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BRANCH OF RESEARCH

October, 1934

CONTENTS

	<u>Page</u>
Forest Experiment Stations	
Allegheny	1
Appalachian	7
California	11
Central States	17
Lake States	23
Northeastern	25
Northern Rocky Mountain	29
Pacific Northwest	37
Southern	45
Southwestern	51
Research, Region 2	55
Manuscripts	59
Translations	61

ALLEGHENY FOREST EXPERIMENT STATION

General

Emergency funds have permitted us to employ about seven men continuously, of Assistant to Technician or Junior Forester rank. They have also made possible the following substantial improvements: a fifty-foot greenhouse connected with one of our laboratories on the campus of the University of Pennsylvania, in Philadelphia; a combined field laboratory and living quarters building, with running water and electricity, and a garage and workshop, at our new branch station on the Lebanon State Forest in southern New Jersey; and improved roads on the Kane Experimental Forest.

The Station hopes to work out a satisfactory cooperative arrangement for the establishment of a branch station in the oak type at Beltsville, Maryland, where several thousand acres of forest are now included in the Department's research area. Unexpected obstacles to this have arisen outside the Forest Service. Perhaps the most interesting possibility for such a branch is in connection with the Game Conservation Institute, at Clinton, New Jersey, one of the few institutions in the country giving a course in practical game management. The Institute owns about 1000 acres, part of it in woods.

The Station's long campaign for the purchase of the Tionesta virgin timber area within the Allegheny National Forest has made encouraging progress. During the summer Region 7 made an appraisal of this area, and recommended a purchase which includes about 3500 acres of original growth. The recommendation was promptly concurred in by the Forester, and the offer of purchase has been accepted by the owner of the property, the Central Pennsylvania Lumber Company. Should the commission approve the purchase on grounds similar to those advanced in purchasing Heart's Content, the Station believes that an extremely valuable and significant precedent will have been set, not too late, we hope, to save other priceless and unique tracts throughout the East. Credit for the progress made so far is due to Region 7, which has been willing to sacrifice acreage to unique values. But above all, we should thank the Pennsylvania Forestry Association, whose committee on virgin timber areas, headed by Mr. Francis R. Cope, Jr., has worked tirelessly in behalf of this purchase. Members of the committee, as well as Dr. True, Vice-President of our Advisory Council, have gone to Washington more than once to urge it; have established the absolutely vital contact with the owners of the property; and have aroused an astonishing enthusiasm for the purchase among a number of other Pennsylvania organizations. As a direct outcome of its efforts, a special committee of the Allegheny Section of the Society of American Foresters has been appointed to enlist

support within the profession, and this committee, acting jointly with one appointed for similar purposes by the New York Section, brought before the Association of State Foresters, meeting at Knoxville, an effective resolution favoring preservation of virgin areas.

In cooperation with Region 7 the Station has outlined codes of forest practice for the important types of its territory.

Visitors to the Station from abroad have included Dr. Franz Heske, Germany, and Mr. Stanley Sherry, of South Africa. Dr. Heske gave us some invaluable advice when he warned us against too exclusive a faith in sample plots and similar research devices which absorb great amounts of time and may yield results of only very limited application. They must be supplemented by "general observations", on which most of us look askance these days, but which still have a most important place in forest research, in Dr. Heske's opinion. Mr. Sherry is spending a few months at Johns Hopkins under Dr. Livingston, in pursuit of a better physiological basis for an attack on a disease which threatens Monterey pine plantations in parts of South Africa. The climate of the region in which this pine was originally planted, and where it has made incredible growth during the past forty or fifty years, is characterized by a seasonal precipitation apparently similar to that of southern California. Planted more recently in an adjacent region where the rainfall is equably distributed throughout the year, the pine has been seriously injured by what has hitherto been only a blue-staining organism. Sherry's Oxford professors have suggested a physiological, rather than a pathological, solution of the trouble.

Management, Allegheny hardwoods

A phase of our study of Allegheny hardwoods which promises to be of great value, but which we had hoped to postpone until the Kane Experimental Forest could be further developed, was necessarily undertaken immediately because the Central Pennsylvania Lumber Company had actively renewed its logging operations in the virgin timber on East Tionesta Creek. It is doubtful if the Station will ever have another opportunity to reconstruct, from stump analyses made immediately after cutting, the history of a virgin stand. As soon as it became evident that some 1800 acres of the East Tionesta timber were to be cut this spring, Forbes, Hough, and Ackerman selected about fourteen tentative locations for one-acre sample plots, covering a range of conditions from creek bottom to plateau top, including both north and south exposures. Ten of these plots were eventually laid out, one or more in each of the following conditions: Pure hemlock, pure hardwood, pure pine) a hundred-and-thirty-year-old stand that had immediately followed the blowdown of an apparently similar stand), hemlock-hardwood, and pine-hemlock-hardwood. Stem maps were made in advance of cutting for everything down to .6 of an inch. Rock outcrops, "clay roots" - a hollow with corresponding hump resulting from the windthrow of a large tree and the gradual wash-

ing of the soil from its upturned roots - and similar features which might be the key to species distribution, were carefully mapped at the same time. All standing trees were described, with particular reference to their probable origin, and the height of a large number were taken. With the lumber company's permission, our crews felled all trees below merchantable size on the plots, and sawed off a thin disk at the root collar for permanent preservation. All of the larger hemlocks were cut for their bark this spring, and V-shaped sections were cut from their stumps along an average radius. In a few cases complete stem analyses were made of the hemlock and the small felled trees, in order to get some idea of height growth; seedlings were uprooted and kept for stem analyses to determine the time required to reach stump and breast height. The main objective of the study is of course to determine the time at which each tree now present came into the stands, and, so far as possible, how and why it came in. About sixty soil samples were taken from pits, well distributed over the ten plots, and we hope to arrange a critical study of these by the soils department of the Pennsylvania State College. Photographs, and copious notes on the probable occurrence of fires, windthrows, and other destructive agencies, were also made. Office counts of the eight thousand odd tree specimens obtained on this monumental job began during bad weather in the field, and are being pushed in the office at promising speed. The larger hardwood trees on the plots will not be cut until this winter, so that the field records can not be completed until next spring. Hough has been assisted by S. R. Andrews, R. H. Howard, C. Niederhof, H. W. Turberville, and R. M. Wilkinson.

Management, Coastal Plain

Studies this fall indicate that the acorn crop from white and chestnut oaks was heavy, but not quite as heavy as the 1930 crop.

With the help of A. G. Randall and J. F. Hazen, Wood lifted all of the natural oak seedlings at Camp Ockanickon which had been under observation since 1928, together with those originating from the 1929, 1930 and 1931 seed crops in the nursery beds; the seedlings were measured, and their dry weights obtained. Some of the pitch pine seedlings planted in 1933 were similarly handled. This brings to a conclusion a large part of the work of the past several years at Camp Ockanickon. Office analysis of the data from beds which were treated differently as to soil or cover conditions should be completed this winter. Some of the 1934 acorns were planted in rodent proof beds at the new Lebanon Station. Those of the three principal species were planted under varying degrees of root competition, to follow up some of the leads furnished by the Ockanickon studies. In those studies root competition affected the growth of the seedlings more than any other factor which could be partially isolated.

W. E. McQuilkin, a Morris Fellow at the University of Pennsylvania, and a former pupil of Dr. J. E. Weaver, undertook a study of the root system of pitch pine at our south Jersey stations. He did not use water in his excavations, and therefore did not attempt to get out the root systems as completely as had Wood, working in previous years with chestnut oak. On the other hand, with the aid of C. C. C. labor he was able to get out the gross root system of some very large trees.

In 1930 three one-acre plots were laid out in an eight-year-old stand of sprout oak and pine at Camp Ockanickon. One plot was clear cut. Another was partially cut by removing all but one or two stems in each sprout crop, and clear cutting some of the inferior species, such as gum and post-oak. The third acre was marked for cutting like the previous plot, but no cutting was actually done. These plots were remeasured during 1934, and the results will be analyzed this winter. The greater number and size of the recent sprouts on the clear-cut area, as contrasted with the partially-cut, is plain to even casual observers. The study should yield some much-needed information relative to the management of coppice stands in South Jersey - stands which can be improved, if at all, only by the most judicious use of the axe.

A paper describing the interception of rainfall by the crowns of trees at Camp Ockanickon, studied during 1932-1933, has proven open to criticism on statistical grounds, and will be re-worked this winter. Some of the data, however, together with other meteorological records from both Ockanickon and Kane, were incorporated by Wood in an article submitted for the 1935 Yearbook. We have begun to keep weather records at the Lebanon Branch, but will not abandon measurements at Camp Ockanickon until we have several months of overlapping data for the two locations.

So far the Station has concerned itself very largely with the broadleaf components of the south Jersey stands. On state land the silvicultural policy of the New Jersey Forest Service has been to work toward more pine and less oak. Pine seed trees are favored, and oak seed trees eliminated so that pine will come up in the openings. The elimination of the smaller oaks is to be a natural process, since any cutting of green oak only results in an increase of sprouts. This silviculture is based on very little knowledge of the seeding habits, seed dispersal and germination, and seedling survival of the two principal species of pine, and it is certainly time that the Station undertook work on these problems. On the other hand we feel that we should know much more than we do of the original mixture of species in southern New Jersey, and the conditions which brought it about, before we can wholeheartedly approve the State's policy.

Mensuration, oaks

Schnur is now putting the finishing touches on his manuscript on "Yield, Stand, and Volume Tables for Even-aged Upland Oak Forests". A complete set of synthetic stand tables, each tabulated separately by four species groups, will be presented. These groups are: white oaks, black oaks, other intolerant species, and other tolerant species. This treatment seems effectively to handle the difficult problems of mixed stands. Another interesting feature is the set of total cubic yield tables by density classes. Although it was not found possible to put all of the yield tables on a density basis, density was found, not unexpectedly, to be an important factor in yield, to be quite easily handled at least in the analysis of total cubic volume, and to indicate great possibilities in the study of understocked stands. With minor changes, Reineke's rigid method of determining stand density was used. Schnur's rejection of anamorphosis in the construction of site index curves, and his substitution of a method for determining actual dispersion by using standard deviations from the average height in the several age classes, is another advance in technique.

Schnur has begun a comparison of the volumes of various oak species in the same and in different localities. Only a limited number of tree measurements are available for this study for some localities, but Schumacher and Hall's "Logarithmic Expression of Timber-tree Volume", and their method of comparing equations of different samples, give very good results even with few data.

APPALACHIAN FOREST EXPERIMENT STATION

Management - Coastal Plain

Pulpwood

Field work on the study of growth and production of loblolly pine pulpwood in the Mid-Atlantic Region continued through the month. Three field parties collected data on approximately 50 temporary growth plots. In addition, 330 loblolly pine trees were felled and sectioned on 22 different plots of various ages, site indices, and densities of stocking. Data from these trees will be used in preparation of a new loblolly pine volume table and in a study of various factors affecting the proportion of heart wood and the bark thickness of trees of different characteristics.

