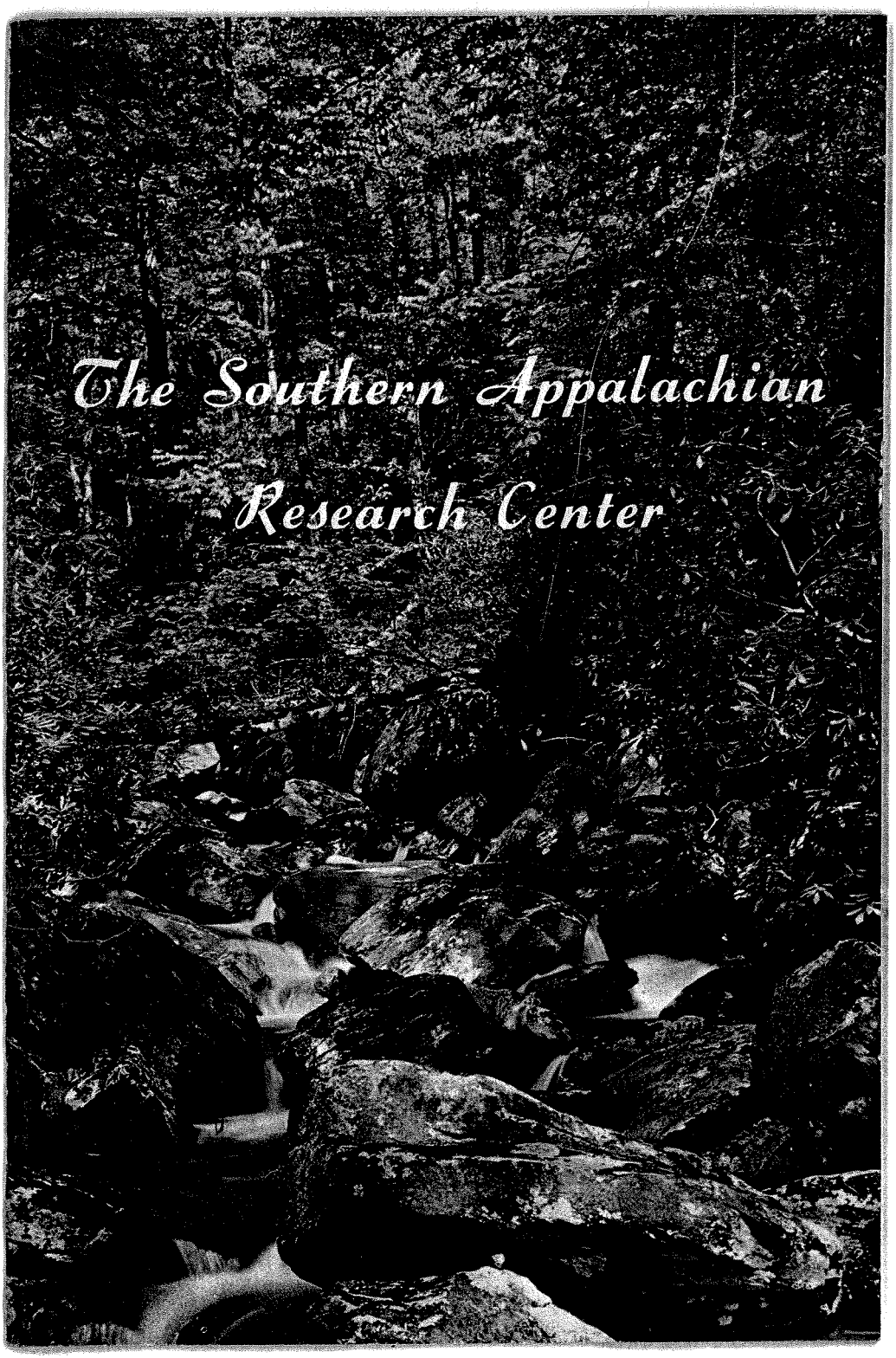
