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BRANCH OF RESEARCH

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## APPALACHIAN FOREST EXPERIMENT STATION

### General

A conference attended by the forestry staff of the T.V.A. and the members of the Station staff was held in which the program of each institution was outlined so that the work could be coordinated. The T.V.A. men attending were: E. C. M. Richards, Bernard Frank, J. J. Goulden and C. H. Burrage.

E. J. Schlatter, Forest Code Examiner, with a representative of the Station visited several logging operations and mills in Western North Carolina. On one area they found that the scarlet oak cut was unusually sound while the white oak contained an excessive amount of hidden defect. Red maple contained very little defect.

A. Inskeep of the Smoky Mountains National Park spent a day at the Station discussing methods of slash disposal with members of the Station and Pisgah National Forest. On parts of a spruce hardwood area in the Park cutover about 15 years ago, slash has apparently decayed very little and presents a bad fire hazard. This slow rate of decay may be due to the elevation since the higher the elevation the slower the rate of decay. In the hardwood stands of lower elevations the extreme hazard is usually over in 5 to 6 years.

K. A. Swenning and W. P. Bullitt of the Meade Paper Company stopped at the Station. They are poisoning sassafras and sycamore on good sites where poplar ought to come in. Sycamore was found to be hard to poison.

### Management - Coastal Plain

#### Pulpwood

Collection from 480 trees of data for the new loblolly pine volume table was completed. Fifteen randomly selected trees were felled and measured on each of 32 plots, there being 2 plots in each combination of 4 age classes and 4 density of stocking classes. Taper measurements were taken at each 10 percent of total height. At each point of measurement a section was obtained for further analysis in the office. In addition bark thicknesses were taken. This data will also be used for a study of the factors affecting bark thickness and the amount of heartwood.

The shrinkage since the last weighing of the pulpwood which had been stacked in different ways was negligible. Preliminary analysis of the data indicates that most of the weight loss occurred during the first 4 weeks after the wood was peeled and panned. An average of 23 percent of the weight was lost during the first month while during the following month and a half there was an additional loss of only 7 percent. A marked negative correlation was found between the size of bolt and percentage of weight lost.

## Management - Mountains

### Selective logging

Sample plots for selective logging have been established at Parsons, West Virginia and Bastian, Virginia with total areas of 6 acres and approximately 35 acres respectively. On both of these areas the Forest Products Laboratory is making a cost production study. Cutting has been completed on the Parsons area, approximately 8000 board feet per acre being cut and 2000 feet left in an average of 19 trees per acre, 10 inches d.b.h. and larger.

### Streamflow and Erosion

#### Road fill maintenance

Following a 7 inch rain road fill planting experiments on the 12 miles of road between Clayton, Georgia and Pine Mountain, Georgia were examined by Hursh and Nothstein of the Nantahala National Forest. The soil along this roadway is little more than a light decomposed granite of a nature that erodes rapidly. Brush wattles had been constructed on these fills, using C.C.C. labor, and the shoulders and spaces between the wattles planted in September and October to a mixture of rye, 2 bushels to the acre, and red top, 20 lbs. per acre. At the same time 400 lbs. per acre of 4-8-4 fertilizer was applied.

The wattles construction was successful in preventing washing along the fills except at points where drainboards had not been installed to carry away large volumes of water. At these points, however, the gulying was considerably less than at similar locations left without wattles for a control.

The rye and red top had succeeded in holding the soil in place along the shoulders and wherever it had been able to germinate along the banks. On steep fills much of the seed was unable to catch and establish itself except where definite furrows had been dug along the contour.

## Forest Pathology

### Decay in sprout oak

Further work on decay in sprout oak in the absence of fire , shows that considerable decay originating from the parent stumps may be present. The larger the old stump and the higher the sprout arises on the stump the greater is the chance for decay.

Where the old stumps had been completely burned away following cutting of the original stand little decay was found in the new sprouts.

### Blue stain on stored pulpwood

In connection with the pulpwood study 10 percent of the bolts in each pen were split open and examined by Hepting. At the end of 7 weeks 41 percent of the sapwood volume of shortleaf pine bolts was stained. Examination of loblolly pine bolts at the end of 5 weeks showed stain in 33 percent of the sapwood volume. This wood had been piled in cribs 5 to 6 feet high.

Cross Nectria-inoculation work with various strains of Nectria indicates that the strain attacking yellow poplar and mountain magnolia is the same and is confined to those two species; that the strain from sassafras is specific, affecting only that host; that the strain on cucumber may be specific; but that the strains on many of the other hardwoods including the birches, aspens, maples, hickory, black walnut, elm and others are more or less the same and are capable of affecting a great variety of tree species. The results so far are indications rather than proofs of these relationships.

Plots have been laid out in a stand of sapling yellow poplar to determine whether cankered trees will heal out their cankers if released from competition.

Studies on the fruiting of Nectria on cut and girdled yellow poplar and black walnut show that at the end of 12 months there is roughly twice as much fruiting of Nectria on the cankers of the cut trees as on the girdled.

## Forest Insect Investigations

On November 19 Johnston moved to Asheville from his temporary Headquarters at Raleigh, North Carolina.

### Tree injection and wood preservation

The demonstration rustic cabin at Bent Creek was completed during the month. Each log in the building was tagged, naming the kind and amount of chemical used in the tree from which the log was taken. Preparations were made for the construction of a wood shed in which untreated logs and logs injected with copper sulphate will be used.

Additional tests of methods of tree injection were made in both standing and felled trees.

Tests for visibility of chemical distribution in treated logs were carried out with some success. It was found that copper sulphate and mercuric chloride reacted positively.

Sections of a number of the trees used in the cabin were sent to Washington where quantitative chemical analyses will be made. The results of the analyses should indicate the amount of chemical at various heights and depths in the trees.

### White grub studies

Additional grubs were collected, some of which were preserved for detailed study. The others were placed in soil boxes for winter use and life history study.

During the vertical distribution diggings indications were that the grubs were starting down in the soil during the second week of November. However, damage to nursery stock had not stopped.

### Fire Weather

Fire hazard was low except for a rainless period from November 12-20 when a large High stagnated over the Southeastern States. Plentiful and well distributed rains following this period raised the total for the month to 4.53 inches as compared with a normal fall of 2.23 inches. This was sufficient to indicate an excess of 1.46 inches for the year, the most favorable since 1929.



## CALIFORNIA FOREST EXPERIMENT STATION

### Forest Management - Pine Region

#### Experimental Seeding and Planting

Lloyd completed planting seedlings and seed spots on the bear clover area and the Anderson Valley burn on the Stanislaus. He also sowed 400 seed spots at Big Springs on the Lassen Forest, in a manzanita brush field in which the Biological Survey has been carrying on rodent control. Snow forced the postponement of the work on the Nelson Creek burn on the Plumas.

### Forest Management - Redwood Region

One of these projects is the Hodge Indian allotment sale of redwood timber near Klamath, California. The area is small, only 80 acres, but supports a stand of approximately 10,000,000 feet of merchantable redwood in addition to a small amount of Douglas fir, spruce and western hemlock.

Mr. Marshall, forester for the Indian Service, was particularly anxious to practice some silviculture in the logging of this area because it is probably the first sale of redwood timber by either the Indian Service or the Forest Service, and it is also one of the first sales under the Wheeler and Howard Act.

The Station was invited to advise the Indian Service as to how the area should be logged, and Person and Brundage, in cooperation with Marshall, Muck, and Radtke of the Indian Service, drew up marking and logging plans which were embodied in the contract with the Klamath-California Lumber Company.

The principal points of the contract provide for the use of a flexible 40-inch minimum diameter limit, the yarding of all logs at right angles to the contours, and the use of blocks, siwash trees and any other means necessary for the protection of trees left.

Trees over 40 inches in diameter are to be left in cases where their falling would destroy smaller trees which should be left. Some trees under 40 inches will be cut in cases where they could not be protected against injury.

No slash disposal is to be either required or permitted by the Company. After logging of a setting is completed, experimental spot and controlled downhill burning during the rainy season will be tried.

## Range Research

A 70-man CCC winter camp under the supervision of the Sierra Forest was established on the San Joaquin Experimental Range for pasture-fence construction and general development work.

The advisory committee of stockmen and other land owners previously selected by Madera County met Director Kotok and staff members from the Station and the Sierra Forest to review on the ground preliminary plans for the experiments to be undertaken on the Experimental Range. General approval of main lines of effort was voiced.

## Erosion - Streamflow

### San Dimas Experimental Forest

A rain, interesting from the viewpoint of research, occurred over the Experimental Forest during the period of November 15-19. The total catch varied from 1.31 inches to 3.50 inches with a general average of 2.56 inches. The large flumes showed small runoff from areas of one or more square miles, and the only runoff from the triplicate watersheds (less than 100 acres) occurred at Bell No. 1 which contains several acres of barren road fill. There was no torrential runoff in any part of the Forest from this comparatively heavy rainfall.

During the month an informal agreement was concluded with Dr. I. P. Krick, meteorologist in the aeronautics department, California Institute of Technology, to receive currently the weather forecasts which he formulates by the air mass method.

A SERA camp of 100 men was put in at Tanbark Flat during the month to supply labor for the installation of a battery of 13 large tree phytometers. The daily average of SERA workers on the Forest during November was 380. The working force of one entire CCC camp was also occupied on the Forest.

## Forestation

### Feather River Nursery

Native soil around the nursery exhibits pH about 7.0. To improve the nursery beds a considerable amount of "black soil" (pH 6.0) has been admixed to increase the acidity of the original soil. At present the seed beds have a rather uniform acidity, pH being 6.2. Of interest is the fact that an experimental seed bed having a top dressing of about 3 inches of sand suffered considerably from damping off. The pH of these beds was found to be on the alkaline side (7.4).

## Kennett Area

Plans for reseeding 130 acres of the 800-acre erosion control and planting project in the Kennett smelter fume area have been completed. The necessity for reseeding the area became apparent after the discovery that the high percentage of failures (82% of all seed-spots) resulted neither from soil toxins nor drought, but from the fact that the seed in the barren spots had been covered too deeply and had either not germinated or had "died aborning" in the heavy clay soil. Seed of the following species is being sown: Pinus ponderosa, Pinus jeffreyi, Quercus kelloggii, Quercus wislizenii, and Quercus douglasii.