Thirty pens of peeled pulpwood were re-examined and reweighed after forty days of drying. Some of the sticks in these pens lost as high as 40% of their original green weight in this period. Ten percent of the sticks in all pens were examined for occurrence of blue stain. Observations show that the percentage of wood stained in these bolts was very high, in some cases reaching 50%.

Streamflow and Erosion

Continuous observations on small streams flowing from forested areas have shown a marked reduction in diurnal fluctuation during the past month. Apparently, this change is associated with colder weather and less ground surface evaporation and transpiration.

The precipitation which reaches the ground along a tree bole has been determined, from 175 catchment collars, to be from 1 to 6 gallons for a storm of .95 inches. Indications are that heavy canopied pines collect a greater amount of precipitation than deciduous trees of equal diameter.

Fire-weather

In addition to telephone or telegraph warnings to forest officers in this fire-weather district, forecasts are broadcast daily from the following radio stations: Asheville, WWNC; Charlotte, WBT; Knoxville, WNOX; Bristol, WOPI; Chattanooga, WDOD; Nashville, WSM.

Forest Insect Investigations

Due to the cold weather during February, 1934, overwintering broods of the southern pine beetles, which had killed quantities of merchantable timber during the past 2 years, suffered almost complete mortality, and, as a result, this insect has been rather scarce this past summer. Some of the pines that were lightly attacked last fall did not die until early this summer. This is believed to have been due to the longer period of time it took for the small amount of blue stain present to penetrate the sapwood sufficiently to cause the tree to die.

As a result of a severe sleet storm last March in North Carolina, around Winston-Salem in particular and eastward toward High Point, N.C., and Richmond, Va., many pines were severely damaged. Considerable areas had trees with stems and limbs snapped off below a 4 inch diameter. In the eastern part of the affected zone, no trees were observed to have been attacked by barkbeetles up until August. From then on, however, particularly around the area damaged most severely, *Ips* barkbeetles attacked and killed some groups of trees as the result of attraction to so much injured pine.

Ips calligraphus Germ. adults were found in about 100 good-sized loblolly pines located at Fortress Monroe around the fortifications when this locality was visited on July 17, 1934. About 500 trees in all had been attacked. They began to die in February and caused much concern as they served to camouflage the guns of the fort. It is believed that the beetles were attracted to the area because of the weakened condition of the trees. Salt water had washed over the narrow peninsula during a storm in August, 1933, covering the area to a depth of over 6 feet. The salt water remained in the depressions about the roots of the pines for a period of 2 weeks before being absorbed by the soil.

Tree injection was continued with special reference to improvements in the technique of injecting trees for insect control and for wood preservation. To facilitate the introduction of poisonous chemicals into the sapstream of living trees, a new type of rubber band has been devised and improved which fits around the trunk at breast height and is stapled into place. It is believed that this material, as well as the finding of a chemical which is easily applied and is not dangerous to handle, have possibilities in materially reducing the cost of barkbeetle control when used in large-scale operations.

As a result of the successful treatment and preservation of pine poles that were injected 4 years ago with standard preservatives, trees were injected during the summer to be used in a practical demonstration of this method of treating wood prior to its use in the construction of cabins, especially where it is desired to preserve the bark for its rustic effect. Using these trees, a log cabin is being

constructed under the supervision of Wilford, on the Bent Creek Forest near Asheville. Logs which were treated with 3 different chemicals are being used and so arranged in the cabin walls that comparisons between the effectiveness of the chemicals used can be made from time to time. Check logs will be placed in a woodshed adjoining the cabin.

Insects in Relation to the Cutting of Pine in ECW Work for the Southern United States

Investigations made last winter of pine cut during the summer of 1933 in stand improvement work and in the building of fire lines, trails, telephone lines, etc., lead to the general conclusion that summer cuttings can be made without danger of causing significant insect losses, especially when conditions are favorable for tree growth. Further information obtained from a study of plots where pine was cut during the past winter and summer seems to substantiate this view. In all localities where thinning was done, practically no insect attack resulted. Where nearly 50% of the young pines were removed and the tops left intact, only a light barkbeetle brood was able to develop. Along highways a few pines were killed in some instances, but, considering the amount treated, it was not significant. Very little damage occurred where the operations were continuous.

In areas where the young pines were removed by hack girdling, to the extent of nearly 50% of the stand, no injury of much consequence occurred to the crop trees. The main attraction of beetles was to trees of 6 inches and under in diameter which had been weakened and blown over by wind. Approximately 50% of this class went down. The larger diameter trees were not so affected and only a few crop trees were attacked.

White Grub Studies in Forest Nurseries

Cooperative studies have been continued with the State Forest Service offices in North and South Carolina to determine more exactly the habits, life histories, and methods of control effective against white grubs under forest nursery practices. A portion of the North Carolina State nursery at Clayton has been set aside by State Forester Holmes for the exclusive use of the Division of Forest Insects in its investigations of the white grub and its control. Intensive caging work has made it possible to identify some of the species of economic importance. Although several species have been taken, Phyllophaga lactuosa continues to be the most abundant and injurious so far. Facts relating to the longevity of this species, the number of eggs oviposited, length of egg stage, and first moult, etc., have been ascertained. It is quite certain now that grubs can cause considerable damage to seedlings during the first season. In the three year forms of the north such damage does not occur until the second season.

Quite extensive tests are being conducted with 50% miscible carbon disulphide to determine the conditions under which it can best be applied to obtain control at the least expense. Consideration is being given to such factors as dosage, the time and method of application, soil temperatures, and activity of the grubs at different depths in the soil at the time the chemical is applied. Grubs are being confined at different depths in the beds to determine the extent of penetration obtained under various conditions.

Continued observations on beds treated with acid lead arsenate indicate that unless applied in light dosages in certain light sandy soils, severe injury can be expected for a period of at least four years following the treatment. The above dosages apply to beds sown to different species of pine. Black locust and black walnut seedlings appear to be less tolerant to arsenic than pine. There are some indications that other chemicals will be effective and can be used as substitutes for arsenic.

CALIFORNIA FOREST EXPERIMENT STATION

Forest Management - Pine Region

Stanislaus Branch

Early storms with possible sudden curtailment of field work find much to be done at Stanislaus Branch where deep snow is normally expected. Sowing, planting and rodent control on the area from which bear clover was eradicated is being rushed without regard for Sundays and holidays since the soil was thoroughly moistened by rains October 18 and 20. Experimental seeding and planting is also being done on the large Anderson Valley burn without rodent control. Collection of data from seed traps must be timed carefully to catch all the seed but still avoid burial of the traps by snow. Detailed mapping of three large Mc plots, two stand improvement plots and the bear clover area remains to be done. A warm fall has necessitated continuation of site factor soil and seasonal growth records.

Forestation

The work of collecting, cleaning and germinating seed has been intensified during the past month. The cleaning of seed was greatly expedited by the construction of a combined seed threshing machine and scarifier costing about \$75. All seed collected so far this year has been cleaned and put into cold storage.

Germination tests on wide-spread chaparral genera, like Ceanothus, have shown that simple methods of inducing germination, such as scarification, scalding or sulphuric acid treatment, are effective only in the case of species which grow at low elevations. Those which grow in the colder regions of the State do not yield to such treatments but require stratification.

An inspection of Grizzly Peak Boulevard berm planting, done in January 1934, showed that all plantings survived through the dry period and may now be considered as permanently established. The best results were obtained with Hypericum calycinum.

Range Research

San Joaquin Experimental Range

The headquarters construction work under the immediate supervision of the Sierra National Forest is rapidly approaching completion on the new foothill work center.

The cover plots are completed and instruments installed and operating. The sideboards installed without stakes are as firmly held in place, after the first rain, as though they were in cement. The straight alignment and firmness of boards were partly achieved by use of a sideboard, one inch trench digging tool designed by Magee. The tool can be built in fifteen minutes with about twenty-five cents worth of material. Blueprints of tool are available for any stations wishing to use them in installation of erosion plots. Weather Bureau instruments were installed by L. G. Gray of the Weather Bureau.

The detailed topographical map of the experimental area has been completed by Davidson of the Regional Office. The CCC camp on the area was completed under Sierra National Forest supervision. Fifty men will be moved in this week.

Some grass seed, supplied by the University of California, has been planted on the area. Warm weather, after the one inch rain, has started the feed growing in favored spots on the range. The rattlesnake season on the experimental range closed (we hope) with a total of 47 snakes killed.

Erosion - Streamflow

San Dimas Experimental Forest

Of particular interest during the past month was the "unusual" storm which centered over southern California on October 17 and 18, coating the higher mountain peaks with snow and drenching the San Dimas Experimental Forest with rain varying from 3.94 to 8.43 inches with an average of about 6.75 inches. This storm which appears on our records as the first of the winter season was really a much delayed summer rain characterized by numerous heavy showers, rather than prolonged rainfall of less intensity. Ten recording rain gages distributed over the Experimental Forest yielded several excellent records of these intensities and the total catch was measured in more than 300 standard type gages. Seven large Parshall flumes and V notch weir installations came into operation and measured runoff for the first time, these concrete structures having been completed during the past summer. Good records were obtained where flood waters were not laden with erosion debris resulting from road disturbance.

As the result of erosion from roads in Bell Canyon a large deposit of eroded material was dumped into the upper end of Big Dalton reservoir by this recent storm. A detailed survey of this reservoir had been made with assistance furnished by the Regional Engineer only a short time before the storm, and a survey of the deposited material has just been completed from which the amount of road erosion will be computed.

The average rain catch on the Bell Canyon triplicate watersheds for the recent storm was 6.58 inches. On the Fern Canyon triplicate watersheds the average catch was 7.46 inches. Bell Canyon Reservoir No. 1 was partially filled with an estimated 180 cubic yards of erosion debris carried from road slopes in the area. Some of this material was deposited in the stream channel last winter and carried into the reservoir by the recent storm. A heavy scum of chaparral litter, amounting to 83 cubic feet, was removed from the surface of Bell Reservoir No. 3, this amount having been washed from a watershed of 62 acres.

Construction of flumes, debris dams and trails continued during the month, and an installation of nine runoff plots was started in Fern Canyon. Erosion control work was completed on approximately five acres of road fills at the head of Volfe and Monroe canyons. A daily average of nearly 300 SERA workmen and 100 CCC boys were employed. Two camps have been established for SERA men working on the Fern Canyon flumes and debris dam, to avoid many miles of daily travel in reaching these remote jobs. These camps are functioning well with 50 men each.

The San Dimas Experimental Area was the focal point of an erosion control school, the second of its kind, conducted under the direction of Kraebel. Representatives of the National Park Service, the State Park Service, State Division of Highways, Los Angeles County Forestry Department, U. S. Bureau of Public Roads, and U. S. Forest Service attended two 3-day sessions starting October 17 and 24, respectively. A total of about sixty men attended. Each session started with a half day's lecture on the purposes of erosion control, and the methods that have been developed by the California station for the fixation of road slopes. Later field trips were made to examine treated and untreated road slopes along some of the major mountain highways in the Angeles and San Bernardino National Forests. Erosion control work being done on the Experimental Forest afforded opportunity for detailed observation of a going job in which considerable interest was displayed. From the round-table discussions held at the end of each session it was evident that many of those in attendance were impressed by the work that had been done and the need for further investigation.