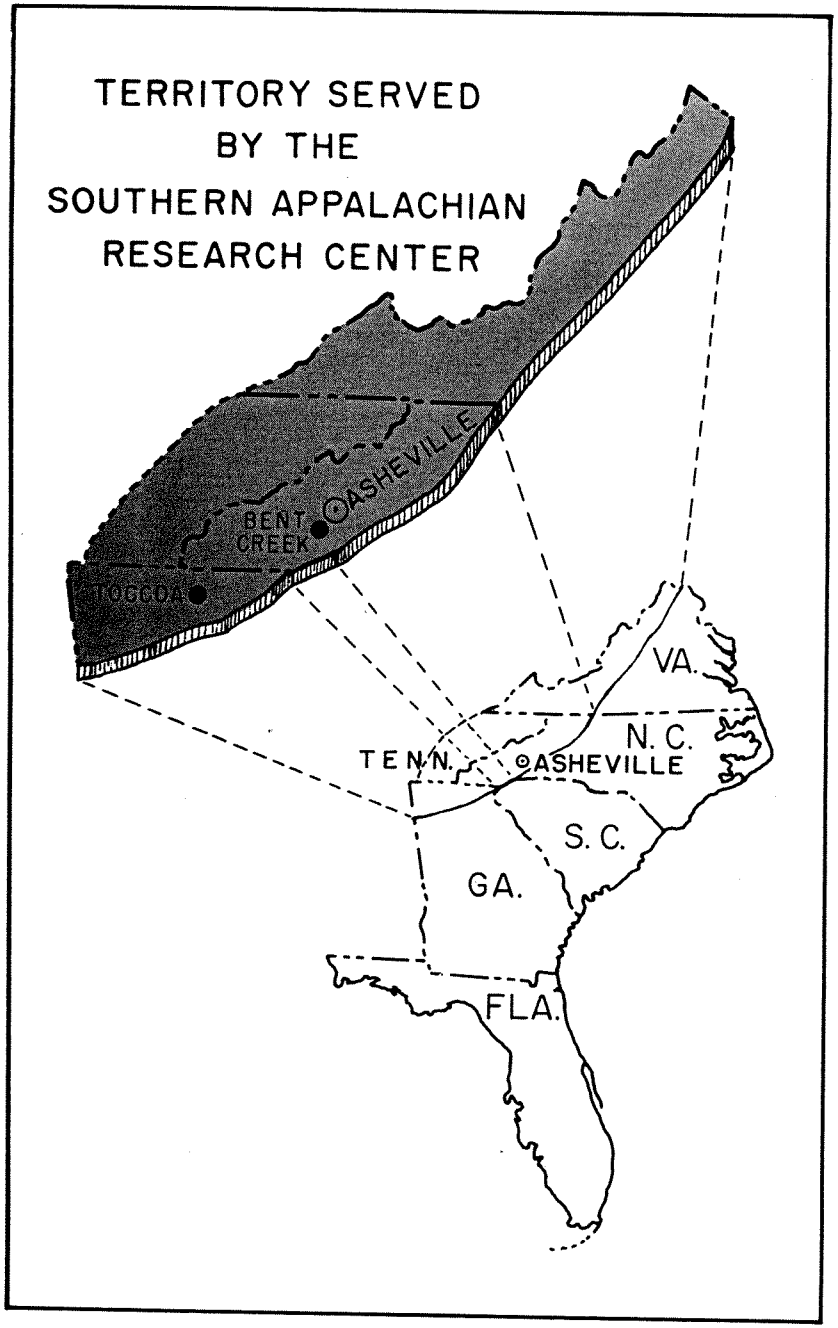