In addition experimental plantings of 1-1 stock of Pinus ponderosa and Pseudotsuga taxifolia are being made in groups on selected sites. The planting of willow and Baccharis cuttings will be limited to small experimental units for the purpose of determining the most suitable size of cuttings, as well as depth and arrangement of planting, to obtain maximum survival and maximum effect in checking gully erosion.

## Fire Research

### Transportation Planning

The third of the Protection Planning Projects undertaken jointly by the Experiment Station and the Regional Office has made considerable progress. After the statewide fire detection and communication planning projects had been completed a similar arrangement was set up for carrying forward transportation plans on the eight forests on which this work had not yet been initiated. A. A. Brown has continued as the Experiment Station representative with the crew of ECF and NIRA workers that had been built up. F. P. Cronemiller represents the Regional Office.

The particular developments in this work as being carried out are, (1) complete field investigation of every road proposed in the plans, (2) coordination of compilation work with field investigation to keep the two operations in step, (3) complete logging of all existing roads for speed, distance and location, (4) development of new theories to adapt plans to the enormous chaparral areas in which foot travel is impossible and one-man attack on fires is largely ineffective.

Forest Products

Logging and Milling Studies

The field work for the east-slope pine region logging and milling study was completed with final inspection for seasoning degrade and assignment of rough-dry grades to the last 300 M feet of study lumber.

Some observations were made to determine the extent of degrade of lumber on passing through the planer. These data have been subjected to analysis.

Ponderosa Pine, 5/4-inch by All Widths

Rough dry grade	Basis No. pcs.	Basis volume	Total per-cent	S2S Grades Recovered												
				Clr.	C Sel.	D Sel.	3 Clr.	1 Shop	2 Shop	3 Shop	3 Com	4 Com	Stn. 3Clr	Stn. 1Sh	Stn. 2Sh	
				Percentages												
Clear	52	1207	100.0	61.5	33.4	3.9		1.2								
C Sel	77	1566	100.0	8.0	66.2	13.3	2.9	1.6	3.9	4.1						
D Sel	75	1390	100.0	0.9	17.4	50.3	1.3	5.3	13.9	8.9	2.0					
3 Clr	56	1426	100.0	2.3	8.0		39.1	45.7	3.9	1.0						
1 Sh	159	4380	100.0		1.5	1.6	1.3	49.5	44.1	0.4		1.1	0.5			
2 Sh	272	6308	100.0			0.2	0.3	6.8	77.3	13.2	1.0	0.4		0.4	0.4	
3 Sh	104	2259	100.0			0.6		0.1	27.6	65.8	2.6	3.3				

The table shows for each rough-dry grade of 5/4-inch-by-all-widths stock, the percentage of all the lumber of that grade that remained on grade after surfacing, as well as the percentage that went to other grades. For example, of all the rough-dry C Select that was surfaced, 66.2% remained on grade after surfacing. 8.0% was raised to clear, 13.3% went to D Select, 2.9% to 3 Clear, 1.6% to 1 Shop, 3.9% to 2 Shop, and 4.1% went to 3 Shop.

If we assume that a given volume of each of the rough-dry grades listed was to be run through the planer, the study shows that we may expect to recover as S2S clear lumber, only 61.5% of the rough-dry clear volume plus 8.0% of the rough-dry C Select, plus 0.9% of the rough-dry D Select, plus 2.3% of the rough-dry 3 Clear. Recovered volumes of surfaced C Select and other grades may be arrived at in a similar fashion.

Applying Code prices to 1000 board feet of each of the rough-dry grades, there is a value represented of \$249.50. The surfaced value of the same lumber without any degrade is \$261.50. The surfaced value

of the same lumber with degrade as indicated in the study (see preceding paragraph) is \$245.99. Thus instead of the surfacing operation on 5/4-inch stock paying its expenses and netting a profit, we find that on this particular operation, a loss was sustained.

The information will be of great value to this operator and will encourage closer attention to the common causes of degrade, namely, too low moisture content and resulting shattering of knots, excessive cup, kiln stain. It further shows the tendency on any operation and should therefore find a wide range of usefulness.

Sufficient data have been gathered to show the effect of thickness and width on surfacing degrade. This analysis will be presented in the final report of the study.

### Forest Economics

#### Wood Requirements

Survey records secured from 219 farms located in Central California were used as the basis for estimates of the lumber required on various types of farms for buildings, corrals, and irrigation structures. Surveys of the non-residential buildings used in sample rural communities were also made to determine per capita needs for various kinds of buildings and to discover the more important trends in requirements. It appears that lumber needs for rural non-residential buildings are decreasing, partly as the result of centralization of business in the larger cities, partly because of the increased use of brick and steel construction, and partly because of the changes in type of farming involving centralization of storage and manufacturing.

Estimates of requirements for urban non-residential structures have also been made. Both urban and rural building data have been revised, and a report on the major lumber requirements completed. Summary of the data indicates that during the decade 1920-30 about 45% of the decade lumber consumption of the state, amounting to some 32,500,000 M.B.M., went into urban buildings, about 11% was used for rural structures, and about 22% for boxes. It is estimated that requirements for the decade 1930-40 will approximate only about 65% of the 1920-30 consumption, but it is expected that requirements will again increase to possibly 80% of the 1920-30 consumption in the decade ending in 1980.

#### Four-County Tax Study

As this study is part of a larger land-use study, the subject of how California handles its new public domain is of particular interest. If any year's property tax remains unpaid for five years the property is deeded to the State and held in trust by the State

Controller. It is estimated that some two or three million acres have been removed from the tax rolls and are held for the State in this fashion. The State Controller has a force of clerks computing the number of acres owned by the State which are described according to the rectangular General Land Office surveys. The results of this computation will soon be made public. A large acreage owned by the State and described as portions of Spanish grants or private subdivision can not be computed within the limits of time and funds available. Another large acreage has been deeded to the State but, as the descriptions on the deeds are insufficient to locate the property, the deeds convey nothing and have no force. Another large acreage deeded to the State and removed from the property tax rolls is known not to have been advertised according to law prior to deeding, in which case it is very likely that the State's title will not be sustained by the courts.

The State Controller has no field agents or trespass agents and State lands have not been plotted on maps. Not even the State Division of Forestry has knowledge of the extent or location of these lands. State law describes trespass on these lands as a misdemeanor and provides that the State is entitled to all rents and profits derived from the use of these lands, yet the State Controller's office estimates that 80-90% of these lands are occupied in some manner without permission from the State. The State may lease these lands for any purpose that does not involve depletion. Mining and cutting timber constitutes depletion, but agriculture or grazing does not. A great many parcels are under lease from the State. These lands are subject to redemption by the former owners at any time but cannot be sold before July 1, 1936. Many valuable gold mining properties are owned by the State and held by the State Controller. As they cannot be either leased or sold they are being worked in trespass. The State Controller's office estimates that most of the State-owned gold mines are being worked in this fashion and are producing no taxes or other public revenue. There is no estimate of the amount of State timber that is being cut in trespass.

Wade DeVries, Senior Forest Economist from the Washington Office is conducting the taxation phases of this land-use study.

## CENTRAL STATES FOREST EXPERIMENT STATION

### Forest Soils

Auten completed the statistical compilation of data on water absorption collected during the summer. The report has been mimeographed and distributed as Station Note No. 16: "The Effect of Forest Burning and Pasturing in the Ozarks on the Water Absorption of Forest Soils."

Auten attended the annual meeting of the American Soil Survey Association in Washington, November 20-24. As Chairman of the committee on organic and forest soil, he presented the committee report on the bibliography of forest and organic soils for the period 1926-1934. With Station cooperation, Auten compiled the bibliography, and a limited number of copies were mimeographed, with the approval of the officers of the Association.

### Forest Planting

#### Survey of "Old Timbers" area

The preliminary survey of "Old Timbers" in Ripley County, Indiana, characteristic of the "buttermilk" flats of Illinoian age, was pushed through to completion by Chapman and Cochran. Some plantings have already been made by Alexander Thomson, and, because of his program to plant more trees, there are excellent possibilities for cooperative studies. Kellogg contacted the party on November 7-8 and spent the day with them. Southern red gum, red maple, pin oak, and some white oak reproduces vigorously on the poorly drained flats of Clermont silt loam where seed supply, seedbed conditions, and protection have occurred. In places, where beech seed has been available, good reproduction is appearing. On the breaks and slopes, yellow poplar, sugar maple, and some walnut reproduction appears. The planting of walnut usually has been a failure on the flats, but planted trees are growing moderately well on the bottom of Big Graham Creek. On the flats bearing thin soil, walnut seedlings which had established are now dead because of drouth and lack of adequate soil moisture. The planting of many thousands of Norway spruce has been a total failure. It is planned to experiment with plowing and discing to secure natural reproduction and to plant the three southern pines (shortleaf, pitch, and Virginia) and eastern red cedar to determine their suitability on the flats.

Pine plantations - Boy Scout camp

Kellogg found time to complete the computations of remeasurements made last spring on the Scotch, red and white pine plantations in southern Delaware County, Ohio. The Scotch pine, planted in 1929, apparently were established well enough to suffer little if any decrease in height growth through the drouths of 1930-31. The red and white pine, planted in 1930, have grown much more poorly and have suffered loss in height growth. Red pine showed a decrease in the 1931 growing season, but not in 1933. White pine showed a decrease in the growing seasons of both 1931 and 1933. Remeasurement of this season's growth as influenced by the drouth will be made next April.