Redding Erosion Studies

In cooperation with the School of Forestry, University of California, the California Forest Experiment Station has completed a new series of installations for measuring erosion resulting from burning in the chamise and woodland oak-pine types west of Redding, California. The installation comprises seven 1/50-acre erosion plots, 4 slope erosion boxes, 2 gully boxes, 1 gully erosion bulkhead, and 2 standard rain gages. The plots are located in and near the experimental pas-

tures fenced last year by the University Division of Forestry. The soils of the area are red, rocky, sandy loams and have for the most part a well established erosion pavement.

The objective of the study is twofold:

1. To determine the amount of erosion from burned and unburned areas.
2. To test new methods of instrumentation for erosion measurement.

The School of Forestry will be largely responsible for the collection of data and the maintenance and operation of the installation. The findings of the study will be made available for use by both the School of Forestry and the California Forest Experiment Station.

Runoff and Erosion Plots

Progress has been made in working up and checking plot data from San Dimas, Panorama, Strawberry Canyon, and North Fork plot installations. With the aid of SERA computers the data have been completely summarized for the individual storms and seasons since the establishment of the plots. SERA computers have also been used to assist in summarizing seepage and runoff data from the Oxford Street tank installations.

Fire Research

Early October rains terminated the test fires study for the 1934 season and the camp at Westwood on the Lassen was broken on October 10. The results of the season's work are represented in the records on 86 test-fires between 1/16 and 1/4-acre in size. About one-half of these fires were studies on flat ground, one-half on slopes to a 50 per cent maximum. In addition, records were obtained on about 20 sets of "duplicate" fires. A new plan in fire study was attempted last season, with the starting of two fires under slightly dissimilar conditions of type, slope or exposure, and recording their spread. Some interesting variations resulted. Since arriving from the field a large part of the time has been spent in preparing the data for analysis.

During October a trip was made by Ikenberry and Curry, accompanied by Price, Elliott, and Durbin of the Regional Office, over the experimental stump-killing areas treated by Ikenberry during the past ten months. The trip resulted in a decision on the part of the administrative organization to use the sodium arsenite treatment on the Ponderosa Way. This decision made it imperative to produce a manual of instructions on the work, which has now been issued. In addition,

a series of training meetings will be held at convenient points along the Ponderosa Way during November for training superintendents and foremen in safety features and in the technique of treatment. Fifty camps will use the arsenic treatment during the winter months on the Ponderosa Way. This treatment may also be adopted in work on some southern California firebreak projects.

Products

Logging and Milling Studies

Field work on the woods phases of the new east-slope pine region project was practically completed this month. About 300 M feet of air-dried and kiln-dried lumber will receive final inspection during the first half of November. The final shipping-dry grades can then be summarized for all millstudy logs.

The Dow power-felling saws have temporarily displaced all hand fellers on the Fruit Growers' Supply Company logging area. Brundage and Tebbe have had no opportunity yet to analyze their studies of this saw in detail, but from general observation it appears that the machines have the capacity easily to double and possibly to treble the output per man on level or gently sloping ground in small and medium sized timber. The maximum round stump diameter which the saws observed could cut without side notching is 50 inches. Longer saws originally made by the Dow Company did not stand up but we understand they have improved the design and are now producing a satisfactory 8-foot saw.

Many alterations have been made since the first machines were delivered to the lumber company last summer. Altho the logging superintendent believes some more changes are advisable, he holds the opinion that even in the present stage of development two saws handled by well trained crews will readily cut the company's present quota of around 250 M B.M. per day.

The unknown factors at present are depreciation and maintenance costs. The half-season's experience to date can not be used as a reliable guide because of the crews' inexperience and the time lost due to faulty design of certain parts, now remodelled. A full season's run next year should yield the data necessary for a reliable comparison with hand-felling tests.

Economics

Wood Requirements

Study of lumber requirements for rural farm construction was begun during the past month. As a basis for prediction of future

lumber use, surveys were made in several farming areas to determine the kind of buildings in use on each type of farm, the average life of farm structures, and trends in the type of construction used. Data obtained from about 185 farmers indicate, for example, that dairy farms require an average of about 60,000 bd. ft. in buildings, fruit farms an average of about 20,000 bd. ft., and part-time farms an average of about 10,000 bd. ft. The use of lumber per farm appears to be decreasing, however, because of the use of corrugated iron structures, the practice of shipping such crops as fruit and field crops directly to central warehouses, and the substitution of tractor for animal power. Old farms are usually overequipped with buildings as a result of repeated splitting up of the original acreage or changes in type of farming. From the limited amount of information obtained, it appears that the life of farm buildings averages about 35-50 years, while the life of the lumber averages about 50-70 years, much lumber being reused.

Available data on fuel wood indicates that on most farms about 5 cords of wood are used each year in addition to gas, oil, coal, or electricity. In most cases this firewood is supplied from the farm. On fruit farms much of it is tree prunings and dead trees taken out. In many cases a large part of the consumption is old fencing.

Wood requirements for fencing are decreasing on all farms except dairy, stock, and grain farms, especially in areas close to large towns or cities. On specialized farms such as fruit and field crops, there is little or no replacement of either field or line fences. In southern California new fences are all of steel on account of termite infestation.

CENTRAL STATES FOREST EXPERIMENT STATION

Meetings

The annual meeting of the Central States Section of the Society of American Foresters was held on October 11-12-13 at Harrisburg, Illinois, headquarters of the Shawnee and Illini National Forest units. The field trip on October 12 included inspections of the Shawnee purchase unit and the experimental forest area proposed for this Station. An outdoor luncheon for the party of 50 members and guests was served at the branch station headquarters.

On October 30, Auten and Baker attended a meeting of the advisory council of the Soil Erosion Service at Zanesville, Ohio. The work of this organization is progressing and their program presents a comprehensive and coordinated attack on the many economic, social, and technical problems of land use. Excellent cooperation is being secured from the federal and state agencies interested in the problems of agriculture, soil erosion, forestry, biology, engineering, and economics, in a manner that compels recognition and appreciation.

Increased Enrollment at O.S.U.

At the beginning of the fall quarter at Ohio State University, student enrollment had increased very considerably over that of 1933-34, and promises to wipe out the decrease of some 17% during the depression period. This year there are about 1/3 more freshmen and 1/10 more upperclassmen than last year. There are three times as many freshmen and twice as many sophomores enrolled in the forestry course as there were last year.

This increase in number of students with no increase in appropriations has made it increasingly difficult for the University to allot sufficient space to the Station. It has been necessary for us to give up the laboratory room formerly used by Auten for his soils work, and as yet no other laboratory quarters have been found.

Research Projects

Forest Soils

Auten spent most of October on the statistical analysis of data secured during the summer in water absorption tests made in northern Arkansas, in southern Illinois, and elsewhere. This work represented a continuation of the soil porosity and water absorption project

previously reported, with special emphasis on the absorptive capacities of old fields, pastures, and burned woods, as compared with undisturbed woods, on stony, sandy, and silt loam soils.

The brass tubes formerly used for absorption tests in silt loam and clay soils were found to be impractical on stony soils; accordingly, square wooden frames were used, sealed to the soil surface with clay around the edges. As might be expected the rate of absorption was not the same as that from the tubes, because the tubes contained a much greater quantity of water in contact with a unit of soil surface, but the comparison of both methods on the same site gave similar results in the relative rates of absorption between undisturbed forest and old field soils.

Sandy soils showed much less loss of porosity after clearing than did the loams and clays, as might be expected, and a pure, coarse sand, after clearing and cultivation, would probably retain most of the water absorptive capacity developed under forest conditions. It was found, however, that a sandy soil with even a relatively small amount of fine soil particles becomes surprisingly compacted after clearing. The most important result of the 1934 tests was the determination that the cherty silt loams of the Ozark soils lost a great deal of their original water absorptive capacity after clearing, when heavily pastured, or under woods repeatedly and severely burned. This conclusion emphasizes the value of reforestation and forest protection in the Ozarks for flood prevention and water conservation.

Another striking result was the determination of the fact that successive applications of water were absorbed readily in the case of undisturbed forest soils, whereas, on pastured or burned sites, each successive water application was absorbed much more slowly. The following table brings out these various facts rather strikingly.

No. of Seconds Required to Absorb 1 Liter of Water
(Average of 100 tests)

<u>Soil</u>	<u>Site Condition</u>	<u>1st Liter</u>	<u>2nd Liter</u>	<u>3rd Liter</u>	<u>4th Liter</u>
Clarksville	Forest Cover	18	22	26	31
Cherty Loam (Arkansas)	Burned Woods	70	102	163*	196*
	Open Pasture	56	96	162	211
"	Old Field Pine	19	28	47*	68*
	Open Pasture	81	131	124*	157*
Sandy Soil (Arkansas)	Forest Cover	16	22	25	27
	Open Pasture	41	59	70	77
Yellow	Forest Cover	46	43	44	47
Silt Loam	Burned Woods	132	216	294	378
(Illinois)	Open Pasture	396	744	994	1157

* Less than 100 tests

Forest Planting

A discussion by Kellogg of the failure of mixtures of conifers with black locust was issued as Station Note No. 15. Several comments have been received, some of which offer supporting observation and experience from other portions of the country.

A small planting was made by Kellogg and Myer to test the feasibility of underplanting black locust with white oak, in plots established by Hall in his study of the locust borer on the Carnes tract near Cambridge, Ohio. Half the acorns were still dormant and half were sprouting when collected. Some seven plots were underplanted on western, flat, and northern exposures. Unfortunately the drouth has continued through the autumn and it is questionable whether the oaks will establish. Part of the plots bear a 1-2 inch litter of leaves (originally 6-8 inches) applied by Hall in his studies.

Chapman and Cochran spent the latter part of the month on an inventory and map of the plantings at "Old Timbers," Alexander Thomson's holdings near Versailles, Indiana. This property offers an excellent set-up to observe and experiment with planting on flat, worn-out Clermont silt loam ("buttermilk flats"), which are characteristic of large areas in southeastern Indiana and southwestern Ohio.

Forest Types

Kellogg and Chapman, after inspecting a number of forest plantations in southern Illinois, returned through Kentucky to observe forest conditions in and around the "barrens" or prairies areas in what is known as the Purchase Area (between the Tennessee and Mississippi rivers) and in the Karst region west of Bowling Green. Since settlement a marked and rapid advance of the forest has occurred, almost completely obliterating the prairies. The forest is composed chiefly of post and blackjack oak, with some hickory.

A mixed mesophytic forest was found on the loessial bluff overlooking the Mississippi. Chestnut, beech, maple, yellow poplar and white oak were common except in the stream bottoms. Two or three miles eastward witnessed a change in type to the post and blackjack oak-hickory forest. This type extended eastward through the Karst to Allen county where beech, maple, chestnut and yellow poplar again appeared. This mixed mesophytic forest was found from Scottsville to the Knobs just south of Lebanon, with very few and very local occurrences of oak-hickory. Virginia pine appeared on the Knobs but did not extend in the Blue-grass.