The Southern Appalachian
Research Center

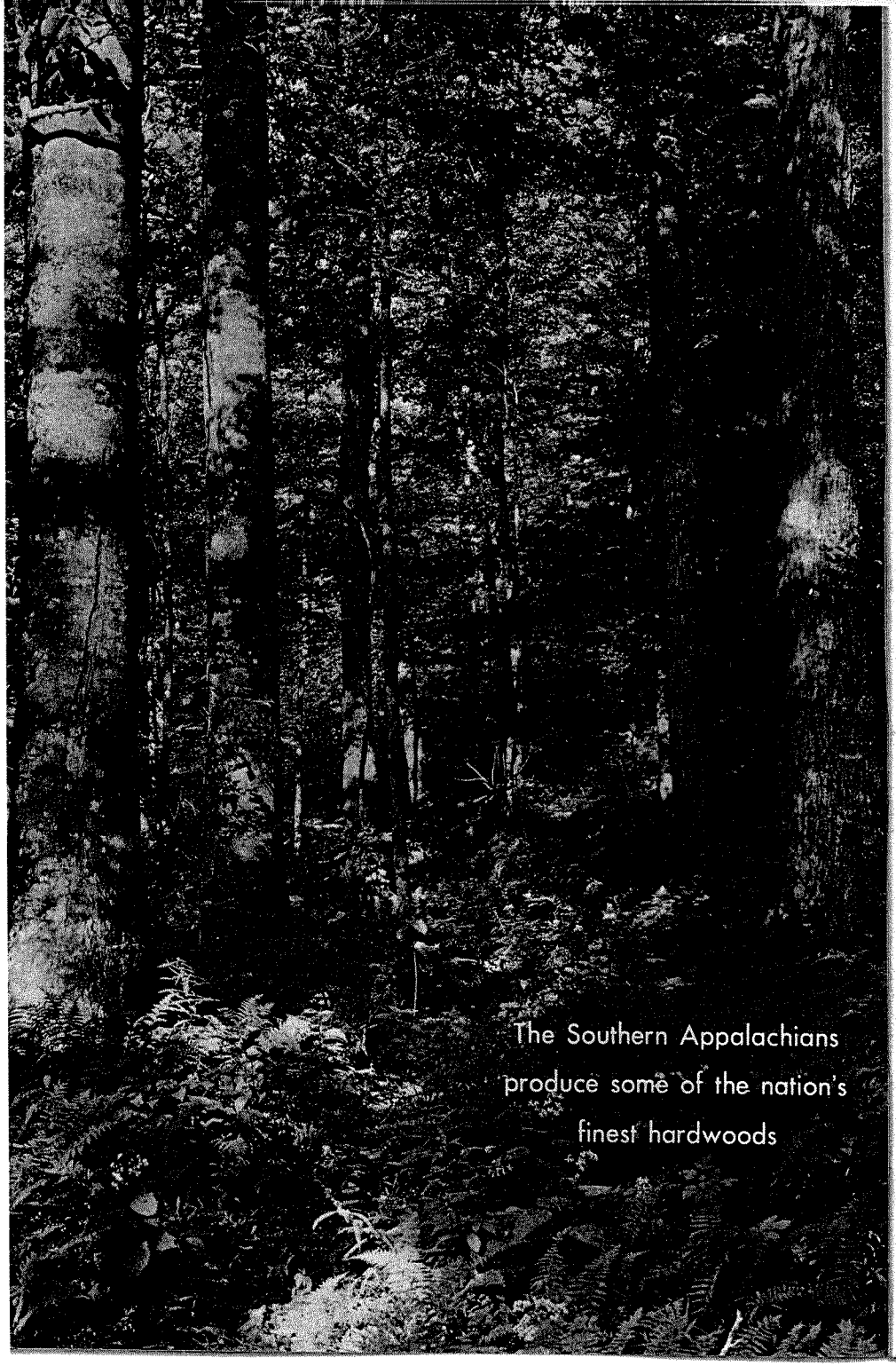
The Southern Appalachian Research Center is one of seven such sub-divisions within the territory of the Southeastern Forest Experiment Station. It is responsible for the U. S. Forest Service research program in the highlands of southwestern Virginia, western North Carolina, eastern Tennessee, and northwestern Georgia.

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
Southeastern Forest Experiment Station
Asheville, N. C.

E. L. Demmon,
Director

1 9 5 6





The Southern Appalachian Research Center

by James F. Renshaw

INTRODUCTION

The research center territory includes most of the Blue Ridge system of mountain chains, ridges, and plateaus. In altitude the Blue Ridge exceeds all other mountains in the Southern Appalachians, rising to over 6,000 feet on many western North Carolina peaks. West of the Blue Ridge a system of valleys and ridges extends the length of the region and from northeast to southwest. Thus the work area covers a wide variety of climatic conditions, elevations, soils, etc., and it follows that similar wide variations occur with respect to timber types, species and their development. The climate is well suited to forest growth, and sufficiently moderate so that timber cutting operations are possible the year round. The drainage of the region is both to the Atlantic and the Gulf, and many streams having their headwaters in the mountains are important sources of hydro-electric power.