Measurement and year	Scotch Pine	Red Pine	White Pine
<u>Av. Total Ht.</u>	<u>Feet</u>	<u>Feet</u>	<u>Feet</u>
1929	1.1	-	-
1930	1.4	0.9	0.9
1931	2.1	1.3	1.1
1932	3.2	1.5	1.4
1933	4.6	2.2	2.0
1934	6.4	3.3	2.6
<u>Av. Growth in Ht.</u>			
1929	0.4	-	-
1930	0.7	0.4	0.3
1931	1.1	0.2	0.2
1932	1.4	0.7	0.7
1933	1.8	1.1	0.6

Seed collection

Kellogg, assisted by Chapman and Myer, and Hall's field assistants, has been collecting and extracting small quantities of hardwood seed for measurement. Kuenzel made arrangements for a small quantity of excellent seed from locust growth in Wisconsin. The following table contains the measurement of this seed:



## Seed Crop of 1934

## Central States Region

Species	State	Place	No. Fruits Per Lb. as Collected	Dry Seed Per Lb. after Extraction
<i>Acer saccharum</i>	Ohio	Reynoldsburg	4,608.	4,608
<i>Cornus florida</i>	Indiana	Henryville	1,144.	3,901
<i>Corylus americana</i>	Ohio	Linnville	-	370
<i>Fagus grandifolia</i>	Indiana	Osgood	1,849.	1,849
<i>Fagus grandifolia</i>	Indiana	New Marion	1,574.	1,574
<i>Hicoria ovata</i>	Ohio	Carnes tract	26.8	150
<i>Juglans cinerea</i>	Indiana	New Marion	21.3	- 0
<i>Juglans cinerea</i>	Illinois	Shawnee Unit	15.8	- 0
<i>Juglans nigra</i>	Kentucky	Wooten	6.	18.5
<i>Juglans nigra</i>	Ohio	Columbus	9.8	22.1
<i>Juglans nigra</i>	Ohio	Circleville	5.7	15.6
<i>Juglans nigra</i>	Ohio	Carnes tract	6.2	26.3
<i>Juglans nigra</i>	Ohio	Columbus	15.	43.
<i>Juniperus virginiana</i>	Illinois	Shawnee Unit	12,290.	54,673
<i>Magnolia acuminata</i>	Ohio	(N.E. part of state)	38	5,585
<i>Pinus echinata</i>	Ohio	Kelley's Run	48 to 88	45,582*
<i>Pinus virginiana</i>	Indiana	Henryville	-	64,731
<i>Prunus serotina</i>	Ohio	Linnville	1,536	4,689
" "	"	"	-	3,587
" "	Indiana	(Turkey Run) ( St.Pk. )	3,027	7,576
" "	Ohio	Columbus	-	4,404
<i>Quercus alba</i>	Ohio	Glenmary	143.5	143.5
" "	"	"	71.0	71.0
" "	"	Linnville	106.0	106.0
" <i>borealis</i>	"	"	85	77.0
" <i>montana</i>	"	Crystal Spgs.	-	56.4
<i>Robinia pseudoacacia</i>	"	Minerva	-	23,274
" "	Wisconsin	Westfield	-	19,938
" "	Indiana	Aurora	-	24,478
" "	Ohio	Hillsboro	-	16,329*
<i>Toxylon pomiferum</i>	Ohio	Carnes Tract	1.06	7,822
" "	Indiana	New Marion	1.01	11,340

0 Hulls not removed

\* 1933 Crop

## Insect Investigations

### Clear cutting experiments

In badly infested black locust stands, control of the locust borer is being attempted through clear cutting experiments. Work has been initiated at Arenzville, Illinois on two small tracts, one moderately damaged and the other seriously damaged; and at Minerva, Ohio, on two large plantings both of which are seriously injured.

### Pruning experiments

The widely-spaced 7-year-old locust planting at the Elizabethtown experimental farm of the Illinois Agricultural Experiment Station was pruned by a field party. Wide spacing had resulted in excessive branching and crotches. Pruning and improvement trimming was made to eliminate all branches below 6 feet, and all superfluous crotches, leaving a single main stem for each tree. Time records on this work in this 3-acre tract indicate that one man can prune about 23 trees per hour.

### Acorn and hickory nut insects

The treatment of acorn and hickory nut insects has been continued during November. A check on water treatment was run at the Shawnee Branch Experiment Station in Illinois, where the treated and check series have been planted in a screened seed bed. Further work has been done in Ohio in cooperation with the Soil Erosion Service at Zanesville. To date, the water treatment for a period of about a week appears to offer the greatest promise for acorns, although it appears to have little effect on hickory nut insects. Further work is contemplated on the problem, using heat and chemical.

### The pine tip moth

A very serious infestation of the pine tip moth in loblolly and shortleaf pine on the Illinois Agricultural Experiment Station Farm at Elizabethtown was treated by the removal of all infested tips. Random sampling of trees and tips indicated that about 95 per cent of all tips were infested, and that the average number of pupae per tip was about 12. This would mean an average of approximately 350 pupae per tree, the trees averaging about 4-1/2 feet in height. Practically every tip which was not protected by high grass was infested. Time records on the work indicated that one man could remove the tips from approximately 40 trees per hour.

### Black locust planting stock

Arrangements have been made with the CCC Nursery at Loogootee, Indiana, to supply four thousand large seedlings for check planting with root cutting stock which is being raised by the Bureau of Plant Industry. The Forest Service Nursery near Wade, Illinois, will supply an additional two thousand seedlings for this work, in which it is hoped to determine whether selected strains of locust vary in resistance to borer attack.

### Black locust seed collection

During November Hall and his assistants cooperated with the U. S. Forest Service in Illinois in the collection of seed from the trees which were pruned at Elizabethtown.

At the present time, Hall is cooperating with the Bureau of Plant Industry in collecting black locust seed at Minerva, Ohio, for use in the Soil Erosion Service Nurseries. Collection is being made on the Minerva clear cutting areas. It is estimated that at least 1,000 pounds of seed will be gathered at Minerva. In this work each tree is cut with a saw and is then carried to a large canvas cover where the pods are threshed off.

### Locust bark collection

Dr. D. B. Jones, of the Bureau of Chemistry and Soils, has recently demonstrated that black locust inner bark contains a considerable amount of protein. Inasmuch as this protein may be poisonous to young locust borer larvae, it was decided to determine if the amount of this protein varies in different trees. Twenty-one trees were sampled for the preliminary test. Ten trees which showed very decided tendencies toward being susceptible to locust borer damage, and eleven which appeared to be immune were selected. These samples have been sent to Dr. Jones in Washington, where he will run some preliminary tests for us.

## Forest Management

### Illinois experimental forest area

A survey of approximately 2,500 acres of forest land in Illinois has been completed. This includes the 840-acre Fowler tract, the largest single block under option within the proposed boundaries of the Experimental Area on the new Shawnee National Forest in Illinois. This survey will be plotted on a scale of 8 inches to the mile, and will show 20-foot contours. A detailed type map will also be prepared from data collected on this survey.

Sutton will remain at the Illinois field station to establish a series of growth and study plots. Diller has returned to Columbus to complete the topographic and type map, and to make a similar survey of the small area in southern Ohio which State Forester Secrest has turned over to the Station for experimental purposes.

#### Chestnut oak regeneration study

The Ohio chestnut oak regeneration quadrats were remeasured and a number of porosity tests made by Auten and Kuenzel. Seedling counts showed that a high correlation exists between seedling survival and litter depth; and this relationship was further substantiated by porosity tests which showed the beneficial influence of a sufficient litter cover on the soil. The contrast between porous and compact soils was apparent within the radius of a few feet.

Although favorable soil conditions are most important to the establishment of chestnut oak seedlings under natural forest conditions, a sufficient quantity of light was found to be an important factor for their subsequent survival and growth. At Rock House State Park in Hocking County, Ohio, the removal of blight killed chestnut was followed by an increase in the average height of chestnut oak seedlings.

Kuenzel completed the fifth remeasurement of additional chestnut oak seedling plots on the Clark County State Forest, Indiana. Barrett established these plots in 1929 in conjunction with a clear cutting, a partial cutting, and an untouched check area.

#### Remeasurement of growth following cutting in all-aged stand.

Kuenzel, assisted by Cochran, completed the first remeasurement of the 1928 Mill Tract on the Clark County State Forest at Henryville, Indiana.

In 1929, Barrett established a series of permanent strips across this tract to study growth of the residual stand following a heavy selection cutting the previous year. Parts of these strips have been destroyed through the construction of a dam by C.W.A. labor (and the subsequent flooding of part of the area), the construction of a new road, and the erection of a shelter house near the lake.

## Miscellaneous

### Drouth damage

During the summer and fall observations of 1934 drouth damage to trees have been made throughout the region. Late in July, Kellogg and Chapman encountered very severe drouth conditions in southeastern Indiana. The grass and ground vegetation on the Ohio River bluffs were completely browned and dry in a manner similar to that in the foothills of California. The tree growth was suffering severely. Hackberry leaves were curling and drying, as were black cherry. Oak leaves appeared to be still uninjured. In places, black locust leaves were apparently uninjured; but in others, branches or portions of crowns were yellowing and dying. Honey locust was observed to display the same reactions. Elm leaves were somewhat curled and partly wilted, but still intact.

In many places in Ohio and Indiana, beech trees were dying from the tops down during August. Particularly along roadcuts, the excessive drainage and cutting of roots have killed the beech. In Gibson County, Indiana, in the drained White River bottoms, scattered remnants of bald cypress - relics of a once splendid stand - were observed damaged - presumably from the drouth. All the crown except the top 5 - 10% of the needles had turned brown.

During August, Chapman observed that the major drouth damage for 1934 appears to be on the beech-maple type in Ohio. In rather extensive ungrazed beech-maple woodlots, dead and dying trees are confined largely to the margins. But where the wind can sweep under the canopies of smaller, grazed stands, dead and dying trees are quite uniformly scattered throughout the forest.

For several years, the deterioration of single walnut trees has been observed in the Cornbelt states. Apparently it is caused by the cumulative effect of drouth and deficient soil moisture, coupled in many cases with root damage and soil compaction from grazing. Limbs and portions of crowns die back although exposed to full side light.

Wiesehuegel reports that drouth conditions prevailed in the vicinity of the Sylamore Experimental Forest on the Ozark N. F. Only traces of rainfall and a few scattered showers occurred from June 10 to early September, compared to a normal precipitation of about four inches per month.

Trees on slopes directly exposed to the sun's rays were mostly affected. Stands on both sandstone and cherty soils showed damage. In the juniper type at lower elevations the damage was most severe. The leaves of associated black oak, black-jack oak, post oak, black hickory, and chinquapin withered and dropped. Some juniper and short-

leaf pine were killed, but showed much greater resistance to lack of moisture than the hardwoods. On the better red oak-white oak-hickory sites, it was very common to find dogwood badly defoliated where it grew as an understory.

It is felt that the consequences of this most severe drought are not as serious to tree growth as seemed evident when whole hillsides first began to turn brown. About the middle of September, after several rains had fallen, the trees which were seemingly dead were growing a new crop of leaves and many will very likely survive.