Across the southern edge of the Blue-grass, clearing has gone so far that few woodlots remain. This region is characterized by many lone single yellow oaks (*Quercus muhlenbergii*), blue ash (*Frax. quad-*

rangulata) and occasional walnuts and hard maples. Much black locust has been planted around yards.

East of Winchester, the Virginia and pitch pines appear at the edge of the Knobs and soon shortleaf pine became common. Through 40-50 miles occasional second growth white pines were observed on residual sandstone soils.

Originally much of the eastern end of the state contained a mixed mesophytic forest. Following cutting and fires, an oak-hickory or oak-hickory-pine type frequently comes in. There are enough culled-over stands remaining to indicate that the original forest was not oak-hickory, but a mixed forest with much beech and maple on south slopes and hilltops, as well as in the ravines and coves.

Locust Borer

Dr. Hall conferred with Craighead on the progress of the summer work on the locust borer, and plans for fall and winter. It was decided to concentrate, during the winter, on cutting experiments designed to accelerate rate of growth in locust. These experiments will include clear cutting badly infested stands, thinning fast-growing stands, sanitation cuttings in older stands, and some pruning experiments. Through the cooperation of Extension Forester L. E. Sawyer of Illinois, several desirable areas were located near Arenzville and Elizabethtown. Nothing of a suitable nature was found in Mississippi.

Hall spent two days during the latter part of the month with Dr. C. F. Swingle from the Bureau of Plant Industry in northeastern Ohio in an effort to locate locust seed for the Soil Erosion Service. Two areas were located where it is expected that from 1,000 to 1,500 pounds of seed may be gathered.

Secret and Page were reappointed on October 11. They spent the first three quarters of the month in infesting black locust trees with recently hatched locust borer larvae for the purpose of determining winter mortality in this insect.

Leaf Hopper

In company with Dr. T. E. Snyder, Mr. Lamb, Meginnis and Assistant State Forester Mitchell, two nurseries in Mississippi were inspected for injury by the leaf hopper and a stem girdler. Damage by the leaf hopper, in the two nurseries at Holly Springs did not appear to be as serious as in the Forest Service nursery, which was visited earlier near Jonesboro, Illinois. Here, an estimate by Ranger Wernham placed the injury by the hopper at about 75 per cent in their early planting. A number of trees had recovered from this injury but were

somewhat weakened and as a result the breakage of the stems near the ground level was quite high when the trees were lifted. It appeared that there had been no injury at Jonesboro in their late planting, made in early August, which may indicate that this insect may be controlled by late planting.

Acorn Insects

Numerous requests have been coming in from the Forest Service and Soil Erosion Service for a satisfactory method of control for acorn insects and for that reason the last quarter of the month has been spent by Hall, Secrest, and Page conducting experiments on the control of these insects. The main objective was to get a method of control which would cause no injury to the seed. Carbon bisulphide (CS_2), paradichlorobenzene (P.D.B.), and water were the materials used. Germination tests are being conducted on all treated seed and in addition samples from each experiment are being planted out of doors. Preliminary results seem to indicate that a concentration of CS_2 , strong enough to kill larvae inside the acorn, will cause injury to the seed. This is especially true in the white oak group where sprouting may have started. It will be necessary to wait until the germination tests are completed before the true effect can be determined. However, there was a distinct browning of the cotyledon and radicle in all cases where CS_2 was used.

P.D.B. proved to be ineffective as a method of control in any of the concentrations used.

The water treatment appears to have considerable promise, judging from the preliminary results. In this experiment both distilled and tap water were used. The acorns were completely immersed and a float put on top to keep them well covered with water. Two periods of 3-1/2 and 5-1/2 days were used, respectively. The period of 3-1/2 days gave almost complete control with the distilled water and about 85 per cent control with the tap water. The 5-1/2 day treatment gave complete control with both the distilled and tap water. In this experiment there appeared to have been no injury to the seed. While it is recognized that these results are entirely preliminary, it is felt that it would be safe to suggest the water treatment, especially for acorns of the white oak group.

LAKE STATES FOREST EXPERIMENT STATION

Spruce Cutting Experiment

Cutting experiments in upland black spruce have now been established on the Superior National Forest. The stand is about 65 years old and runs about 30 cords to the acre. Three methods were tried: (1) clearcutting, (2) strip cutting, in which alternate strips 100 feet wide were cut and left, and (3) light selection in which 25% of the merchantable volume was removed.

In the clear cutting, absolutely everything was taken out, including trees below merchantable size. In the strip cutting, only trees which would make two sticks of pulp wood were cut. This left a stand of about 300 stems per acre of trees under merchantable size. It is believed that these will blow down, but so far no wind-fall has occurred. The selective cutting was intended to be sufficiently light to prevent wind-fall. On certain parts of the areas cut over, the soil was scarified to determine the effect of soil treatment on reproduction. Since there is a seed crop this fall, some results from this treatment should be forthcoming in 1935.

Jack Pine Seed Studies

Seed traps located in cut-over jack pine on the Superior Forest are continuing to yield interesting and valuable data. During a period of 14 months, only two seeds of jack pine per trap were caught, indicating conclusively that jack pine seed trees, 60 to 70 feet tall, retain practically all of their seed locked up in unopened cones, even during a hot summer. On the other hand, a few branches of jack pine slash placed over one seed trap yielded over 2000 seeds per trap from cones which opened from the heat of the sun during a six months period. In other words, for this density of slash, something like 80 lbs. of jack pine seed would be dispersed on a single acre. Obviously, the slash after cutting must be properly handled so that the seed is dispersed if reproduction is to be obtained.

Management - Northern Hardwoods

Cutting at the Dukes Station in the Upper Peninsula of Michigan is now under way in a hardwood-conifer stand. Last year was our first attempt at cutting in this type. The timber is decidedly inferior to that which has been previously cut, and besides the inferior birch and maple there is considerable defective and dead cedar.

Nevertheless, in last year's operation, a profit of about \$8.00 per acre was made, which is considered very good for what was essentially a salvage operation. This year about 50 acres of this type will be cut.

Management - Pine

The need for building logs by the administrative organization for the construction of ranger and guard station buildings, presented an opportunity to start cutting experiments on the Cut-Foot Experimental Forest on the Chippewa. Four methods were tried out in a Norway pine-jack pine stand: (1) Group selection, (2) National Forest method, (3) Experiment Station selection, (4) Commercial cutting to diameter limit of 8 inches.

Conversion of Aspen

A conversion experiment was established on the Nicolet National Forest in Wisconsin. The National Forest arranged to do all of the work, but the Experiment Station made the plans and furnished a field assistant to help with the laying out of the plots. Several classes of stock and four species - Norway pine, white pine, jack pine, and white spruce - were used. Ground preparation, including simple scalping, scalping with the cutting of old roots down to a depth of 10 inches and furrowing, were tried. Brush was cut before planting and follow-up release cuttings will be carried out for several years.

Forest Survey

The strip survey crews on the Forest Survey work have now all moved to the Upper Peninsula of Michigan, where a drive will be made to clean up all of the field work before weather conditions become too severe. By the first of the year, it is hoped that the parties will be able to transfer their activities to the Lower Peninsula, where working conditions during the winter will be better. All that remains of the field work in Minnesota is the completion of some of the type maps.

NORTHEASTERN FOREST EXPERIMENT STATION

Forestation

An examination of the conditions affecting the growth and development of plantations on burnt over land near Little Tupper Lake, New York, was made during the past month. The tract which was studied consisted of an area of about 2,600 acres of cutover timber land which was burned about 1903. The fire is stated to have burnt with intense heat so that the duff was consumed down to the mineral soil. Several hundred acres of the burn were planted with Norway spruce and white pine in 1917 and 1918. There are only scattered remnants of these plantations to be found at the present time. It is stated that the failure of the white pine was caused largely by deer browsing in the trees during the early spring months before the grass starts to grow. The cause of the early poor survival of the Norway spruce is not known. At the present time nearly all the larger Norway spruce are affected by the so-called club-foot disease or abnormality of growth. This trouble manifests itself by an enlargement of the leader or side branches, with an excessive size of the central pith in the leader as well as an unusual length development. In some cases numerous buds along the leader have started to develop into tiny shoots.

A series of plantations of white pine, Norway pine, Norway spruce, and Scotch pine are located near Sabattis Station, on old run-down pasture land. This land was burnt in the fire of 1903 and again in 1908. The plantations have been established at intervals during the last 10 to 12 years. The growth of the Norway pine appears to be entirely normal, but the terminal buds on the white pine have not developed on many trees during the past year. This has caused an abnormal type of branching of the leaders on the affected trees. A large part of both the Norway spruce and Scotch pine are affected by the typical club-foot abnormality. A point of considerable interest was noted in examining the older Norway spruce plantations, aged about 10 years, which are 5 to 6 feet in height. There is an occasional tree of white spruce apparently present as an accidental mixture. These white spruce, like the red spruce near Little Tupper Lake, are making an entirely normal growth. Neither of the native spruces are eaten by the deer. The height and diameter growth of the white and red spruce are below that of the Norway spruce, but the healthy condition of these trees points to the desirability of using the native species for planting burnt over land in the Adirondacks region.

Management

In connection with the establishment of sample plots in even-aged, second growth northern hardwood forest, Reineke found in New York that some of the best stands, with a high percentage of white ash and black cherry, are in the Catskill State Park on areas cut clear for charcoal about 55 years ago. These areas now support a dense stand of northern hardwoods with white ash as large as 14 inches d.b.h. At critical elevations (between 2500-3000 feet), the damage done by ice is quite severe, resulting in malformation of the trees. Black cherry and beech are most severely affected. This phenomenon is also characteristic in similar stands in the Green Mountains in Vermont.

Protection - Fire

In the oak region, the mortality of trees injured but not killed outright by fire reaches appreciable figures the first year after burning. On two fire damage plots in southern New York, Stickel has found that in one case the mortality by number of trees amounts to 27 percent and by basal area 18 percent. For the second plot, where the burning was more severe, 47 percent of the injured trees died, resulting in a reduction in basal area of 47 percent. These data are only for trees 2 inches or more in diameter. On both plots the greatest mortality occurred in trees 6 inches or less in diameter. Red oak seems to be considerably more fire resistant than the associated chestnut, scarlet and white oaks.

Protection - Insects

In order to have a relatively large area for demonstrating the practicability of reclamation of severely weeviled white pine plantations MacAloney recently completed the first pruning and girdling operations in a four acre, 20-year old plantation near Petersham, Mass. About 775 crop trees were selected and pruned to a height averaging 12 feet, and about 200 dominant scrubs were girdled. The cost to date, exclusive of marking and supervision, was \$12.50 per acre. One more pruning operation in 1936 or 1937 will complete the work to 16 feet.

The annual examinations of the reclamation plots continue to bear out the statements made by Cline and MacAloney. The crop trees are responding to the partial liberation caused by girdling competing severely weeviled scrubs; the healing of the small branch cuts is progressing satisfactorily; there is no damage from barkbeetles or pitch midges; and the girdled trees will die in one or two years if they are properly girdled. Care must be taken that the girdle is clean cut all round the bole of the tree. Large branch cuts do not

seal over with pitch enough to prevent the entrance of fungi. A fungus, Stereum sanguinolentum Arb. and Schw., which causes the serious "red heart" in balsam fir has been collected from these large cuts two years after the operation. This is considered as a potentially serious woodrot in these trees and it is advised that trees with branches or double stems over 2 inches should not be considered for crop trees, unless the cuts are painted.

