,756,000 cubic feet went into 2,399,499,000 shingles, 5,999,000 cubic feet went into waste wood (splints and spalts), and 12,789,000 cubic feet was converted into sawdust.

One phase of the mill-waste studies conducted in each forest region of British Columbia was to determine the volume of waste now being utilized. It was found that the present utilization of sawmill waste varied greatly among various districts and among individual sawmills in each district.

The principal uses to which sawmill waste in the Province is now being put are lath, shingle bands, and fuel. The quantities of these commodities made at British Columbia sawmills from sawmill waste in 1928, and their value, are estimated as follows: 118,193,000 pieces of lath, $403,060; 17,328,000 pieces of shingle bands, $46,162; and 192,275 cords of fuel, $364,833. The total estimated value of these items is $814,055; the lumber produced during the year was valued at $46,112,039.

In addition, some of the mills convert sawmill waste into pulpwood and pulp chips, snow fencing, and stock for coal-car doors.

Sawdust and shavings together with "hogged" sawmill waste wood are also sold by many of the mills as "hogged" fuel. Sawdust and shavings are the chief fuel used in developing power for sawmill operation.

All the sawmill waste not utilized as by-products or used in the production of domestic power is sent to the refuse burners. It is shown that the quantity of material thus destroyed as true waste varies from 2.4 per cent of the log (exclusive of bark) in the Douglas fir mills of the coast region to 15.2 per cent of the log (exclusive of bark) in the Engelmann spruce mills of the interior region.

There are other potential uses for mill waste in British Columbia, of which some are impracticable under present economic conditions and others have not been developed on account of lack of knowledge or of a suitable market. As the more promising of these uses Mr. Jenkins lists short-length lumber, wood flour, wood distillation products, briquettes, and wall and insulating board.

In conclusion Mr. Jenkins says "The Forest Products Laboratories of Canada are now investigating

the possibilities of more profitably utilizing the sawmill waste of British Columbia and of reducing it to a minimum by improving methods of manufacture."

Pine Identification by Needles

By W. A. DAYTON, United States Forest Service

W. M. Harlow, who is instructor in wood technology at the New York State College of Forestry, has obtained and assembled in a handbook [4] the diagnostic characters of native and introduced pines as represented by leaf structure alone. This is the first time that such information has been keyed in manual form. The subject is of great scientific and practical interest. Taxonomically the work is invaluable, especially in view of the critical nature and immense economic importance of the genus Pinus and the extreme difficulty, or sometimes even impossibility, of satisfactorily identifying pine material without cones.

The work includes an index of common and scientific names, an introduction, a chapter on the general morphology and anatomy of pine needles, a key to the species based on needle structure, acknowledgments, bibliography, and an appendix giving methods of technique used in the study; more than half the work, however, consists of annotated plates of the beautiful microtome sections, which admirably illustrate the internal leaf structure of the 54 pines discussed. The booklet is attractively printed on glazed paper.

Slash Disposal in Pine Forests of the Northwest

By F. S. BAKER, University of California

In a bulletin [5] of 58 pages T. T. Munger and R. H. Westveld have covered the subject of slash disposal in the northwestern pine forests in a most complete and satisfactory manner. About half the bulletin is made up of a fundamental discussion of the physical and economic considerations governing slash disposal in general, with specific references to the northwestern pine region. The second half is a detailed discussion of all the different methods of treating slash that are commonly used at the present time. The silvicultural effects of each method are noted as well as the effect on soil and forage and on fire hazard. The costs of the different methods are also discussed.

The authors' most important conclusion, to my mind, is their insistence that the method of slash disposal must be flexible. We have been far too prone to say that in a certain region piling and burning is best, in another logging and scattering. It is becoming more clear all the time that such blanket statements are untenable and that the method of brush disposal must be determined locally on very small areas in accordance with the various degrees of fire hazard, silvicultural conditions, objectives, time of the year, etc. A flexible method allows the use of the cheapest method that is compatible with the objective sought.

Definite conclusions as to how reproduction is affected by the layer of needles that accumulates on the forest floor where slash is merely scattered or is not disposed of in any way are impossible in the Pacific Northwest, the authors state, because of the scantiness of the data. Such data as are available seem to indicate that undisposed slash favors both germination and survival of subsequent seedlings. G. A. Pearson is cited as having found slash beneficial to reproduction except where rank herbaceous vegetation is present. Pearson also notes,[6] however, that, where the layer of needles exceeds one-half inch in depth, germination of ponderosa pine may be diminished, and states that, on the whole, during the needle-mat period of about five years the establishment of seedlings is retarded rather than promoted. Bates, Hilton, and Krueger also noted [7] that unburned slash hindered to some extent the germination and establishment of lodgepole pine. The same thing has been noted in spruce and fir forests where, of course, the needle fall is much heavier than in open pine forests. Perhaps the better spring rainfall conditions in the Northwest tend to counteract the repressive effect of a mat of needles on germination. Obviously, the matter needs further investigation.

Black Rock Soils Data To Be Correlated With Growth

Commenting on J. T. Auten's review in the January, 1932, FOREST WORKER, of the bulletin Physical Properties of the Cove Soils on the Black Rock Forest, Henry H. Tryon, director of the Black Rock Forest, writes as follows: "Mr. Auten raises a point of criticism which is, I think, quite justifiable and seems to need a word of explanation. He expresses 'a desire for some tangible connection between such an investigation and forestry plans for the area.' Simultaneously with the field work of the soil survey we obtained a formidable array of data on tree growth and association of species. We are well equipped to carry out the suggested correlation of soil conditions and growth; but we were unable to combine this with the soil study proper. The results will be forthcoming later on."

[4] The Identification of the Pines of the United States, Native and Introduced, by Needle Structure. New York State College of Forestry Technical Publication 32. April, 1931.

[5] Slash Disposal in the Western Yellow Pine Forests of Oregon and Washington. U. S. Department of Agriculture Technical Bulletin 259.

[6] Natural Reproduction of Western Yellow Pine in the Southwest, U. S. Department of Agriculture Bulletin 1105, p. 98.

[7] Journal of Agricultural Research, vol. 38, no. 4, pp. 229–243.

U. S. GOVERNMENT PRINTING OFFICE: 1932