ORIGINAL FOREST

At time of settlement the Southern Appalachian region was covered with an almost unbroken forest canopy. Timber stands were made up of fine specimens of yellow-poplar, black cherry, chestnut, black walnut, white pine, spruce, the oaks, and many other species. Stand composition and volumes varied considerably depending on site, aspect, elevation, soil; according to early accounts shaded

north slopes and coves had a volume of from 15,000 to 50,000 board-feet per acre, probably averaging 25,000. On moist slopes volumes ran from 7,000 to 15,000 board-feet per acre, averaging about 9,000, while on dry slopes volumes ran from 2,000 to 7,000 board-feet, averaging 3,000.

EARLY TIMBER CUTTING

The pioneers began felling trees for cabins and fields. Considerable volumes of fine timber were necessarily destroyed in these operations. Gradually, timber acquired a market value, and the finest trees of the better species were selected for cutting, first by the early settlers and later in commercial operations. Lumbering reached its peak about 1909, with railroad logging, steam skidders, and band mills operating throughout the territory. By 1930 practically all the virgin timber had been cut or at least "sorted over," and large-scale operations all but disappeared. Next came the small portable sawmill which can operate profitably in small timber, and which is frequently used to cut timber not yet economically mature. Within recent years power saws for felling and bucking, and tractors for skidding have become commonplace.

PRESENT TIMBER STANDS

More than 60 percent of the Southern Appalachian area remains in forest land. Destructive logging and the practice of "high-grading" have reduced many acres to a low level of productivity. According to best estimates, the small remaining acreage of old growth averages only 4,200 board-feet per acre, with an estimated net growth of 50 board-feet per acre per year. Second-growth stands average about 2,400 board-feet per acre, with a net growth of 140 board-feet per year. A large part of the territory is in stands not yet of sufficient size to be classed as sawtimber. An average of all conditions shows only 1,400 board-feet per acre, with an average growth of 60 board-feet.

Although past practices removed only the better trees, most of the common species, of which there are about 60, now have some commercial value. The removal or elimination of trees too defective to be merchantable is, however, still a problem in many areas.

More than 25 percent of the region's forest land is in public ownership, and the bulk of this is being managed for continuous timber production. Over 40 percent of the woodland is owned by farmers, and this large proportion of the area is not contributing its potential share of timber. Forest products provide only about 3 percent of the annual farm income; this could and should be increased to the benefit of all concerned.

FOREST INDUSTRY

As pointed out, the large sawmill is no longer a part of the Southern Appalachian scene. Instead many small circular mills have replaced it. Of particular benefit to the forest owner are the expanding outlets for other forest products. At present good markets exist for sawtimber, pulpwood (both softwood and hardwood), locust posts, and dogwood for shuttle blocks. More distant or limited markets can be found for veneer logs or bolts, fuelwood, and for specialty items. Considerable improvement could be effected by the further diversification of industry and the strengthening of existing ones.

FORESTRY PROBLEMS

Following is a brief statement of major timber management problems and needs of the region.

Technical

The conversion of cutover and rundown stands to satisfactory growing conditions.

The determination of cultural practices required to maintain stands in good growing condition.

The determination of measures necessary to protect the forest property from fire, disease, and insects.

Determination of soil and site requirements for different species, and yields of different species on these sites.

The determination of harvest cutting practices and methods which will produce the greatest sustained return to the owner.

Better utilization of trees when they are cut.

General

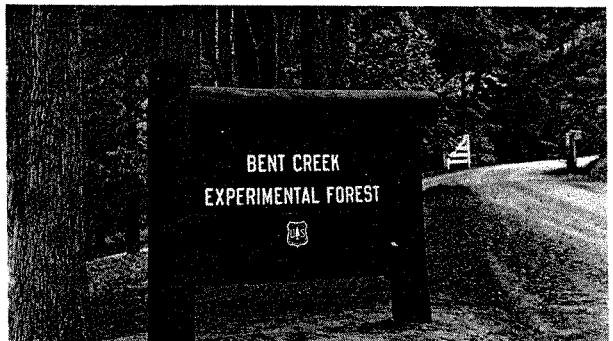
Increased assistance to private owners in forest culture, and in harvesting and marketing forest products.

An accelerated program of forest planting, where necessary, to increase the productivity of poorly stocked lands.

The establishment of safeguards to the forest owner in the form of available credit, insurance, and stable markets.