NORTHERN ROCKY MOUNTAIN FOREST and RANGE EXPERIMENT STATION

Silviculture

Some interesting facts are available from cone crop examinations which have now been conducted for eight years on several of the methods-of-cutting plots. One plot which contains 82 white pine trees from 4 to 19 inches d.b.h. gives an indication of the seed bearing ability of trees of different sizes. The trees 4 to 8 inches d.b.h. bore an average of 0.1 cone per tree per year for the 8-year period, the trees 8 to 12 inches bore 3 cones per tree, the trees 12 to 16 inches bore 6 cones per tree, and the trees 16 to 20 inches bore 11 cones per tree per year. It is well to keep in mind in this connection that western white pines do not bear cones as prolifically as some other conifers. Characteristically the cones are at the tip of the tree and 25 cones or more represent a large crop though individual trees with as high as 225 cones have been counted. The scale used by the Station in estimating white pine cone crops rates a tree with 1 to 5 cones as having a poor crop, one with 6 to 15 as having a fair crop, and one with 16 or more as having a good crop.

Eighteen seed trees on this plot between 13 and 19 inches d.b.h., inclusive, bore the following total number of cones and average number per tree during the eight years indicated:

	<u>1927</u>	<u>1928</u>	<u>1929</u>	<u>1930</u>	<u>1931</u>	<u>1932</u>	<u>1933</u>	<u>1934</u>
Total cones	172	29	284	128	9	303	70	0
Av. per tree	9.6	1.6	16.0	7.1	0.5	16.8	3.9	0
Rating	F	P	G	F	P	G	P	N

In addition the 1926 cone crop, the fall before this plot was established, was one of the noteworthy bumper crops generally commented upon by all observers. Counting 1926 as good, it is evident that for this locality there were 3 good crops, 2 fair, 3 poor, and one failure in nine years. This agrees with general observation through the years that about one year in three can be counted upon for a good crop with some seeding in between.

As in other forest types, cone crop counts must be made early in the season in order to get the record before squirrels begin to cut the cones before the middle of August. An example of the loss due largely to squirrels is afforded by one plot containing 42 white pine trees, on which two cone counts were made in the same year, one on August 13 and one on October 13. The latter examination revealed only 20 per cent of the number of cones that were on the trees at the time of the earlier count. Ordinarily the open

white pine cones cling to the trees for at least a year.

The severe fire weather conditions in Region 1 during the 1934 season were also reflected in heavy seedling mortality. At Priest River drouth conditions were unusually severe, the total precipitation for the growing season, May to September, inclusive, being 46% below normal; while precipitation during June, July and August was only 0.87 inches, the lowest since records were begun in 1912. The principal weather factors during 1934 compared with the 20-year normal are shown in Table 1.

The extremely low precipitation in the 1934 season resulted in drouth mortality somewhat heavier than usual. This factor accounted for 15% of total mortality in western white pine and 52% in western hemlock among the 1-year old seedlings on a lower north slope in the Benton Creek drainage. The much better survival in western white pine is chiefly attributed to the marked difference in root penetration. In the middle of August, root length on this site averaged 7 inches for white pine as against 2.5 inches for western hemlock. As a result, surface soil drying due principally to evaporation killed large numbers of the relatively short-rooted hemlock. Seedling mortality by cause is shown in Table 2. Biotic losses from fungi, insects, birds and rodents caused the loss of about 37% of total germination for both species. Heat, drouth and other physical causes, however, accounted for 60% of total germination in the case of western hemlock and only 19% in the case of western white pine.

Table 1

Climatic Records -- 1934 -- Priest River.

Records for May to Sept., Inclusive, Compared with 20-year Normal

Climatic Factor	Unit	20-Year Normal Record	1934 Record	Departure of 1934 Record from Normal	
				Actual	Percent
Precipitation	Inches	5.86	3.15	-2.71	-46.2
Average Relative Humidity, 5 P.M.	Percent	44.7	37.0	-7.7	-17.2
Mean Air Temperature	°F	58.6	59.1	+0.5	+ 0.9
Maximum Air Temp.	°F	76.4	76.9	+0.5	+ 0.7
Minimum Air Temp.	°F	40.9	41.0	+0.1	+ 0.2
Average Hourly Wind Velocity, 8' Level	MPH	1.96	2.01	+0.5	+ 2.6
Soil Temp. 1' Level	°F	56.8	59.6	+2.8	+ 4.9

Table 2
Mortality by Cause
Percentage of Total Germination

Cause	Western Hemlock	Western White Pine
Fungi	22	15
Insects, Birds & Rodents	10	21
Other Biotic	5	1
Total Biotic	37	37
Heat	6	1
Drought	52	15
Other Physical	2	3
Total Physical	60	19
Total Mortality	97	56

Fire

The record of fire danger factors obtained at Priest River during the past fire season covers a longer period, includes more factors, has less breaks due to instrumental and personal slips, and at least equals in accuracy, any similar record ever before obtained in this region. This record is now being used, with those from the other 45 stations in Region One, to rate the character of the 1934 fire season.

At Priest River one of the new features of this work consisted of a so-called vegetation plot, on which measurements and descriptions were obtained every 10 days, beginning May 23, of the growth and condition of seven species of grass, weeds, and brush, which influence the rate of spread of fire according to their volume and succulence. Soil moisture also was measured for the 0-6, 7-12, and 13-18 inch layers separately.

Great differences were found between the moisture contents of the plants observed. The oven drying of samples showed that fern was the best fire retardant with 660% moisture content on May 23, when pine grass had 160% moisture. By September 3 these plants showed only 60% and 40%, respectively. New growth of ceanothus, ocean spray and willow ranged between 200% to 250% in May and dried to around 100% in early September.

Soil moisture extremes were as follows:

May 23	0-6"	45 %	7-12"	41%	13-18"	35%
Sept 3	0-6"	6½%	7-12"	8%	13-18"	7%

Each of these moisture contents is the average for nine samples, each sample being from a staked spot selected by lottery, the stakes being first placed five feet apart and numbered, the numbers to be used on each date then being drawn from a hat.

The second new feature of the Priest River measurements of fire danger consisted of the use of eight fuel hygrogaphs and eight hygrothermographs to compare north and south slope conditions at 2700, 3800 and 5500 feet elevations, together with similar measurements in full sun and in half shade at 2400 feet elevation. The two last listed are part of the major stations now in their fourth year of operation. The average duff moisture and wood moisture from these two stations is used as the fuel moisture indicative of fire danger at Priest River.

Some rather startling, and several interesting and useful, features of weather and fire danger have been brought out by these measurements. All the instruments used must be checked, however, and the records corrected where necessary before compilation, analysis, and conclusions can be completed. Even then, it may be found that additional records will be needed before tentative conclusions can be published.

One development of this work, however, may be of particular interest. This is the need of comparing or calibrating all instruments used in such measurements, even though they be so-called standard meteorological devices. Hygrothermographs, of course, must be checked frequently, reset quite often, and the graphic records recorreccted before they can be used to prove that differences shown are due to site and not due to instrumental errors. It has also been found at Priest River, as a result of a suggestion by J. B. Thompson, that standard 3-cup, or 4-cup anemometers are not always accurate, and therefore the records not always comparable. Eight of these instruments exposed side by side showed wind velocities varying from 77% to 108% of the average for the eight. Two new 3-cup anemometers differed by 5% and 2½% in two tests. Thermometers also were found to differ sufficiently to require correction factors if differences of one or two degrees between sites are to be claimed as real.

Two tests of rain gauges were made, one at Missoula, and one at Priest River. In each case, a standard 8" gauge, a Friez electrically-recording tipping bucket, and a \$1.50 Forest Service gauge were used. Each gauge was placed at an apex of an equilateral triangle about 3 feet to a side, with the mouths of the gauges all at

the same level. For 25 rains at Missoula, the tipping bucket recorded a total of 4.39 inches; the standard 8" gauge showed 4.21 inches, and the Forest Service tin can 4.22 inches. At Priest River, the tipping bucket recorded 2.93 inches, while the measure of the catch by draining the gauge showed 2.96 inches for 22 rains. For these same rains, the 8" gauge showed 3.13 inches, and the Forest Service can 2.92 inches. The instrumental difference appears to be from three to five percent.

A similar test also was made at the Spokane office of the Weather Bureau, and it is understood that the Pacific Northwest Station assisted by running at least one comparison of gauges. None of these records have been received by the Northern Rocky Mountain Station as yet. Our own results indicate that for ordinary use the \$1.50 Forest Service gauge introduces no more instrumental error than the \$100.00 tipping bucket, if the 8" gauge be assumed as correct.

Further testing of other research instruments, such as so-called metallic tape measures, scales and balances etc., showed clearly that most new instruments, and nearly all old ones, especially if they have been repaired, need to be checked for accuracy before they are used. This station is therefore considering the desirability of establishing what may be called a Bureau of Standard Measures, to test instruments of all kinds used in our work. Field instruments would then be checked periodically by comparison with a standard of known accuracy. It is believed that such a procedure might improve many of the correlations sought between cause and effect. The scientific character of many of our reports also might be strengthened if it were shown definitely in each report that instrumental errors have been reduced at least until they do not exceed the refinement of analysis applied to the data obtained by use of these instruments. This would also tend to prevent greater refinement of analysis than is warranted by the instruments used.

Forest Survey

Thirty men were in the field during October type-mapping in place and estimating. These men were in addition to the two field inspectors, the two men on collection of cruise data, and the four men on intensive forest survey on the experimental forests. Rain, with snow in the higher places, slowed up the work during the latter part of October. Some of the summer assignments in northern Idaho were finished and the men moved into Stevens and Pend Oreille Counties in Washington. Field work on the three eastern Washington counties, assigned to the Forest Survey at this Station, will be completed before the field season ends.

Between 25 and 30 men will be employed during the winter on the office work of compiling the field data collected during the past summer. Office space in the Federal Building is not available for any of this crew and offices are being sought elsewhere. There is a scarcity of office space for rent in Missoula and it may yet be necessary to move the Survey crew to Spokane for the winter.

Bradner has been working on a sustained yield plan for the region, with special reference to the amount of merchantable timber and cutover forest land that would necessarily have to be acquired in order to place some of the present forest communities on a stable and prosperous basis. Sawlogs are being shipped such great distances to operating mills that it is rather difficult to designate the community that should be maintained or the number of mills that can be supported. As an example, one large company with mills at Newport, Washington and Sandpoint, Idaho, has discontinued operating and has placed its remaining timber on the market. Two Washington companies, one at Libby, Montana, and several northern Idaho operations, have purchased timber from the liquidating company and are now logging it. In the meanwhile, the mills at Newport and Sandpoint are idle and much of the timber that would help to support the communities is moving out.

The Coeur d'Alene River drainage was selected as the first sustained yield unit. The Coeur d'Alene National Forest, together with the the State of Idaho and the large private holdings, would sustain a cut of 70 million feet annually. It is estimated that the acquisition of the private timber and Zone 1 cutover lands would cost approximately \$436,000.