## LAKE STATES FOREST EXPERIMENT STATION

### Supervisors visit experimental forests

For some time the Station has been endeavoring to get the results of research into a wider use on the National Forests of the region. As a means to this end a suggestion was made to the Regional Forester that field days be held at each of our experimental forests to which would be invited the Forest Supervisors, Rangers and some of the CCC overhead. Our suggestion turned out to be timely, since a trip was being arranged for the Forest Supervisors as a group to visit all National Forests in the Lake States during early November. Time was allotted during this trip for the experiment station personnel to demonstrate in the field, the more important work that we have under way at the Chippewa, Superior and Upper Peninsula branches, and at the Michigan Forest Fire Experiment Station.

### Plains shelterbelt investigations

Field work in connection with the reconnaissance of shelterbelt possibilities continued during the month. As colder weather set in in the north, field parties moved south; some of them now being in Kansas and one party in Texas. First-hand knowledge is being obtained of soil conditions, grass land and other vegetative types as well as the results of past windbreak and shelterbelt planting. In the office, weather data are being compiled and all foreign literature on the subject is being assembled and digested.

### New volume table method

Work on a simplified technique for constructing merchantable board foot volume tables has been completed and a brief outline of the method has been sent out for criticism.

The new tables are based on diameter breast high and height in logs, not to any fixed top diameter or even to a top diameter which varies with D.B.H., but on the truly merchantable height of each tree. A volume table may be constructed from a relatively small number of sample tree measurements, and the time required is a very small fraction of that needed to make a table by methods now in use.

### Acquisition plan for Lake States

In connection with the country-wide plan of land use being developed by the National Planning Board the Station was asked to

prepare a broad plan of public acquisition for the Lake States Region. The plan which was submitted Nov. 8, was largely graphic and made concrete recommendations for future acquisition. Particular emphasis was placed upon the place of public forests in community development. The principal new ideas developed were that public forests should be created and developed where they will help existing communities rather than attempt to move communities into now uninhabited regions. Also that the public should revise the policy of "worst first" and seek to bring some of the better lands into the National Forest System. A complete set of maps showing distribution of population, location of communities dependent upon the forest, the accessibility of forest areas to markets, the location of remaining virgin sawtimber and pulpwood, the location of poor sandy, swampy or rocky land and finally the most promising areas for public acquisition.

### Forest Research Digest

The Station has undertaken the publication of a mimeographed periodical which will appear at approximately monthly intervals. It will be known as "The Forest Research Digest". The purpose will be to assist in the distribution of the knowledge gained through the experiments of the Lake States Station and also to present in brief and summarized form the findings of other agencies which are applicable and of interest in this region. It is hoped that this publication will enable the members of the Station staff who are in the field and therefore necessarily somewhat out of touch with one another's work as well as the administrative personnel to keep informed of the latest developments in forest research. The first issue will appear early in December.



## NORTHERN ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

### Erosion and streamflow

The areas burned over in August and September, 1934, on the Selway and Lochsa river drainages have not suffered severely from soil erosion during the period of heavy fall precipitation, according to early observations. Rainfall has been slightly above normal during October and November over most of the burn, but because of the light intensities of the rains the soil has had the best opportunity to pack with a minimum amount of washing.

Erosion in the form of shallow gullies was noted only on clean-burned slopes, 70 percent and steeper. Gullying is also confined to south and southwest slopes that had previously been covered by open stands of ponderosa pine and Douglas fir, or where there had been sparse brush cover. Consequently, there are very few roots that serve as a binder and that help to hold the soil in place on such sites.

The soil on eroding slopes is shallow and has a high mica content. The flakes of mica seem to form a "shingle" through which water does not readily percolate. Run-off is therefore rapid and gullying results.

Almost no vegetation has come in since the fire. Willow, alder, and vine maple are beginning to sprout and moss is just starting to show on ash beds in the stream bottoms. Grass seed that was sown in October has sprouted and thick stands of grass an inch high cover some of the heaviest parts of the burns along the river breaks.

No log jams, deltas, or silt deposits were noticed in the streams as a result of the fire. Although three inches of rain fell during the 10 days of the reconnaissance, streams were running crystal clear.

### Fire

The determination of the character of the 1934 fire season in Region One was based upon the best records of the kind ever obtained in this Region. Every fire Forest submitted an excellent chart record showing for each day the wind, humidity, visibility, fuel moisture, and the class of fire danger based on these factors and on lightning occurrence. Nearly 200 lookouts contributed to the rating of lightning storm frequency; and 160 wind gauges, 32 sets of wood

cylinders, and 14 duff hygrometers were used in measuring some of the other factors.

The results show that the 1934 fire season warranted the employment of the full regular forest protective organization (Class 4 danger), beginning about June 20 on all Forests and ending September 9 on some and September 18 to 22 on others. This is a season of 81 to 94 days, which compares favorably with the 73 to 100-day season on various Forests in 1933, and the 99-day season in 1932.

Instead of outstanding days of extremely great danger, the characteristic of the 1934 season was sustained high danger. On several Forests there were only one or two days in the entire month of August that did not rate Class 5 (first emergency call) or Class 6 (second emergency). Four out of 11 Forests reported one or two days of Class 7, the peak of peaks.

Using Class 5.5 as 100% or the worst probable danger to be expected in this Region during July and August, the various Forests rated as follows: Bitterroot 80%; Cabinet 88%; Clearwater 89%; Coeur d'Alene 82-1/2%; Flathead-Blackfeet, with the most lightning, 92-1/2%; Kaniksu-Pend Oreille, with the least lightning, 80%; Kootenai 84%; Lolo 89%; Nezperce 90%; the old Selway 83-1/2% and the St. Joe 81-1/2%.

Weighting these danger ratings, according to the area represented by each Forest, shows that July and August 1934, brought 86% of the worst probable danger to these sixteen million acres. For the same area and months in 1933 the rating was 73-1/2%.

### Silviculture

The usual seasonal influx of field crews took place during November. Technician C. A. Wellner returned from the Priest River Branch after having completed the seasonal examination of some 35 permanent methods-of-cutting and thinning plots. On four thinning plots, this season's work marked the fourth measurement of plots established by D. R. Brewster in 1914. In addition to permanent sample plot remeasurements, Wellner also collected data on some twenty yield plots in even-aged ponderosa pine stands for incorporation with Meyer's yield study; and he gathered some exceedingly interesting information on character of stocking versus numbers of seedlings per acre in the western white pine type. The need for additional information of this latter sort has been felt for some time in connection with the interpretation of data on cutover areas showing numbers of seedlings per acre but without figures on distribution and consequent adequacy of stocking.

Some preliminary results of Wellner's work are tabulated below showing the amount of area stocked with western white pine in terms

of number of established seedlings per acre. Only seedlings 6 inches or over in height are considered established in this tabulation. From this table it is clear that 100 seedlings per acre will insure only 30 per cent of the area in the seedling stage, while the area so stocked may fall as low as 10 per cent. Some 500 white pines per acre will assure at least 30 percent of the area in white pine (certainly a small enough percentage on timber sales where effort and money have been devoted to obtaining this species) while with luck some 70 per cent of the area may be stocked with this desirable species when this number of established pines are present. As indicated in this table, some 2,000 white pines per acre are necessary to reach 100 per cent stocking, white pine considered alone, while the area in white pine may fall to 70 per cent on this basis. The actual per cent of area occupied in the sapling and mature stands will depend in part upon the success of white pine in competing with other species and the tabulation shows only the percent of 4-milacre quadrats occupied by white pine in the seedling stage. Other species may, and usually are, present in considerable numbers on the same quadrats.

Number of established white pines per acre	Character of stocking - 4 milacre basis	
	Minimum expected	Maximum expected
	<u>Percent of Area Stocked</u>	
100	10	30
200	15	50
300	20	60
400	25	65
500	30	70
1000	50	90
2000	70	100

Davis also reports a season full of material and satisfactory accomplishment. The new Deception Creek plant took definite form with six buildings being constructed, including a five-room and a three-room residence. With the help of the Deception Creek CCC camp, the road and trail system for the Experimental Forest was about half completed and good progress made on thinning, stand improvement, roadside cleanup, and fireproofing projects. A twelve-acre area was clearcut and safely broadcast burned.

Research work also went forward with nine permanent sample plots being established. All but one of these plots are to study the results of thinning in young white pine stands of varying age.

Included with these plots is a rather extensive latin square thinning plot installation consisting of sixteen pairs of subplots thinned to form different degrees of stocking.

### Logging and milling

Data from the tractor skidding study carried on this fall at the operation of the Montana Logging Co. has been compiled by Bloom. The skidding unit consisted of two caterpillar 60-tractors and a Willamette-Erstad arch #152, and was the first one to operate in ponderosa pine in western Montana. When compared to pan skidding the arch indicated a decided advantage in the volume of the average load hauled and in handling big trees. The arch hauled an average load of 3500 feet of logs (tree lengths) compared to 2200 feet (tree lengths) for the pan method. In pan skidding, output remains practically constant for trees 32" d.b.h. and larger, because of the mechanical handicap offered by a tree of such size and weight when practically its full length is dragging on the ground. In arch skidding output increases uniformly for trees 32" d.b.h. and upward, indicating that this mechanical handicap is overcome to a great degree.

### Wood requirements

Progress on this phase of the Forest Survey included additional computing both in connection with urban construction and the analysis of records covering the use of wood by the Anaconda Copper Mining Company at Butte, Anaconda, and Great Falls, Montana.

For more than fifty years the copper mining industry has been one of the principal consumers of lumber and timber products in Montana. The output of the Anaconda Copper Mining Company's Butte mines virtually constitutes the Montana production of copper. Timber consumption records covering the past twenty-five years show that the annual wood requirements of this company are very nearly in direct ratio to the metal production. During the past ten or fifteen years from 14 to 15% of all forest products used within the state have been consumed by the Anaconda Copper Mining Company.

In underground work at the Butte mines the Company uses large quantities of wood in the shape of stulls (round props) and sawed mining timbers (square props) to support the ground, plank lagging to keep loose material from falling between the timbers, shaft timbers and miscellaneous forms such as wedges, butt blocks for wedging in place, chute planking, etc.

On the surface, wood is used in all sizes for general construction purposes such as ore bins, buildings, trestles, trainways, flumes, repair work, etc.

At the Anaconda and Great Falls smelters the company uses considerable wood in the shape of lumber for general construction purposes, converter poles, and cordwood.