****

Although studies may be conducted in any part of the region where conditions are suitable, most of the work is necessarily concentrated on Federally-owned experimental forests. There are two such areas in the Southern Appalachian territory--the Toccoa Experimental Forest, in Union County, Georgia, and the Bent Creek Experimental Forest, in Buncombe County, North Carolina. The former is at present inactive, while the latter contains most of the studies in the current research program.



THE BENT CREEK EXPERIMENTAL FOREST

Area.--Approximately 6,300 acres--a basin about 5 miles long and 2 miles wide, all within the drainage of Bent Creek.

Location.--On State Route 191, approximately 10 miles southwest of Asheville.

Topography.--Ranging from level bottomland to slopes of more than 100 percent on upper ridge tops. Elevations run from 2,100 to 4,000 feet.

Soil.--Upper slopes are classified chiefly as Rough Stony land (Porters soil material), lower slopes as Porters stony loam. Considerable acreages of Halewood and Hayesville loams occur at lower elevations, and limited areas of several silt loams are found along stream bottoms.

Climate.--Average annual rainfall about 45 inches; mean annual temperature 55 degrees F., with extremes ranging from -10 to +95 degrees F.; average length of growing season 175 days.

Timber types.--With a few exceptions, all of the commercial timber species occurring in the Southern Appalachians are found on Bent Creek. Species have been grouped into the following types: white pine, yellow pine, yellow-poplar (pure), long-rotation oak, short-rotation oak, pine-hardwoods, cove hardwoods, stream-bottom hardwoods.

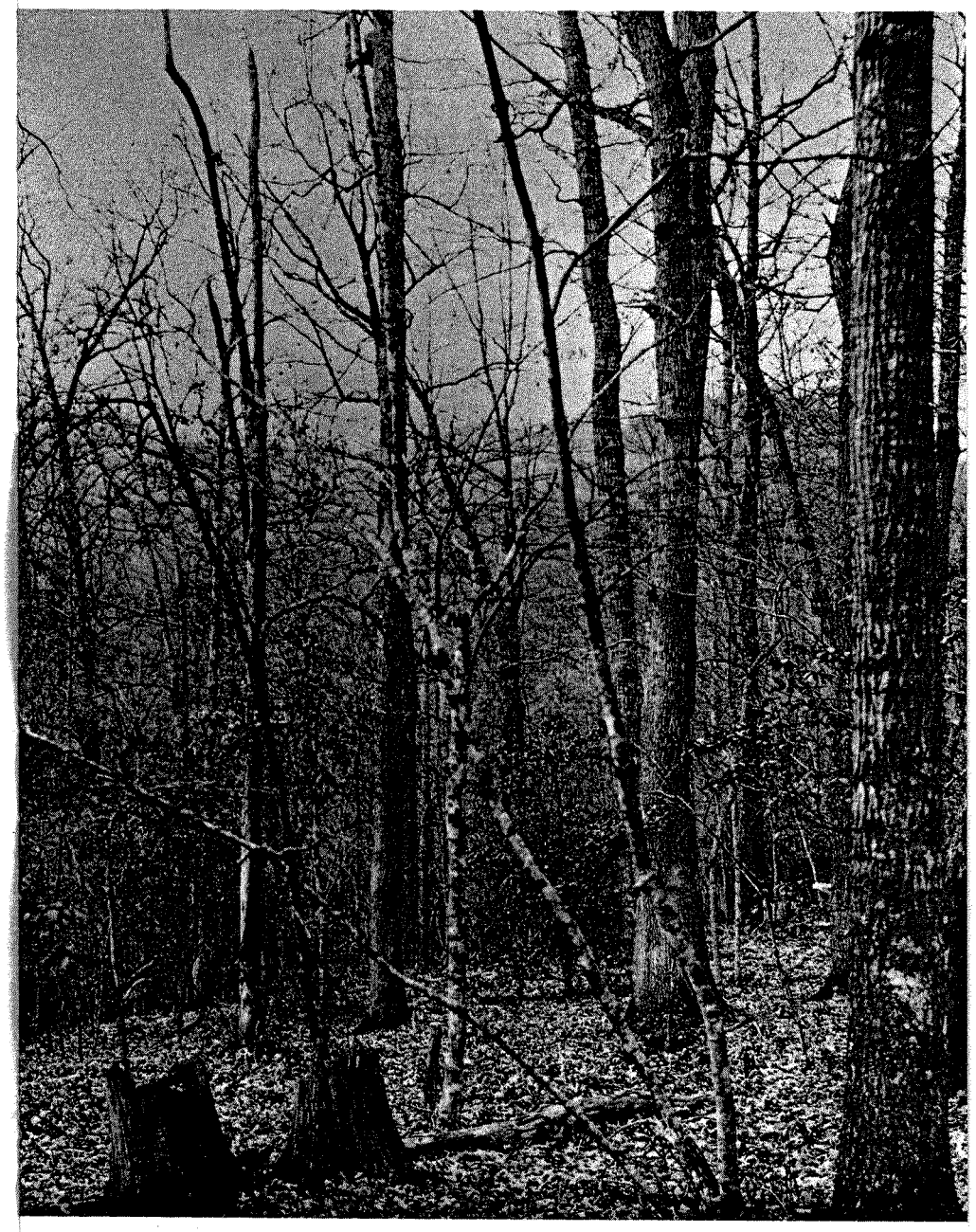
Timber condition.--Depending on past use and fire history, existing timber growth ranges from pure sapling stands of old-field origin to all-aged mixed stands which may be classified as old growth.