The average annual production figure for existing mills now operating within the unit, amounts to 137½ million feet. Only six of seven mills draw their sawlogs from stands within the Coeur d'Alene unit and these mills now depend upon this unit for but 78 million feet out of a total yearly mill cut of 98½ million feet.

In the past, Spokane mills have also drawn heavily from this Unit, and under certain conditions could afford to do so again. It is obvious that an annual yield of 70 million feet will not support all the present mills, though it would come close to supporting those mills now operating that are drawing all or a part of their logs from stands within the Coeur d'Alene Unit.

The rest of the sawlogs which support the mills within this Unit now come from the St. Joe and St. Maries Units to the south, and it may be necessary to combine the two units to make an adequate plan.

Logging and Milling

A logging output study was carried out at the Montana Logging Co. operation on Lynch Creek. Data were secured on skidding costs by tree sizes when a Willamette Erstad #152 Arch was used, with a 60-caterpillar tractor doing the yarding and the same type of tractor handling the roading. There are now two skidding arches being employed in the ponderosa pine belt of western Montana and other operators are considering their use. The study was conducted as a part of our logging output project, under which similar studies are carried on from time to time in order to keep abreast of current logging practice.

Production costs were secured from several portable tie mill operators in northwestern Montana, to be used in the final report and trade journal publication on selective cutting in the larch-Douglas fir type. Ties are now being delivered f.o.b. the Great Northern Railway in this territory for as low as \$10.50 per M, which includes \$1.50 per M for stumpage.

PACIFIC NORTHWEST FOREST EXPERIMENT STATION

Forest Economics

New Public Domain

Several hundred copies of each of the following preliminary statistical reports were bound and distributed: "Facts Bearing Upon Instability of Forest Land Ownership in Western Oregon" and "Facts Bearing Upon Instability of Forest Land Ownership in Western Washington". Newspaper and personal responses were many and favorable. The present supply is about exhausted.

Field data gathered in sample areas within Benton, Lincoln and Columbia Counties, Oregon were partially tabulated and mapped. These areas are involved in long-term tax delinquency and are mainly forest in character. They illustrate a variety of situation, among which are transition from forest to farm and back to forest, conversion through cutting from virgin forest to a seriously denuded no man's land, and ownership conditions in old burns, second growth and virgin stands. Correlations of tax delinquency with lay of the land, soil types, forest types, forest sites and intents in ownership were made and tabulated for the Benton County sample area. Plans for the report on effects of instability of forest land ownership were reviewed.

Selective Logging

Kirkland left for Washington on October 10 after collaborating with Brandstrom on the completion of the manuscript "Principles and Procedures in Forest Property Management in the Douglas Fir Region". Part of Brandstrom's time during the rest of the month has been spent in going over the manuscript with Miss Kerr. The manuscript would be now ready for final reviews except that a number of graphs and maps that are being prepared at the Washington office have not yet arrived.

At the request of the president of the Pacific Logging Congress, Brandstrom made a trip to Mineral, Washington on October 17 and 18 to go over the plans for a field day demonstration of modern logging methods.

Section of Forest Products

Douglas Fir Mill Production Studies

A work plan for production studies in small Douglas fir mills has been prepared.

The study scheduled at Molalla has been indefinitely postponed because of the inability of the mill to operate under present conditions.

The staff spent eight days in a study of two small mills at North Plains, Oregon. Both have double circular headrigs, are dry land mills, and are cutting second-growth Douglas fir logs grown within 15 miles of the mills. The first mill has no edger, is powered by a steam tractor, and can produce about 1 M feet per hour. The second mill has an edger, is powered by a stationary engine to which steam is supplied from a donkey boiler, and cuts 2,500 feet per hour. The mills operate intermittently depending upon the receipt of suitable orders and logs, hence it has been necessary to work a few days a week, first in one mill and then in the other. Present plans indicate that sufficient logs for analysis will be obtained by the middle of next month.

An attempt at popularizing mill production studies so that mill operators will more clearly understand and appreciate them has been made in an article submitted to the Timberman. It discusses the methods employed in such a study, using the results of a recent study at one mill. Emphasis has been placed first upon simple explanations of the steps in analyzing log values, and second upon the way in which the results may be adjusted to fit changed operating conditions.

Statistics of lumber production are still in active demand, several requests for the Oregon production by counties and species having been answered during the month.

More wood samples have been identified than in any other month during the past three years. All of these, however, have been in connection with Forest Service projects, none having been received from outside sources. One fossil wood was submitted by the Mount Hood National Forest and identified as western hemlock. Specimens of submerged trees removed from the Columbia River bed above Cascade Locks were submitted by Silviculture. Douglas fir, western red cedar, Oregon white oak, and ponderosa pine were noted in the group submitted.

Information was supplied to the Regional Office as to lumber manufacturers also engaged in logging.

Minor Products

Data on price movements of Oregon fir balsam, cedar leaf oil and cascara bark from 1914-1919 were obtained from files of the Oil Paint and Drug Reporter in the Portland Public Library. Through the cooperation of Cary Hill of the California Station these were carried back to and including 1910. The data will be compiled soon and so issued as to be comparable with those covering the period 1920-1933 which were prepared last spring.

Minor Timber Species

Some time was devoted to bringing up to date the report on northern black cottonwood. The first roughdraft is complete except for the section on management.

Farm Timberlands

A few days were devoted to the bringing together of available data on the farm timberlands of Oregon and Washington.

Deterioration of Fire-Killed Timber

Rapraeger spent about 10 days in the field on this project collecting data which will supplement those already collected by Entomology and Pathology.

Mensuration

Spruce-hemlock Yield Study

Office work on this study is progressing rapidly, all plot statistics having been completed for the Oregon and Washington data. Efforts have been successful to obtain on loan, plot measurements taken in British Columbia as well as in Alaska. Meyer made a short field trip to British Columbia to obtain permission to use their data and to get a personal impression of type conditions in the province. Much excellent material was obtained which will allow us to extend the range of our yield tables and make them wide in application.

Some of the plot statistics are almost unbelievable. The best plot taken was in a pure Sitka spruce stand 173 years old in Douglas County, Oregon, and contained 45,000 cubic feet per acre, equivalent to 278,000 board feet, Scribner rule, scaled in 32-foot logs to a 12-inch top. In terms of International rule and the close limits of utilization used in yield studies of other regions, this is equivalent to 350,000 board feet per acre. Five other plots in

the same stand all gave volumes over 200,000 board feet Scribner rule per acre.

Silviculture

It may be that tree rings will play a part in working out the recent geological history of the Columbia Gorge in the immediate vicinity of the Bonneville Dam now under construction. During periods of low water, a submerged forest shows up in the present bed of the Columbia from Cascade Rapids east for a distance of 50 miles or more. It was first reported by Lewis and Clark in 1805, and they estimated that the trees had been dead for 25 years or more at that time. The Experiment Station and the State Parks CCC Camp at Wyeth are cooperating with Mr. Don Lawrence, a Johns Hopkins graduate student, in trying to find out when the forest was submerged and how it happens that the trees are so well preserved. Like the present stands that border the river, the submerged forest consisted chiefly of Douglas fir, with a certain amount of red cedar and oak. Near the eastern limits of the area some ponderosa pine has been found. The wood of these trees where submerged or covered by silt is often found to be in a perfect state of preservation. We are trying to see if there is any correlation between the ring pattern of the submerged trees and the oldest living trees in the vicinity and thus establish the date of submergence, which is estimated to have occurred from 150 to 2000 years ago ("twenty old squaws", or from 1000 to 2000 years, according to Indian legends). Apparently a sudden settling of the earth's surface was accompanied by a gigantic land slide from the north side of the river, completely damming the Columbia, forming a great lake. The bed of the lake gradually filled with sediment, and at the same time the level of the lake was slowly lowered by the cutting away of the slide. At present the river has cut down the slide to a point below the level of the old lake bed so that the accumulated silt has been carried away and the standing tree trunks of the old forest are exposed.

For all the Douglas firs which have been cut, no correlation is apparent, but it is hoped that some correlation in ring pattern will be apparent when the oldest submerged tree, a ponderosa pine, at the eastern limit of the lake is examined.

Fire Studies

Matthews reports that progress is being made in checking and copying the fire danger station records, obtained by national forests and cooperating agencies during the 1934 fire season, for a permanent Station file. Several inquiries about the fire danger stations were received and have been answered. Two exhibits were prepared showing certain of the instruments. One of these exhibits

has been in windows of the First National Bank and one of its branches for about a month. Certain final summaries of fire depletion in the Douglas fir region of Oregon and Washington are being completed for the Forest Survey. Byram and Backus have finished testing the visibility meter with artificial smokes. Byram is working up the results of these tests and Backus is drawing up plans and specifications for each of the instruments in order to have a permanent record of how the instruments were built and the specifications for the material used. Such plans and specifications have been completed for the hazard indicator stick scales and the fan psychrometer.

Methods of Cutting in Ponderosa Pine

Kolbe and Field Assistant Grant spent October in re-examination of permanent sample plots on four national forests in central and eastern Oregon. These plots were established to test results obtained from various degrees of cutting. Morris joined the party to assist in the work on the oldest plots for this project, which are on areas cut over 20 years ago. These plots are on the Whitman National Forest in eastern Oregon a short distance from the proposed Blue Mountain Experimental Forest. This examination of sample plots throughout the pine region of Oregon showed 1934 to be a very poor year for new reproduction but an unusually favorable one for the growth of residual trees and small seedlings already well established. On these cut-over sample plots which cover about 200 acres not over three reserved trees were lost as the result of insect attack this season.

Forest Survey

Douglas Fir Region

A considerable amount of time, not only by members of the Survey staff in Portland but also by Lodewick, Johnson and Matthews, has been spent on the final round-up of acreage figures for assumed depletion for the next three decades. To prorate assumed future depletions for both fire and cutting to forest units consisting of from 1 to 5 counties each has proved to be a most complicated job. The cooperation of the Regional Office has been secured, particularly in the matter of assumed future cuttings on national forests. Delving into the matter of assumed future depletions has brought to light many interesting inventory facts and has required the harmonizing of many more or less divergent opinions as to what the future holds. The general plan has been to first get some general agreement as to future cutting and fire depletion for the region as a whole for the first decade, and then to break down this general depletion figure unit by unit.

In setting up cutting depletion figures for any particular unit the record of past depletion is used as a guide, but the remaining supply of timber left in the unit is the governing factor. It is already apparent that while there may be a supply of all species of timber left in certain units ample to maintain a cut comparable to the past record of depletion, such a cut cannot be maintained even for the first decade if Douglas fir lumber is to remain the predominate product in the Northwest. In other words, certain units will be cut out even in the first decade if Douglas fir is the governing factor. The question then comes up as to the future of lumber versus pulp products, and next as to which other forest units will take up the slack for Douglas fir. After all forms of depletion for the first decade have been set up a tentative set of inventory sheets is drawn up showing the timber remaining in each unit at the end of the first decade. The procedure is then repeated for the second decade and another set of inventory balance sheets set up and the third decade is then worked out. The problems in planning for assumed cutting for as far as 30 years ahead are seemingly endless, but nevertheless interesting.