The following conversion factors showing the total quantity of wood used in various forms per ton of ore mined by the Anaconda Copper Mining Company in Montana, are based on the total consumption of forest products and the total tonnage of ore produced by this company in Montana during the ten-year period 1923 to 1932, inclusive.

Table 1 - Total quantity of sawed, round, hewed, and split products consumed. Reduced to cubic feet of wood per ton of ore.

	Lumber	Stulls	Lagging poles	Converter poles	Cordwood	Total
	Cu.Ft.	Cu.Ft.	Cu.Ft.	Cu.Ft.	Cu.Ft.	Cu.Ft.
Ten year WTD ave.	1.308	.860	.006	.153	.030	2.357 <sup>oo</sup>

<sup>oo</sup> Of this amount 2.046 cubic feet of wood per ton of ore was consumed at Butte and 0.311 cubic feet at the Anaconda and Great Falls smelters.

Table 2 - Total quantity of sawed lumber and miscellaneous timber products converted to board feet per ton of ore.

	Lumber	Stulls	Lagging poles	Converter poles	Cordwood	Total
	Ft.B.M.	Ft.B.M.	Ft.B.M.	Ft.B.M.	Ft.B.M.	Ft.B.M.
Ten year WTD ave.	15.80	3.83	.03	.72	.13	20.51 <sup>oo</sup>

<sup>oo</sup> Out of this total 18.12 board feet per ton of ore was used at Butte and 2.39 board feet per ton at the Anaconda and Great Falls smelters.

Total consumption by the Anaconda Copper Mining Company in Montana for the ten-year period 1923 to 1932 (all sawed, round, hewed and split products) was approximately 530 million board feet. The aggregate cost of all timber products included in this total was \$14,650,000. The total tonnage of copper, zinc, and manganese ore mined by the company in Montana during the same period amount-

ed to 26,092,396 tons.

It is believed that the above conversion factors may be applicable outside of Montana in copper mining districts where the stoping or caving system of mining is used.

Forest Survey - Inventory phase.

The Forest Survey field mapping crew reduced to 25 men continued in the field during the first half of November. During the last half of the month the Idaho and eastern Washington men were concentrated at Spokane where field overlays were inked and tied in. The men used the Forest Service Warehouse offices. A number of the men were out at the county seats collecting the latest status of ownership records while still others worked at National Forest headquarters on cruise and type data.

A number of the Montana men are still in the field but are stationed at forest headquarters or county seats collecting cruise and status data. The rest of the men are in at the Missoula headquarters.

Office quarters for the winter compilation crew have finally been secured and can be occupied by the middle of December. A crew of 30 including besides the compilers, a clerk, machine operators and draftsmen will be carried through to the end of March. Several of the men will be assigned on special work, such as cutting and fire depletion, growth studies, and requirements.

Bradner is continuing the work of analyzing the Survey data with relation to sustained yield units and acquisition plans.

## PACIFIC NORTHWEST FOREST EXPERIMENT STATION

### General

Meetings have occupied a good deal of the time of various members of the Station, particularly the Director. He was in Ogden the first ten days of November and subsequently attended the Washington Forestry Conference in Seattle and various committee and Planning Council meetings.

R. C. Hall of the Forest Taxation Inquiry continued to assist in an advisory capacity in the formulation of a forest tax program in the States of Oregon and Washington. He met with the taxation committees of the Forestry Division of the Washington Planning Council on November 5 and with the corresponding committee of the Oregon Planning Council on November 15. It is understood that both of these committees will endorse the general program advocated in the forest taxation report, and will recommend the adoption of the deferred timber tax plan for application to mature timber.

The West Coast Lumbermen's Association has issued in attractive, illustrated form a "Handbook of Forest Practices"; this is a manual of instructions and explanations for the use of loggers operating under Schedule C of the Lumber Code. It was written largely by T. T. Munger and R. E. McArdle, and the drawings were made by one of our CWA draftswomen.

### Forest Survey

#### Ponderosa pine region

November saw the return to the office of all Survey field men, the majority coming in about the middle of the month, the last after Thanksgiving. Moravets has been assigned the job of directing the gathering of all available data, such as ownership maps, cruises, and type maps, for the remainder of the east side of both Oregon and Washington, and was given several NIRA and ECW employees to help on this job. When this is completed all of the existing data useful to the Forest Survey will have been gathered for the entire area in both Oregon and Washington. As soon as this is completed he will use this personnel on inventory phase computations for that portion of the east side worked during the past field season.

Preparation of 1-inch-to-the-mile type maps for the area worked during the past field season is well under way.

## Douglas fir region

Work on anticipated depletion due to cutting, fire, and other causes for the next three decades was completed, and the computations as to types and volumes left in each unit at the end of each decade are well along.

Bolles, Buell, Briegleb, and Kemp started writing unit reports, and Cowlin continued on parts of the regional report as well as working with Kemp on part of one unit report.

Progress was made on the preparation of the material for the 1/4-inch-to-the-mile regional type maps to be lithographed by the U.S.G.S. Detailed types for the northwest quarter of Oregon have been generalized and technics for the reduction and transfer of these data have been completed. Further work on this job was held up pending the arrival of Mr. Wilkinson of the U.S.G.S., whose advice is desired as to color schemes, minimum size of areas to be shown, and other technical problems connected with a color lithograph job of this magnitude.

There was the usual run of requests for any and all types of Survey data, including inventory, depletion, and growth statistics, as well as type maps. Every month the use made of Survey statistics and maps is impressive.

## Forest Economics

### Selective logging

During the first part of the month the manuscript by Kirkland and Brandstrom entitled "Principles and Procedures in Forest Property Management in the Douglas Fir Region" was made ready for reviews, which are now under way at the Station and at the Washington office.

Brandstrom, accompanied by Ericson and Wright of the Regional Office, made a 3-day field trip to inspect various areas on the Willamette National Forest with regard to their suitability for experimental selective logging. The Regional Office is ready to undertake experiments on national forest areas with a view to testing and developing intensive selective methods of logging. Several such areas are under consideration.

### New Public Domain

Kearns and Wilson spent part of November in Douglas County, Oregon checking (1) county owned lands as to (a) status of ownership, assessment classes and assessed values prior to forfeiture



for unpaid taxes, and (b) county policy in handling these lands, . their present resale value, sales made to private persons since September 1932, and deedings to public bodies for public purposes; (2) privately owned lands that were delinquent in September 1932 for 1930 and prior taxes, still delinquent on November 17, 1934 and now listed for tax foreclosure by the county; (3) privately owned lands delinquent and not delinquent on November 14, 1934, for taxes levied in 1933 and prior years in School District #77 (Glendale) by present use, ownership class including residency, operation, and size. Tabulation and computation of field data gathered in Benton, Lincoln and Columbia Counties, Oregon were continued.

Wilson, as chairman of the Land Classification and Use Committee of the Oregon Planning Council, attended meeting of the Legislative Committee of the Council at Eugene on November 3, State Emergency Relief Administration at Portland on November 8, Oregon Planning Council in Portland on November 21.

### Section of Forest Products

Lodewick addressed a group at Reed College studying the economic effects of the Bonneville dam on the subject "Pulp and Pulpwood Possibilities in the Columbia Region". He also made an inspection of and report on a shipment of garage doors at Vancouver Barracks.

### Douglas fir mill production studies

Lodewick, Johnson and Rapraeger spent eight days in the field completing studies at the mills in North Plains, Oregon. Altogether 300 logs were traced through. The checking of tally and time computations is now under way, preparatory to a determination of conversion values for logs in each grade.

### Minor timber species

Johnson completed the first draft of a manuscript on northern black cottonwood which is now being reviewed. This is in the form of an office report and will be reworked for trade journal publication.

### Deterioration of fire-killed timber

Rapraeger spent the last half of the month in field work on this project, visiting burns in northwestern Oregon, on the north bank of the Columbia, and north of Seattle.

## Farm timberland products

Johnson spent some time in preparing a manuscript on the general phases of farm timberland products in the Willamette Valley.

### Section of Silviculture

Morris used the new inch-to-the-mile type maps of the Forest Survey to determine the location and area of some of the great forest fires which have occurred in western Washington and western Oregon since the 1840's. Even-aged stands of timber follow fires in the Douglas fir region, and when observations of fire scars or charred stubs are combined with knowledge of age-class distribution it is possible to map very old fires. In some cases the outlines of 80-year-old fires are still distinguishable, but in other cases re-burning or cutting has destroyed part of the evidence of the original fire.

## SOUTHERN FOREST EXPERIMENT STATION

### General

Mr. R. E. Marsh, Assistant Chief of the Branch of Research, spent the last two and a half weeks of this month at the Station, during which time he visited the Experimental Forests and conferred with members of the staff on their projects and plans, and with the Director and Planning Committee on organization and personnel matters and on future work of the Station.

Organization of college students employed under FERA to assist the Station in abstracting and excerpting pertinent data on eleven general forestry items from available library resources was completed in thirteen southern colleges and universities. About thirty students are now working on this project and numerous interesting and valuable excerpts have been sent in.

### Forestation

Wakeley and Olsen spent the greater part of November preparing first drafts of working plans for experimental plantations, checking the statistical phases of the studies in detail with R. A. Chapman, and subdividing the experimental planting area at Alexandria in such a way as to meet the requirements of this winter's planting and at the same time leave ample area for other tests to be laid out during the next ten years. In both office planning and field layout the cover map prepared during October was invaluable. This cover map was prepared by using as a base the 5-foot interval contour map at 16 inches to the mile, made last spring by the CWA engineer at the time he set creosoted posts to mark the corners of ten-acre blocks. On this base brush, residual trees, reproduction, and the important grass types were indicated, using the airplane photograph of the area to supplement the field work.

Huberman, with the assistance of Junior Forester A. D. McKellar, assigned by R-8 to help the Station, made the final remeasurement of the seedlings in part of this year's experimental nursery beds; completed two-thirds of a soils map of the R. Y. Stuart Nursery; collected weed seeds for next year's study of chemical weeding; and measured stem length, stem diameter, root length, lateral spread of root, and dry weight of root of a large number of longleaf, slash, and shortleaf pine seedlings, for analysis to determine root-extent classes. The correlation between top development and root development is to be measured, and if possible the root-extents are to be

grouped in about 5 classes, which can be shown graphically in the form of eccentric circles (or other figures) drawn on a board, all tangent to a line (representing the ground line) at a point at which a perpendicular scale is drawn for the measurement of stem lengths. With this device it should be possible to measure stem length and root extent with sufficient speed to keep the seedling from drying out so much as to affect its chance of survival. In this way the average sizes of stock used in field follow-ups of nursery studies can be obtained directly, instead of by measuring additional trees grown under similar but not necessarily identical conditions of soil and treatment.