HISTORY OF THE AREA

Originally inhabited by the Cherokee Indians, Bent Creek was first settled by the white man about 1795. Homestead grants were available at the rate of a few cents per acre, and many large tracts were acquired in this way. Subsequently, they were broken down by inheritance, sale, or tenancy to the point where a sizeable agricultural community existed within the Bent Creek watershed.

More than a hundred homes, ranging in size from 1-room log cabins to large 2-storied buildings were constructed on the area from 1795 to 1900. Industry developed included seven blacksmith shops, five grist mills, a chair and furniture factory, a dry kiln, planing mill, and four sawmills. The first timber removal was, of course, for the construction of homes, outbuildings, fences, and much timber was destroyed by land-clearing activities. Only the best trees were utilized throughout this period of settlement. About 1865, timber acquired a commercial value, but even then logging was confined to accessible areas from which only desirable species of high quality were removed. It has been estimated that about 60 million board-feet of timber was cut and utilized from the Bent Creek area during the period of settlement. A considerable portion of this came from the 1,500 acres which were cleared for cropland or for pasture.

This repeated "high-grading," or removal of high-quality timber, coupled with grazing use and perennial burning over a hundred-year period, brought about a condition existing today over much of the Southern Appalachian mountain area, namely, stands composed of overmature, misshapen, and highly defective trees and containing a high component of less desirable species. The chestnut blight completed the cycle of deterioration when it eliminated approximately one-third of the remaining hardwood volume from the area.



A typical Southern Appalachian timber stand from which the best timber has been removed. It has in years past been repeatedly burned and perennially grazed.

During the period 1900-1909, most of the land within the Bent Creek watershed was purchased by George W. Vanderbilt as a part of his French Broad valley domain of approximately 100,000 acres. Vanderbilt undertook forest management on a rather extensive basis, and did succeed in reducing woods burning to a considerable extent. As far as can be determined, no commercial timber operations were conducted on Bent Creek during this ownership. After Vanderbilt's death in 1914, the bulk of his holdings, about 80,000 acres, were sold to the U. S. Government to become the nucleus of the Pisgah National Forest. With a few exceptions, fire has been successfully excluded since 1914. The Bent Creek area remained under the management of the Pisgah National Forest until 1925, when 1,100 acres were set aside by the Chief of the Forest Service for experimental use. Later in 1935, 5,200 acres additional were added, making the total area now available for experimentation and study approximately 6,300 acres.

ADMINISTRATION AND MANAGEMENT

The Experiment Station controls cutting operations on the Forest, within National Forest regulations. Timber removed in experimental cutting is sold on the stump or at roadside, often to cooperators assisting in logging studies.

The primary responsibility for fire protection and for maintenance of the experimental area remains with the Pisgah National Forest; however, better than average protection is afforded through the almost constant presence of station supervisory personnel and labor crews or both.

Located in the heart of the experimental forest is a 300-acre recreational area. This also is administered by the Pisgah National Forest and includes facilities for picnicking, camping, hiking, and swimming. The entire area, being within one of the Pisgah wildlife management units, provides controlled hunting and fishing.