Cowlin has continued with the write-up of the North Puget Sound Unit. The completion of the write-up of this unit is now held up until final assumed depletion and growth figures have been worked out. The discussion and analysis of this one unit will serve as a model and guide for all other units which will be done by the members of the Survey now in the field, who will be returning to the Portland office early in November.

A scheme for consolidation of the Survey's 38 forest types as mapped in the field into some 22 or 23 types to be shown on the regional $\frac{1}{4}$ -inch-to-the-mile type maps has been made and a technic for consolidation has been worked out. This consists of superimposing a sheet of transparent vellum paper over the 1-inch-to-the-mile colored type maps of each county. The consolidation is then made on the vellum sheet, using the detail underneath as a guide. The problem in consolidation is one of deciding which of the detailed types as mapped in the field can be merged to show as accurately a picture as possible on the $\frac{1}{4}$ -inch-to-the-mile map. Generally speaking, areas smaller than 160 acres cannot be shown on the final map, and in certain cut-over and burned-over areas, particularly where field men mapped types as small as 40 acres, good judgment is required in the consolidation. The vellum is then photostatically reduced to a scale of $\frac{1}{4}$ inch to the mile and placed under the regional lithographed base maps and the transfer is made on light tables. It is hoped that by this procedure several men can be put at this job simultaneously and that regional type maps for northwest Washington and the entire west half of Oregon can be sent to the U.S.G.S. early in the winter. When these regional type maps are lithographed they will be the first large scale type maps ever published for any large forest region in the United States.

Ponderosa Pine Region

The field personnel which has been working all summer in eastern Oregon and Washington is still in the field. The weather has been most unfavorable during the latter part of October and it is expected they will return to Portland early in November.

During October aerial pictures were taken for a million and a half acres in the Chelan National Forest. This area will be worked next field season and from the experience with these pictures this season they should be of great assistance. The Regional Offices of Fire Control and Maps and Surveys cooperated in the financing of this project.

SOUTHERN FOREST EXPERIMENT STATION

Experimental Forests

The buildings on the Harrison Experimental Forest in Southern Mississippi have been completed and accepted, and those on the Crossett Forest are in process of construction. The Station planning committee made an inspection trip to the Ashe, Crossett, McNeill, Harrison and Olustee Experimental Forests, in order to formulate plans for their development and management.

The W. W. Ashe Forest on the Kisatchie National Forest, Louisiana, offers excellent opportunities for studies of forest reproduction, natural and artificial; silvicultural burning for longleaf; control of oak brush; and thinning.

The Crossett Forest, near Crossett, Arkansas, will provide a proving ground for large-scale, long-term experiments in forestry practice, as well as serving as a demonstration forest of sustained yield management.

The Harrison Forest, on the Biloxi District of the DeSoto National Forest (Mississippi), offers an opportunity for both intensive and extensive studies on fire (effects, controlled burning, behavior under various conditions); seed production, growth, thinnings, and other management problems; and forest protection other than from fire (insects, rodents, birds, diseases.)

The Experimental Forest at McNeill, Mississippi, will provide for continuation of the fire-grazing-growth study, as well as for studies in methods of cutting and of reproduction, and later for naval stores research.

The Olustee Forest, on the Osceola National Forest, Florida, will continue to be used primarily for naval stores and fire research.

Forestation

1. Huberman completed a preliminary microchemical analysis of the soil in the Robert Y. Stuart Forest Nursery (heretofore known as the Catahoula), based on random samples taken throughout Blocks 1 and 2. He also assisted in the final inventory of the stock in the nursery to the extent of applying the seedling grading rules drawn up by the Station, and helping the nurseryman instruct his staff in their use. This inventory marks an improvement over

previous inventories in southern pine nurseries because it shows numbers of plantable trees (Grades 1 and 2) by species, as well as total number of trees. There are slightly more than 10 million plantable trees.

2. Wakeley and Huberman assisted Nelson of the Regional Office with the design of a new seed-extracting plant, including improved cone trays, for the Stuart Nursery, to take the place of the plant burned down October 13. The kiln in the new plant is to be heated by steam, as originally suggested by the Station, instead of by hot air, like the plant which burned.

3. Wakeley and Olsen prepared a map of the experimental planting tract at Alexandria, showing residual trees by species; brush by species, height and density; major variations in grass and other ground cover; general soil conditions; and all important features that should be taken into account in the laying out of Latin squares or randomized blocks for tests of seed source, spacing, or effect of nursery treatment. The work was greatly expedited by the use, in the field, of an excellent aerial photograph, which showed individual longleaf trees left after logging, and boundaries of brush of various density and height classes.

4. Half the month's work was devoted to obtaining and instructing five FERA student assistants, and to preparation of detailed plans for new work. One FERA student is making an analysis, under Wakeley's direction, of the soil types originally occupied by each pine species, and of the types on which one species has given way to another or to scrub oak or grass, as shown by the United States soil survey reports for the entire southern pine region. It is hoped in this way to obtain sounder information than any now available concerning the choice of species to be planted on any commonly occurring site. Huberman prepared the first draft of a comprehensive working plan for a study of forest nursery fertilizer practice, with emphasis on the relative effectiveness of commercial fertilizers, barnyard manure, and various systems of soiling-crop rotations, in maintaining or improving soil fertility over a 10-year period. Nursery measurements of the seedlings grown under different treatments are to be checked throughout by survival and growth of the stock after planting in the field. Wakeley and Olsen completed about half the task of laying out the experimental planting work of the next 10 years on 1,200 acres in accordance with Wakeley's tentative program prepared last month, and with the cover and soils map just completed for the experimental tract.

Financial Aspects

Reynolds at Crossett cruised and marked for cutting a number of forties which are to be used in his selective logging study in second growth shortleaf and loblolly pine. On each forty, a 100%

cruise was made and a definite volume per acre was marked. These volumes varied by forties from 500 board feet per acre, up to 4,000 board feet. The purpose of the study is to determine the possibilities and costs of selectively logging varying volumes of shortleaf-loblolly pine alone, and shortleaf-loblolly pine-hardwoods combined, from second growth stands of average density. Another purpose is to determine costs of logging trees of different sizes and to study the possibilities of reducing logging costs in the selective logging of light stands. The actual logging will be initiated early in November. The Crossett Lumber Company is cooperating in this study and will follow the working plan as to number of felling crews, skidding teams, and trucks. The company will keep careful costs of all operations and logging will be conducted as it is usually carried out on their holdings. In the future, this company must depend largely on second growth timber and this is the case with most companies logging in this forest type. This study is, therefore, a very practical one and should yield much valuable information.

The Crossett Lumber Company, which is now logging selectively their last block of 25,000 acres of virgin timber, has employed J.D.L. Drake to mark one unit consisting of approximately 2,500 acres. In this selective logging only the growth is being cut and a cutting cycle of 10 years is being used. A diameter limit of 24 inches in virgin timber is being used but crooked trees and trees with red heart or otherwise unfit to be left until the next cut are being marked for removal even tho of smaller diameter. The tops which are felled close to the base of standing pine trees or of valuable white or red oak are lopped and pulled away so as to reduce danger of fire and insect attack. It has been found that about four men are required to lop the tops for 10 saws cutting an average of about 12,000 board feet per saw. This lopping costs between 7¢ and 8¢ per thousand board feet and is certainly well worth while when the value of the high quality virgin timber is considered.

Land-Use

A joint study by the Forest Survey and New Public Domain staffs was initiated in Forest Survey Units Georgia #1 and Florida #1. This study consists of recording from local sources the type of owner and area-class of all land holdings in five selected counties in each unit, together with data on tax-delinquency, assessed valuation and taxation of sample properties of each type and size of holding, and of data on the public finance of each county. Two 2-man crews are engaged in this study in the field, and have completed one county in each unit.

Forest Survey

The 25 field crews turned in during October a total of 10,921 quarter-acre sample plots representing about 8,736,800 acres in the seven units and six states now being surveyed. The Red River back-water area of Unit 2, Louisiana, is finished which completes a particularly inaccessible area before the seasonal rains, and releases several crews for work in Louisiana Unit 2.

Unique in survey field procedure is the method recently started in the Grand Lake region of southern Louisiana by Lehrbas and Putnam. Working from a house boat anchored close to the work, crews proceed to and from the survey line in motor boats. This region is in a transition stage from water to land. Sediment is being deposited in loose, jelly-like layers and bars from a few inches to several feet deep are formed each year. Progress over this is alike for both men and boats - a matter of crawling.

Results of the Survey in units already completed in the Southeast appeared in the Station's "Occasional Paper - No. 36." This paper classified the working turpentine cups in south Georgia by year of working and gives the turpentine history of worked trees. A survey progress map is also shown.

Forest Survey Release No. 4 will be published early in November. It defines the various classes of gum producers and gives tables showing acreage, crops and production in naval stores units in southeast Georgia. A map of this area is included. An advance report on the pulpwood inventory in the completed units of the Southeast is being prepared and will be released in November.

Tabulating and computing work in the office has maintained a schedule which handled the current field work and provided the necessary tabulations and summaries for the periodical Survey releases. A recent discovery by Wheeler that U. S. Census figures include only land area will cause the end figures of several projects to be altered.

Eldredge met with Dr. Herty and the Naval Stores Control Committee to determine what naval stores information should be given precedence in the advance publications of the Survey.

Lehrbas and Eldredge joined Faulks at Pensacola and made a two day scouting trip in the southern Alabama naval stores unit. One of the field party chiefs presented Lehrbas with a wooden turpentine cup, sawed from a block of black gum. Several crops of these cups were in use in this region.

The Naval Stores Review of October 13 carried a Survey news release giving a table of forest type acreage in southeast Georgia, and a discussion of the unit with regard to turpentinizing possibilities. Further favorable publicity was secured in the Pensacola and Mobile

papers in an article on the progress of field crews in west Florida, Alabama and Mississippi.

Erosion

Meginnis reported that most of the 1934 planted black locust stock at Holly Springs, Mississippi, came thru a rather dry summer in good shape. 1934 field experiments on sulphuric acid treatment as a method of increasing the germination of black locust showed that the yield of seedlings was increased from 81% to 114% by the acid treatment.

Pathology

Siggers made the annual remeasurements of the seedlings on the original brown-spot spray plots at Bogalusa. The tallest sprayed seedlings are now 6 to 8 feet high, and these and seedlings down to 1 foot high on the sprayed plots are competing among themselves. About 98% of the unsprayed seedlings are still in the grass.

Hatfield reported that the discoloration of magnolia and yellow poplar heartwood after dipping in Dovicide-H is apparently caused by a chemical reaction in the wood and not due to stain fungi. A bolt-spray test to determine relative merits of certain chemicals proposed for Ambrosia beetle control and another test of 21 chemicals of a local treatment company are under way.

Entomology

Larvae of a Pyralid moth (Elasmopalpus lignosellus Zell.) were reared, and the damage to black locust seedlings, its biology, and control of the insect were studied. This caterpillar has been observed girdling locust near the ground line in Mississippi and Arkansas, killing a large number of seedlings.