### Financial Aspects

Rapid progress is being made toward the completion of the calculation for the cost of harvesting and manufacturing rosin barrels from worked out turpentine slash and longleaf pines. Preliminary analysis of the woods conversion costs of stave bolts was made in units of man minutes required to fell, buck, longbutt, and limb one hundred cubic feet of wood, including bark. Indications are that trees seven inches in diameter at the "bottle neck" (or 10 feet above ground) require 57% more time for conversion into bolts than trees twelve inches in diameter. It is of interest that within the limits of five to eight inches, top diameter limit has no appreciable effect upon the cost of conversion in the woods, the greatest variance approximating only ten cents in every hundred unassembled barrels. There is similar evidence that top diameter is of little importance in the cost items of transportation, handling, and milling.

Between tree diameter classes, however, there are extreme differences, ranging from \$15.60 per hundred barrels in seven inch trees to \$9.40 in twelve inch trees.

### New Public Domain

Recent data obtained by the Regional Office at Atlanta in connection with the National Resources Board Report, in addition to recent revisions made by Craig, indicate the extent of tax-reverted land in the Station territory to be as follows:

<u>STATE</u>	<u>TOTAL REVERTED AREA</u> (ACRES)	<u>REVERTED FOREST AREA</u> (ACRES)
Alabama	181,000	80,000
Arkansas	1,448,000	965,000
Florida	12,192,000	7,925,000
Georgia	40,000	25,000
Mississippi	1,250,000	750,000
Louisiana	1,854,000	972,000
East Oklahoma	2,820,000	2,500,000
East Texas	3,493,000	2,620,000
Total	23,278,000	15,837,000

This total of reverted forest area is 9.5% of the gross forest area of these states.

#### Forest Survey

During the month, two Survey releases were multigraphed: "Gum Naval Stores Production, Producing Acreage, and Number of Working Cups in Forest Survey Unit #1, Georgia" and "Advance Information on the Supply of Pulpwood in Survey Unit #1 Georgia". The pulpwood release was unusual in that it was printed on white paper from southern pine bleached sulphite pulp made experimentally at the Pulp & Paper Laboratory of the Industrial Committee of Savannah, Georgia. The covers of the publication were made from kraft paper manufactured of southern pine wood pulp at Bogalusa, La.

#### Erosion - Streamflow

About 500 black locusts were planted in seasonal planting tests to determine whether the species can be successfully transplanted from the nursery before the end of the growing season. Some of the seedlings were cut back to the ground while others were left unpruned. These plantings will be followed by winter and spring plantings of the same class of stock to determine the effect of planting season on survival.

Examination of the erosion control planting areas planted in 1931, showed that the tree plantings and other vegetation are rapidly stabilizing the gullies. Many black locusts are from 15 to 21 feet in height after 4 seasons. Loblolly pines planted at the same time are from 6 to 10 feet in height and some of the trees grew as much

as 5 feet during 1934. A heavy sod of bermuda grass carpets the gully bottoms and in some instances the grass has formed a complete cover on gully slopes. The vegetative cover has had a very obvious effect in reducing both surface run-off and erosion from the area as is indicated by present channel conditions at the drainage outlet contrasted with conditions prior to 1931.

#### Entomology

Dr. Snyder reported the following work during the month:

1. Preparation of a liability table of insect losses for southern yellow pines for use by Mr. H. B. Shepard in insurance studies.
2. Approval of final draft of specifications to remedy termite damage to buildings and acceptance by the Reconditioning Division of the HOLC, Home Office, Washington, D.C.
3. Further experiments with sprays to prevent ambrosia beetle attack to green lumber.
4. Rearings of additional insects from yellow pine cones, bringing total up to 24 species with many new records.
5. Addresses on termites before the Blue Goose (insurance) Society and the New Orleans Academy of Sciences, November 5th and 22nd.

SOUTHWESTERN FOREST AND RANGE EXPERIMENT STATION

Fort Valley

After nearly 15 years of dormancy, experiments in artificial reforestation have been revived on a small scale. On two plots seed spots, designed to test different soil treatments, were arranged by the system of Latin squares. Practically the only germination was in spots screened against rodents, thus demonstrating once more that rodents are an overwhelming factor in reforestation. Planting with 2-1 ponderosa pine gave fair survival, despite the fact that adequate rains did not fall until August. Survival by sites and treatments are as follows:

	<u>Thrifty</u>	<u>Cut off by rodents</u>
	<u>%</u>	<u>%</u>
<u>Sparse grass and bare ground</u>	69.7	5.0
<u>Stump patches</u>		
Light litter mulch	66.6	5.5
Medium litter mulch	56.7	18.9
Deep litter mulch	14.2	0
<u>Bark mulch</u>		
Light	40.0	10.0
Heavy	28.5	7.1
<u>Burned brush piles</u>	40.0	15.0

Soil moisture determinations at 2-week intervals show a depression on August 1 comparable with that of June, which is unusual since June is the dry season and July-August the wet season. The low survival of plants mulched with deep litter or bark indicates an adverse effect which has yet to be explained. The unusual damage by rodents probably is associated with the dry summer.

A modified form of stand improvement has been developed, which is expected to place this work on a self-liquidating basis. The plan is to avoid wholesale thinning, with the attendant slash disposal and bark peeling, and concentrate on release and pruning of selected crop trees. Region 3 has already adopted such a method, but it is believed possible to reduce cutting still further. As a rule, the pine stands of the Southwest contain enough vigorous dominants to provide 80 to 100 crop trees per acre. Many of these already have adequate growing

space to maintain a dominant position and these require little work but pruning. Trees of this class are growing at a satisfactory rate, but need pruning in order to produce quality lumber. Without pruning, the majority of these more or less open-grown trees will scarcely be merchantable for lumber; by pruning to a height of 17 feet, from 40 to 50 per cent of the volume will be clear.

### Parker Creek

The A Cross C. C. C. has moved back to its winter camp and 40 men began work at the Experiment Station on November 13.

One crew of about 20 men is working on revegetation and erosion control in the vicinity of the Station. They are to cover four concrete lysimeters on the steep slopes northwest of the Station with a layer of top soil and vegetation. It is estimated that about 3,000 grass transplants and 32 shrubs will be used for this purpose, as each lysimeter has a surface area of 100 square feet. The shrub cover will be composed of turbinella oak, desert ceanothus, mountain mahogany and bear grass. Side-oats grama, hairy grama, white feather grass and white eriogonum will form the grass and herb cover. The lysimeters were filled with soil to a depth of about 7 feet shortly after they were constructed last spring and this soil has settled well. It is believed that if normal precipitation falls this winter the set-up will be in good working order by next summer and that in a year's time some interesting data on surface runoff and underground flow will be available.

An area of about 40 acres located 3 miles below the Station has been selected for erosion control experimentation. This area is in a snakeweed type which has very little perennial grass, is eroded to a depth of 1 to 2 inches and has an average slope of 10 per cent. Various forms of erosion control checks and water spreading ditches will be tried out in the effort to prevent soil from being washed from the area and to intercept and hold the surface runoff, allowing the water to soak into the ground. On a portion of this area grass transplants from the C.C.C. nursery at Superior are being set out. As the area is not fenced, these transplants are being covered with brush which protects the plants from grazing and cuts down on loss of moisture by evaporation. Pole and rock checks which have already been given an initial test on a fenced sheet erosion plot are to be used. In addition, checks of woven wire banked by earth and sacks filled with cement and sand in a self-setting mixture of 12 to 1 are to be tried out. Burlap sacks filled with rich soil taken from edges of road cuts and laid end to end on a contour will also be used. These sacks will form a barrier to hold back water for a few years and when they finally rot will release soil which should stimulate plant growth.



Native grass seeds will be mixed with the soil in some of the sacks to determine if revegetation can be assisted in this manner.

On two other areas, one in a diabase soil type and the other in a quartzite formation, water-spreading ditches and contour checks will be used to hold up surface runoff conserving moisture for plant growth and preventing accelerated flow from flooding and damaging the highway as it has in the past.

The other crew has started construction work on a recorder line extending from the Natural Drainage Areas to the Base Rock Lysimeter Plot. After this line is completed intensity of rainfall and runoff from the three drainages (15 to 20 acres in area) equipped with tipping buckets will be recorded on the time recorder already installed at the Base Rock Plot. This crew will also build two concrete dams in lower Parker and Pocket Creeks just above the junction of the two creeks. These dams will have compound weirs for measurement of streamflow and will be equipped with stage recorders when funds are available. Each of the two watersheds so equipped will have a drainage area of about 2,000 acres.

### Jornada Experimental Range

#### Range and Climatic

About 1/4 inch rainfall was received during the month which has helped some. Due to the mild weather this fall there has been a fair growth of weeds.

The cooperater moved 137 cattle during the month but has been unable to locate range for the balance, about 443 adult cattle and 664 calves. Arrangements are being made to feed them during the winter and he plans to dispose of all calves next April.

#### Activities

Camp F 27 N has been reoccupied for the winter period, to continue the range improvement and road program started last winter.

Quadrat charting is to be completed this month.

The development of a proposed management plan for pasture No. 11, on the basis of the grazing reconnaissance made of the area last fall and winter is nearing completion.

The preliminary outline of the report on the project of poison plant eradication was prepared. Additional studies of the anatomy of Drymaria holosteoides were made.

With CCC labor approximately 134 acres, mostly scattered areas, of poisonous plants were grubbed, as follows: Asclepias galioides, 2 acres; Astragalus allochrous, 5 acres; Astragalus Crassicarpus, 5 acres; Actinea odorata, 22 acres; Senecio longilobus, 15 acres; Senecio riddellii (?), 85 acres.

The report of germination tests of previous years was completed. Grass seed of 1934 was collected with CCC labor. Samples were cleaned by CCC's and germination tests were started.