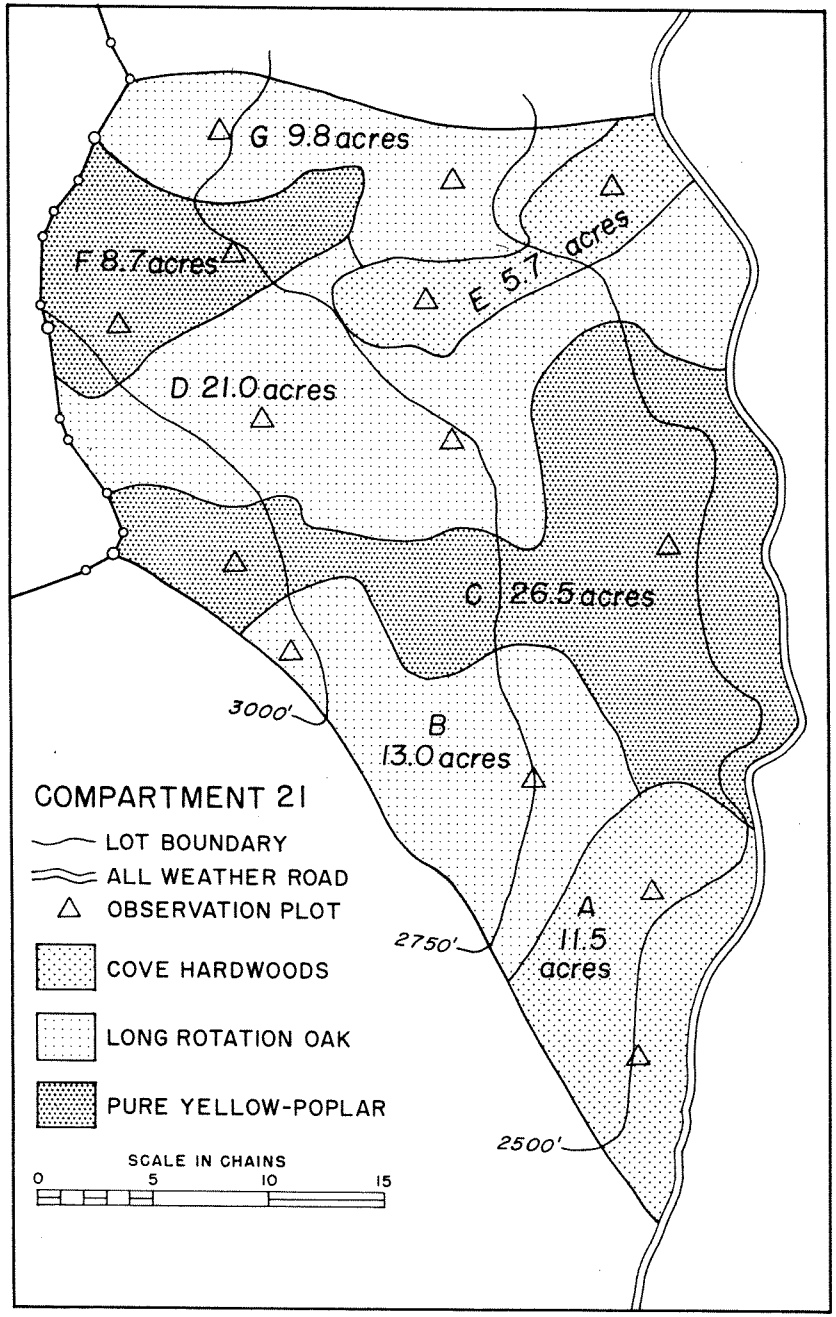
THE RESEARCH PROGRAM

Our research program is divided broadly into two phases, (1) a test and comparison of several practical systems of management, and (2) a continuation of the search for better information through special studies.

COMPARTMENT MANAGEMENT

Approximately 2,650 acres of the 6,300-acre Bent Creek Experimental Forest have been set aside as a management unit on which silvicultural systems are being compared and costs and returns under various methods of management are being determined. The area has been divided into natural logging units of about 100 acres each, as shown on the Bent Creek map. Topography primarily defines the boundaries of each of the compartments. Type and condition class are extremely variable in any one compartment because of the mountain topography and because of past land use. Old-field stands occupy as much as 50 percent of some compartments, none of others. A typical compartment is illustrated by the map on page ten.