Tests of 20 chemical sprays for preventing ambrosia beetle damage to green hardwood logs and lumber indicate some promise for such treatments.

Studies of tree-hopper injury to black locust seedlings and planted trees were made in Mississippi.

Ten species of insects were reared in quantity from nature cones of southern yellow pines from Louisiana and Florida.

SOUTHWESTERN FOREST & RANGE EXPERIMENT STATION

Fort Valley Branch

Growth Plots

In October, Hornibrook, Johnson, Murphy and Lexen remeasured the Wing Mountain intensive and extensive sample plots. These plots are among the oldest kept under record at the Station and date back to the early beginning of the Coconino Forest Experiment Station which was established in 1909. Combined, the intensive and extensive units comprise 480 acres and contain approximately 10,000 trees four inches and over in diameter.

Most notable among the changes that have taken place in recent years is the almost complete cessation of porcupine damage, the development of an excellent stand of young growth and a noticeable loss in standing timber due to mistletoe. The decrease in porcupine damage is attributed to a systematic poisoning and hunting campaign that has been carried on for a number of years, and the good progress of reproduction to control of grazing. The loss through mistletoe was inevitable since portions of the original stand were as much as a hundred per cent infected.

After 25 years this experimental unit has reached a stage where it could be cut over again with considerable improvement to the reserved stand and at the same time assure the young pole growth now developing, freedom from mistletoe infection. Present market conditions, of course, are not such as to make a logging operation profitable; nevertheless, it is encouraging to look back at a quarter of a century of progress and know that the forest is improving as well as growing and that records are available on the changes that have taken place.

Timber Inventory

The intensive inventory on the Fort Valley Experimental Forest, comprising some 2,400 acres, has been completed and progress is being made in compiling the data, although it is expected that the job will last far into the winter. The field work was made possible by Nira funds and the loan of two technical men, Dyksterhuis and Vincent, from the R3 organization.

Forest Planting

Two months without rain have produced devastating results in seed spot and planting experiments. As is usual in dry periods, rodents have also taken a high toll. Natural seedlings over 4 years old have withstood the drought remarkably well.

Natural Reproduction

Observations on the Coconino, Tusayan and Sitgreaves indicate that grazing damage has been worse than in any year since 1927. This condition, however, applies mainly to a few allotments on which stock came in earlier or remained later than is customary. Damage to terminals was accentuated this year by the fact that the shoots began to elongate a month earlier than usual, thus exposing them longer to browsing during the dry foreshadow when leader damage is prevalent. Generally, the pine seedlings have made good growth; many of the 1919 class have reared their leaders beyond reach of sheep, though few are out of danger from cattle. Goodly numbers of 1928 and 1929 seedlings are now coming into prominence to fill gaps in the ranks of their older brethren.

Stand Improvement

Several additional stand improvement record plots were established in the Fort Valley Experimental Forest during October. A short article describing methods of stand improvement employed in R3 is in preparation.

Experimental Forests.

Three areas were examined by Pearson and Lexen, in search of stands suitable for an experimental forest in the best pine site of R3. The greatest height of dominants, and altogether the most desirable area was found in the Long Valley section of the Coconino. Trees over 120 feet high are rather common on this area, and one was found to measure 139 feet.

Two isolated experimental areas are being added to the Fort Valley Experimental Forest. These plots antedate the experimental forest by many years. The forest will now be made up of three separate units all within a 20-minute drive from the Fort Valley headquarters.

Cloudcroft Branch

Field work was brought to a close in October. During the past summer, Krauch has carried on a study of reproduction of Douglas fir, remeasured sample plots on the Carson and Lincoln, and established a small Douglas fir nursery for Region 3. The stock in the nursery thus far consists of about 30,000 first-year seedlings which were grown entirely without artificial watering. Whether the nursery is expanded depends upon the Regional program as determined by future NIRA allotments. If it is decided after another year not to continue this nursery, the stock will probably be planted out as seedlings, since to transplant them in the nursery would require installing a water system. Meanwhile the project is furnishing sidelights on the Douglas fir reproduction problem. It is corroborating the findings that climatic factors are not particularly adverse to Douglas fir reproduction, and that solution of the problem lies mainly in the control of rodents.

Jornada Experimental Range

Range and Climatic Conditions

A very beneficial rain fell over most of the Range October 11 and 12, which filled some of the tanks and gave forage growth a late, but fair start. Since the soil was so dry, and no supporting showers were received afterwards, the benefits were not what is usually expected of an inch rainfall, and the drought is still far from being broken. As a result of the subnormal condition, the grazing capacity of the Range will be less than a fourth of normal for the current grazing year. This places the cooperator in an extremely awkward position since there is little available range outside to which the stock may be moved, and the price of feed is prohibitive, especially for such low priced cattle.

The cooperator has shipped during the month a total of 468 cows and bulls and 120 calves to pasturage near Lordsburg, New Mexico. This, plus those previously disposed of to the Drought Relief Commission, reduces the adult stocking from 1800 to approximately 500 head. There are still over six hundred 1934 calves for which provision must be made during the coming months.

The annual cattle count was completed in October but because of the remnant missed, the final figures had not yet been determined. Preliminary figures reveal a hard deficit, which added to the recorded loss will probably total approximately 7% death loss during the current year.

Compilation of back pasture data for an economic study is still under way. Cost figures for the years of Waggoner's tenure as cooperator have been received.

Management

A draft of Canfield's Clipping Study manuscript is now complete, and is ready for submission to the station editor.

Eradication of Poisonous Plants

Experiments were made in eradication of Drymaria holosteoides by grubbing, burning with kerosene and gasoline burners, and spraying with chemicals. The chemicals used were: sulfuric acid, at-lacide, ammonium sulfocyanate, iron sulfate, and common salt. Of these the most effective was 10% sulfuric acid. Although grubbing, burning and spraying with 10% sulfuric acid are all satisfactory, grubbing or other mechanical means probably is to be preferred because of the lower expense.

Similar experiments in eradication of Actinea odorata (?) showed grubbing and 5% sulfuric acid to be the most satisfactory methods.

Small amounts of Drymaria appeared on the range. These limited patches, scattered over areas totaling about 25 acres, were eradicated by grubbing.

RESEARCH - REGION 2

Management of the Fremont Experimental Forest (M-1):

Five plots in the experimental forest were remeasured during October; this remeasurement coming at the close of the first 10-year period following cutting. Although the data have not yet been compiled, it is apparent that the period 1929 - 1934 constitutes the poorest, from the standpoint of increment, since the inception of systematic management some 15 years ago within the forest. The last four years have been marked by an extraordinary deficiency in growing season precipitation and soil moisture and this condition in the main supplies the answer for the slowing up in growth. It is interesting to note that the falling off in growth has been much less in Engelmann spruce, ponderosa pine, and limber pine, in the order named, than in Douglas fir. The decrease in the periodic rate of growth in the last named species, as compared with the preceding period, amounted to between 50 and 75 per cent. In addition to frost sensitivity, observations apparently indicate that the mountain form of Douglas fir is more sensitive to meteorological changes affecting atmospheric moisture and probably soil moisture, than are the species with which it commonly associates.

By the end of the month, thinning had been completed on the area upon which cutting operations were concentrated this year, and most of the felled material had been skidded and yarded.

Erosion Studies:

Two short field trips were made by Roeser, one on the Pike, the other on the San Isabel, to examine areas upon which studies are being conducted to note the progress of erosion under conditions involving various forms of grazing control and to make the prescribed erosion profile measurements in connection with these projects. Since there was a minimum of rainfall during the past season, the effects of protection upon vegetation and upon erosion, as shown by channel cutting and gullying, are less apparent than in past seasons on the Salt Creek area on the Pike Forest. On the Three mile area within the same Forest, where an extensive CCC control project was undertaken in 1933 on a small watershed, the very dry season failed to put the one-year-old check dams to the expected test. Conditions in the San Isabel Cottonwood Creek project were somewhat different. Here the measurements indicated, even under the fairly favorable conditions that existed, that lateral and upstream extension of the gully under study continued at a steady rate of progress.

Climate in Relation to Forest Planting (T-1):

Summarization of the climatic data procured by daily observations at two meteorological stations at the Bessey Nursery in Nebraska, beginning in October, 1930, and compiled through March, 1934, affords an interesting comparison between climatological phenomena existing within an approximately 30-year-old plantation of jack and Scotch pine approaching the 30-foot mark in height and under open sandhills conditions.

For the 42 months in question, 64.47 inches of precipitation fell at the open station and 53.28 inches, or 17 per cent less, at the station within the plantation. The gauges are located three feet above the ground. A difference of 19 per cent exists between the amounts falling in the gauges during the 140-day growing season, which indicates that interception during this period of the year exceeds that during the dormant season, including the winter, during which period only about 33 per cent of the total fall is recorded.

Air and soil temperature averages for the years 1931, 1932 and 1933 (except as noted) with their growing seasons, compare as follows:

Period	Annual		Growing Season (May 10 to Oct. 1)	
	H-2	H-4	H-2	H-4
Station	Within	In	Within	In
Location	Plantation	Open	Plantation	Open
Mean daily air temperature	48.05	50.11	69.43	70.31
Mean maximum air temperature	62.00	84.91	63.37	84.61
Mean daily air temperature range	27.83	30.97	26.54	28.62
Soil temperature at one foot	47.84	50.33	64.74	71.12
Soil temperature at four feet (1)	49.77	52.72	60.70	67.94

(1) For 1931 and 1933

It will be seen that the mean daily air temperature, for the period under consideration, has averaged about 2° F. lower under the stand for the entire year and somewhat less than 1° F. for the growing season. (The instruments are located at a level 6 feet above the ground). The presence of the trees has effected a slight reduction in the annual mean maximum temperature, but curiously enough not for the growing season. It is also surprising to note that the mean daily air temperature range, both for the year and for the growing season, is greater within the stand than in the open. This is probably due to greatly retarded wind movement.

Both at the one-foot and four-foot levels below the surface of the soil, the average temperature under the stand is less than it is in the open, the difference amounting to about $2\frac{1}{2}^{\circ}$ F. at one foot and 3° F. at four feet. For the growing season, these differences are more than twice as great.

As may be expected, (and this is of especial interest from the standpoint of the "Shelter Belt") the most significant change in climatic conditions owing to the presence of trees relates to the retardation of wind movement, as measured at a height of 25 feet. For the period, October 1, 1930, to March 31, 1934, (exclusive of five spring decades) the total movement at the station in the open was 224,018 and at the protected station 78,978 miles. In 1931 and 1932 the movement at the latter amounted to 44 per cent of that at the former; in 1933 it dropped to 27 per cent. The difference probably represents, in part at least, the influence due to the increased height of the trees.

The data in regard to evaporation, as measured at 25 feet above the ground, have not been fully compiled, but they also point to the beneficial influence of the crown cover. For the period, October, 1930, to December, 1932, inclusive, the total evaporation at the plantation station was 35 per cent less than at the open station. For the two growing seasons the difference was somewhat less, 33 per cent. This smaller difference in the summer is probably accounted for by the fact that in this particular locality wind movement very likely constitutes the most important evaporative agent, and the lightest movement is experienced during the summer months.

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