R. V. Boyle and W. V. Turner, ex-forest officers, now in the Soil Erosion Service, accompanied by a Mr. King of the Indian Service, visited the Jornada. They were very much interested in the range revegetation work and expressed their intention of returning soon to make further study.

## INTERMOUNTAIN FOREST AND RANGE EXPERIMENT STATION

### Forest Management

Work during the past summer has been concentrated at the Boise Basin Branch Station. The experimental forest, which includes approximately 5,000 acres of virgin and cut-over ponderosa pine land, was cruised and topographically mapped. Conventional cruising methods were modified somewhat by classifying all ponderosa pine according to Dunning's tree classification. Anderson's economic tree classification was also used on the cut-over area in order to estimate the value of the reserve stand.

#### Methods of Cutting Ponderosa Pine

The analysis of records of growth on three permanent plots on the Payette National Forest, virgin ponderosa pine cut-over by the seed-tree method in 1913, has just been completed. A reserve stand of 3,184 bd. ft. per acre in 1913 grew at an average gross rate of 156.1 bd. ft. per year to 1931. Mortality, largely due to barkbeetle attack, average 19.8 bd. ft. per year, leaving a net annual increment of 136.3 bd. ft. This compares with an annual net increment of 139 bd. ft. on a nearby virgin stand of 26,597 bd. ft. per acre, as previously reported. There was a liberal amount of advance reproduction on the area at the time of cutting, the larger of which has grown into the stand to increase the number of trees per acre from 17.2 in 1913 to 85.7 in 1931. Very few subsequent seedlings have become established and the transect tallied in 1931 averaged only 492 ponderosa pine and 104 Douglas fir per acre.

Similar records for a method-of-cutting plot on the Salmon National Forest show that a reserve stand of 6,733 bd. ft. per acre in 1909 grew at an average net rate of 155.1 bd. ft. per year to 1931. Mortality records, available only for the period 1920-1931, indicate an annual loss of 17.3 bd. ft., largely resulting from windthrow. The relatively slow rate of growth for such a large reserve stand, compared with the Payette plots, was due to poorer site and to the large proportion of slow-growing mature trees. Advance reproduction was abundant and was supplemented by a lesser quantity of subsequent seedlings to make a total of 937 pine and 1,363 fir per acre in 1931.

## Stand Improvement

A series of stand improvement plots were established in the virgin and second-growth areas on the experimental forest. In the virgin stand the work consisted largely of snag removal and thinning advance reproduction. Four methods of treatment were put to practice and the area is to be used for demonstration and research purposes. In the second-growth stand the improvement measures resembled a cordwood cutting which removed all defective and misshapen trees. Trees selected for the final crop were pruned to the height of the first log.

## Fire

A study was undertaken to determine the underlying reason for what has been termed "explosive" conditions in years of extreme fire hazard. Leaf samples were taken from 15 ponderosa pine trees and 8 chaparral bushes at 10-day intervals throughout the season. These samples were oven-dried and it was found that the volatile constituents in the pine needles increased steadily throughout the summer and the volatile constituents in the chaparral steadily declined. Steam distillation of the pine needles was undertaken to determine if volatile oils were causing the marked increase in total volatile constituents. No significant increase of oils could be noted, therefore it is thought that the moisture content of the needle increased. Cool weather in the fall brought a decrease in moisture in the pine needles and the chaparral continued to decrease at a slightly slower rate than it had during the summer. A proper explanation of this phenomena must involve complex physiological and biochemical processes. The problem suggests the extreme need for further physiological research in trees.

In connection with moisture depletion of foliage the effect of slope on soil temperature was studied. It was found in two boxes of soil placed side by side, one lying flat and the other at an angle of 45° to the south, that the surface soil temperature was increased as much as 20° F. by the 45° slope.

Connaughton reexamined the fire damage plots and has completed his report concerning fire damage in the ponderosa pine type in Idaho.

Experimental planting of burned area was studied during the summer. In general the results of planting were not too encouraging but in spite of the extreme drought conditions survival has been good on north slopes and creek bottoms. The preliminary results of this study indicates that planting can begin on north slopes immediately after a fire but that planting of south slopes should be deferred at least until it is possible to take advantage of a brush cover.

## Mensuration

Approximately 200 trees were recorded on form 558a for the preparation of a volume table under different utilization limits than have been employed in the past. Tree class was recorded on all trees taken for the volume table and it is planned to determine whether a significant difference in volume exists between tree classes.

Measurements were made of 43 temporary sample plots in even-aged stands of ponderosa pine in central Idaho to contribute to the interregional study of yield of this species. In parts of this region, notably in Boise Basin, there are extensive stands from 40 to 60 years old, which started during and after some of the early mining and logging operations. Although covering a total of some thousands of acres, for the most part they are understocked and considerable search was required to find suitable spots for yield plots. Evenaged stands older than 70 years are very scarce; there seems to have been no combination of factors (such as severe fire coincidental with heavy seed crops) to produce such stands prior to white man's activities.

## Economics

In lieu of actual field studies of selective logging in this region the experiment station is attempting to bring together the results of work done along these lines in neighboring states into a report which will aid the Forest Service and private operators in applying the results to their properties.

### Range Management - Great Basin Branch

#### Average monthly and annual precipitation over a period of 20 years for four vegetative types on the Wasatch plateau

The following table shows that the station located in the aspen-fir type has recorded the largest amount of precipitation, an amount, however, which is only slightly heavier than that of the spruce-fir. The oakbrush and the pinyon-juniper types show considerably less precipitation than the upper two belts, with the pinyon-juniper recording the lowest of the four belts in question.

Average Monthly and Annual Precipitation in Inches  
1914 - 1933, inclusive

Vegetative type & weather sta- tion elevation	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept	Oct.	Nov.	Dec.	Aver. annual precip
Pinyon-juniper Elev. 5,575	.85	.96	1.34	1.34	1.27	.48	.98	.98	.89	1.04	.83	.74	11.70
Oakbrush Elev. 7,500	1.27	1.23	1.92	1.63	1.77	.69	1.54	1.40	1.19	1.39	1.59	1.89	17.51
Aspin-fir Elev. 3,850	3.15	2.85	4.11	3.54	2.44	.85	1.81	1.80	1.56	1.92	2.19	3.26	29.48
Spruce-fir Elev. 10,200	3.96	2.59	4.35	3.03	1.80	.74	1.86	1.71	1.34	1.40	2.12	3.11	28.01

The average monthly precipitation for March exceeds all other months in each of the four vegetative types except that for pinyon-juniper where March and April are the same. The month of June has received the least precipitation at all stations during this period.

Sampson and Malmsten in USDA Bulletin 1405 (1926) show a very similar comparison for the years 1914 to 1922 inclusive. The above table is a continuation of the same records up to 1933, using available records for a 20-year period.

In arriving at the 20-year average, the formula commonly used by the U.S. Weather Bureau for longtime averages was used to compute the average monthly precipitation where the available data were incomplete. Using as a basis of comparison a nearby station which has complete records for the entire period the average monthly precipitation can be computed for stations where all the data are not available. The U. S. Weather Bureau station located at Manti, Utah, and in the pinyon-juniper belt, was the only station where the records were unbroken for the 20-year period.

$$\frac{\text{Longtime average at Manti}}{\text{Shorttime average at Manti}} = \frac{X}{\text{Shorttime average at Station in question}}$$

Projects being analyzed for final report

Through the aid of the Emergency Work Program a number of completed projects covering a variety of summer range problems are being compiled and analyzed at the present time.

The effect of climate on plant growth on the summer ranges of  
Wasatch Plateau in Utah'

A project dealing with the climatic conditions which influence the fluctuations in the seasonal development of important range plants for different years in three altitudinal zones, to discover the relationships of precipitation, sunshine duration, evaporation, humidity, air and soil temperature, soil moisture and wind velocity to the developmental stages of range plant growth.

The proper degree of utilization of important forage plants on the  
high summer range lands of the Wasatch Plateau

A study to determine the proper degree of utilization, standards of judging utilization and the amount of forage which should remain at the time of seed maturity each year where deferred and rotation grazing is not applied to improve or maintain the forage stand.

The effects of different intensities and frequencies of clipping  
upon the vigor of browse shrubs.

A study with browse shrubs to show the effects of different intensities and frequencies of clipping upon the vigor of two palatable species: birchleaf mahogany (Cercocarpus montanus) and mountain snowberry (Symphoricarpos oreophilus)

The relation of season, frequency, and degree of grazing to the  
productivity, revegetation and vigor of vegetation on summer  
range in central Utah

From 1918 to 1923, nine forage plants were subjected to various systems of harvesting by clipping. The report of this work is contained in USDA Bulletin 1405 by Sampson and Malmsten. In 1923 the project was revised to study more critically some of the methods previously tried out, but on a plot rather than on an individual plant basis. The same year it was extended to a pasture basis. Three 20-acre paddocks were established and each subjected to a different system of grazing. In addition a number of hurdle plots were provided which make possible three additional systems of grazing.

These systems of grazing were followed up to and including 1929 and a report of the findings is nearing completion.

The manuscript "The Annual March and Winter Behavior of the Carbohydrate Foods in the Many-flowered Brome Grass (Bromus polyanthus)" by Dr. E. C. McCarty is in its final draft. This problem

deals with the determination of the percentage of available carbohydrate foods present in the herbage, stem bases and roots. These determinations were made by chemical analysis of samples taken at definite intervals throughout the year. The sampling intervals are related to the stages of development in the yearly cycle of the brome grass.:

### Personnel

Joseph F. Pechanec, JRE, has been appointed to the regular Great Basin Branch of the Intermountain Station personnel through the vacancy created by the resignation of E. W. Nelson.

### Erosion and Streamflow

#### Geological Aspects of the Erosion and Streamflow Problems

Further studies are being made of the geological factors of the watershed which may influence dominantly streamflow, erosion and run-off.

A manuscript is being written on the results of studies made in the Colorado Plateau Province, on the origin and history of the valleys with the soils and sediments, the nature of accelerated erosion and the cause of the recent channeling.

#### Erosion Control Works

During the past summer this station planned and gave technical direction to erosion and flood control work for a CCC camp in the Wasatch Mountains of Davis County, Utah. A system of control and a type of terrace were developed and partially tested that gives promise of success in control of erosion and run-off on critical areas of steep watersheds. Costs were kept of different kinds of work and methods of doing them which is aiding greatly in planning other erosion control projects. It is planned to make available in rather complete form the results of these studies.

#### An Erosion and Economic Survey, Davis County, Utah

An intensive erosion and plant survey was made this summer of a part of the Wasatch Mountains in Davis County, Utah on which the floods originated that have done so much damage in recent years to the settlements and agricultural lands below, and the data are now being analyzed.



The object of the study is to show the relationship of type and density of vegetation, slope, and aspect to erosion and run-off.

At the present time a survey is being made in the devastated areas to determine the economic aspect of the floods, that is, amount of damage already done and the probable future damage under a program of inaction. These studies will bring out the relationship and dependency of settlements and agriculture in the valley lands to the watersheds.

#### Great Basin Branch Project

During the past field season, allotments of Nira funds have made possible the improvement of existing erosion installations at Alpine watersheds "A" and "B". In addition two sets of three 1/10-acre plots each, for the study of surface run-off and erosion were installed. One of these sets is in a grass-weed type in the aspen-fir zone, and the other in a sagebrush type in the oak zone. Each set of three plots affords an opportunity for two methods of grazing treatment and an untreated control plot.

Sixteen plots for study of surface run-off and erosion were installed at the branch station in Davis County. These are 1/10- or 1/40-acre plots in duplicate or triplicate sets, located in annual weed or nearly bare areas, aspen, and sagebrush types. Treatment of these plots by different artificial and natural reseeding methods is intended.

#### Watershed Protection Plan Inaugurated

Some of the seeds of our preaching of the gospel of watershed protection have apparently fallen on fertile ground.

The town of Tooele, Utah and its local irrigation company have arranged for the regulation and supervision of timber removal from lands on the watersheds from which Tooele draws its municipal and irrigation water supplies, by cooperative agreements with the private land owners of these watershed lands. This arrangement is in line with the recommendations of this Station following an inspection made on the Tooele watersheds at the request of the Tooele people who were becoming concerned about erosion conditions which threatened their water supplies.

The people of Weber, Morgan, and Box Elder Counties have started a movement to have portions of the Weber River, Ogden River, and Box Elder Creek watersheds placed under national forest administration. This area is within the Union Pacific land grant zone which was not included in national forest because of the heavy alienation.

## Boise Erosion Project

### Bannock Creek Erosion Installations

A major job which was completed during the past field season is the construction of the dams, settling tanks and shelter houses and the installation of instruments on the paired erosion areas in Bannock Creek. The dams were put down into the bedrock and heavily grouted to obtain as perfect a seal with the granite as possible. Each of the areas was equipped with a shelter house, including a silt settling tank of 9,000-gallon capacity and a 10' by 16' instrument room in which records of surficial and subsurface run-off and silt samples will be procured. Snow survey courses and meteorological stations have been established on the area and everything is in readiness to obtain run-off data from the two areas as soon as melting of the winter's accumulation of snow begins.

A battery of six lysimeters was completed just in time to get the packing and settling effect of this winter's snows. The tanks are located on a 17 percent slope and each are approximately 8 by 11 feet in projectional area and 4 feet deep. In excavating for the tanks the soil was removed in 1-foot layers which coincided with the natural horizons. A base for the entire battery was formed of a concrete slab and the 6 tanks were assembled of boiler plate and welded on the job. In replacing the soil in the tanks care was taken to see that it was packed as nearly as possible in the same way that it was before excavation. It is recognized that in handling, the natural structure was lost, but the usual well-marked structure of granitic soils had already been largely destroyed due to considerable colluvial movement, especially in the upper horizons.

In order to get an indication of the amount of run-off which can be expected from melting snow, the surface and subsurface drains were temporarily connected to two tanks which were buried to prevent freezing. The data so obtained will be a valuable aid in determining the needed size and specifications of the permanent tanks and gages which will be installed next field season.

### Portable Erosion Apparatus

The improvement of the portable erosion apparatus was thoroughly tested early in the season and it is felt that we now have an effective piece of equipment for studying surficial run-off and erosion under a wide range of field conditions. Data consisting of volume of run-off and weight of eroded silt, from 32 series of plots each in triplicate were obtained during the field season. The series included four herbaceous types, each with 2 degrees of slope, 2 intensities of precipitation and with soil undisturbed and disturbed or trampled. Special attention was given to maintaining

good control over other variables such as minor soil differences and intensity of precipitation so that rather good checks were obtained in the triplicate plots of each series and the data for the most part is statistically sound. The use of this equipment on the Boise River watershed has only begun, but already a great mass of significant data has been accumulated, and is now undergoing analysis.

#### Natural Revegetation Studies

All of the 216 major plots and quadrats have been remeasured during the past season and the data are being compared with that of 1931 when the last of the plots were established. As a direct result of drought, all of the fully protected plots show an average decrease in density of 25 percent during the 4-year period, but the decrease on comparable grazed range amounted to an average of 40 percent. A large part of these decreases was due to the following off of annuals; perennial grasses held their own on the protected plots, but decreased 29 percent on the comparable grazed areas.

Further analysis of the data is in progress, and a detailed picture of range vegetation conditions will soon be available.

The measurement of the 5 by 5 meter major plots was carried on by means of the area rule method in which each perennial plant occurring on the plot is actually measured. After four years of use, the method has shown itself to be economical, and accurate and capable of yielding a great deal of dependable data.

#### Root Studies

The effort on this project has been directed at filling in some gaps in our previous supply of root drawings and in excavating out line transects to show the interrelation and competition of roots of associated species. A large number of drawings have been made and will be compiled into a catalog which should be a valuable addition to this little developed field, and an aid to the study of erosion, plant ecology and range management.



## RESEARCH - REGION 2

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

Summarization of the data procured since 1930 by daily observations at the Bessey Nursery in the Nebraska sandhills was completed early in the month. These data were made the basis of a paper, "Climate in Relation to Forest Planting in the Nebraska Sandhills" which was read before the Plant Science Section of the Colorado-Wyoming Academy of Science at Golden, Colorado on the last day of the month. A brief resume of the general substance of the paper is contained in the monthly report for October.

### The Relation of Grazing to Erosion and Reproduction (Pa-101, Pike)

Considerable information, which required most of the past month to compile, was obtained during the periodical examination of the South Platte experimental area in August. This project was begun in 1920 for the purpose of determining the effect of cattle grazing upon trees planted on a denuded area and upon erosion; also, to study the possibility of overcoming erosion by planting and by restricting grazing. Three kinds of observations are involved; namely, 1. listing and mapping of the cover vegetation on a series of quadrats, 2. counting for survival and measuring for growth the planted ponderosa pine trees on eight plots, and 3. measuring a number of channel, gully and slope profiles to determine the changes resulting from erosion.

The areal record of vegetation shows that the average density of the cover in August 1934 was 6.7 per cent on the fenced area, and 6.2 per cent on the unfenced area. Both areas include a planted and an unplanted plot, and in the case of each area the density was greater on the planted plot. The grasses constitute the predominant vegetation in the cover from the standpoint of areal distribution, since they included 74.8 per cent of the cover on the fenced and 78.2 per cent on the unfenced area. The weed cover amounted to 22.1 per cent and 9.4 per cent respectively. *Bouteloua gracilis* is by far the most abundant species of the plants growing upon the area in general.

The information obtained from the record of listed plants indicates that there has been a 34.3 per cent increase in the number of plants since 1920, when the area was fenced, on the two fenced plots and a 20.4 per cent increase during the same period on the unfenced plots. Peculiarly enough, the weeds and shrubs have increas-

ed much more abundantly on the protected than on the unprotected area, while the situation is reversed in the case of the grasses. It is hardly to be assumed, in view of the very open nature of the cover, that the increase in the number of weeds and shrubs is inhibitory to the spread of the grasses. Continued observations appears to be necessary to arrive at a satisfactory conclusion. It is interesting to note, however, when the data for 1934 are compared with those for 1931, that all classes of vegetation (grasses, grass-like plants, weeds and trees and shrubs) suffered a significant loss on the unfenced plots during the past three severe drouth years, while all of the classes except the weeds held their own or even increased during the same period on the fenced plots, the best showing being made by the grasses. For the period in question at least - 1931 to 1934 - there seems to be little doubt concerning the harmful effect of a combination of drouth and grazing upon survival and reproduction of natural cover plants.

While the loss in planted trees has been very small since 1931, it has been less on the unfenced than on the fenced area. The percentage of survival since inception of the study also remains considerably larger on the former area. A certain degree of stability has been established; now that the depredations of porcupines have ceased following a campaign to eliminate them. The somewhat larger loss during the past three years, no doubt, reflects the more serious damage inflicted by these rodents upon the trees within the enclosed area. The same condition pertains also to the growth of the trees. The average increase in height on six counting plots for the period 1931 to 1934 amounting to .64 foot on the fenced and .72 foot on the unfenced plots. The average annual net growth since 1919 of trees surviving in 1934 has been .21 foot on the former and .24 foot on the latter area. A close agreement exists in the average height of the trees on the six counting plots as compared with those on the two growth study plots.

The data on the progress of erosion are interesting and appear to establish a fairly definite correlation between grazing and accelerated erosion. In the case of thirteen 10-foot slope profiles, not including those located across gullies, the following changes in cross-sectional area, expressed in percentage, have occurred since 1930:

Character of Treatment	Change in percent of area since 1930		
	By Cutting	By Filling	Net
Fenced & Planted	7.7	8.4	-0.7 <sup>o</sup>
Fenced & Unplanted	3.1	3.6	-0.5 <sup>o</sup>
All fenced	4.8	5.4	-0.6 <sup>o</sup>
Unfenced & Planted	8.4	5.9	-2.5
Unfenced & Unplanted	35.8	2.1	33.7
All unfenced	24.3	3.7	20.6

<sup>o</sup>Minus quantity indicates that filling has exceeded cutting.

When the results for five gully transects are included with those for the thirteen slope profiles, the following is obtained:

Character of Treatment	Change in percent of area since 1930		
	By cutting	By filling	Net
All fenced plots	6.1	2.2	3.9
All unfenced plots	13.7	2.3	11.4

In the case of the channel profiles established in 1930, the net change has amounted to 6.01 per cent on the fenced area (6.31 per cent by cutting and .30 per cent by filling) and 11.51 per cent on the unfenced area (11.61 per cent by cutting and .10 per cent by filling).

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