The general aim of the work is to test several types of management, keeping records of costs and returns by compartments, so that the economic and silvicultural feasibility of mountain timberland operation can be determined. Something is already known of the silviculture of the hardwood types; much less of the economics of operating areas for products of small or large size. Treatments have been fitted to compartments in consideration of types, condition classes, and topography, not by random selection. In the assignment of treatments, care was taken to insure that soil, site, aspect and other variables were adequately represented among compartments assigned to each major treatment.



Clearcutting vs. Selection

The major silvicultural systems being contrasted are clearcutting[1] and selection. Selection or partial cutting has many proponents, because under this system full consideration is given to the condition, quality, value, and growth rate of the individual tree. Others favor this system because continuity of cut on all acres of a property provides a steady income, permitting development and maintenance of improvements which may lead to better utilization, and because it fits better into the silvical requirements of many tree species.

Clearcutting, on the other hand, permits heavier but less frequent cuts on a given area. The long period of waiting between cuts may be partially compensated for by cheaper logging, less mechanical injury to and accompanying loss of the trees that are left, less erosion and watershed damage when skid roads are not repeatedly opened up, and better environmental conditions for development of some species.

The silviculture applied in any clear-cut compartment may vary from the seed-tree method, where everything is cut except seed trees, to the shelterwood method, where a considerable number of trees remain until the young stand becomes established. Yellow-poplar coves and stringers along streams may be clear cut, for example, with adequate seed trees being left. Slopes, usually covered by oak mixtures, may be clear cut if adequate reproduction is present, or be cut by a shelterwood method if reproduction is yet to be obtained. The method used on any one acre is being fitted to conditions on that acre in keeping with the best practices we know.

Six compartments are being managed under the clearcutting system, eighteen under the selection system. All compartments received their initial cut in the period 1946-1953.

---

[1] Clearcutting is removal of all merchantable sawtimber, as defined in the marking rules.

Short Rotation vs. Long Rotation

Three of the clear-cut compartments are being handled on a short rotation and three on a long rotation. Timber on the short-rotation group will be harvested approximately on a 60-year rotation, and will consist of small products primarily. The long-rotation compartments will be operated on a 120-year basis; harvest cuts will be heavier and products larger. A major aim is to compare the profitability of operating for small products and low volumes with the profitability of less frequent operation for heavier volumes and larger tree sizes. With the rates of growth that can be expected, the experiment will attempt to find which type of management will pay the greatest returns and what silvicultural complexities exist in managing such stands on short or long rotations.

The suggested rotations are illustrative and may be changed if future developments warrant. However, they appear reasonable in view of the growth expected of short- and long-rotation species. Short-rotation oaks, pine, and yellow-poplar will reach small sawtimber size, 14 to 18 inches d.b.h., at 60 years. Some 6,000 board-feet of sawtimber per acre and an unknown amount of pulpwood, posts, and other small products should be available for harvest. At 120 years, the long-rotation oaks, yellow-poplar, and other species will probably produce at least as much sawtimber volume as above, but of far superior quality. The test between these two systems will be based on the net returns for each.

Levels of Growing Stock

On the 18 selection cutting compartments, three combinations of residual volume and cutting-cycle variation are being compared. The importance of this comparison is that it will provide information useful to the land manager who must decide on his allowable cut if he is to maintain or increase the productivity of his forest. He must know what yields he can expect from stands containing different growing stock reserves. Determination of cutting cycle is important because of its tie to production costs.

The intensity of cutting on the selection compartments is designed to leave three different volume levels of sawtimber growing stock, tabulated below. As shown in the tabulation, the low, medium, and high levels are relative and vary by timber types. Broadly speaking, the low level closely approximates present average stand conditions of the Southern Appalachians, where forests have been repeatedly cut over and culled over. The medium level of residual volume has been chosen as that which could be easily attained under management, but in some instances a scheduled cutting will have to be cancelled to permit growing stock to accumulate. Attaining the high level of residual growing stock will in most cases mean the postponing of any cutting except improvement for a period of several cutting cycles. The plan as outlined will provide harvest cuts of sufficient size to make the operation pay, and is based on careful consideration of

A low residual volume compartment after cutting. About 2 MBF of growing stock has been left per acre; the next harvest cut is scheduled for 30 years hence.

A high quality old-growth stand prior to cutting. This is a cove site and the principal species is northern red oak.

existing growth and yield information. Residual volume levels are as follows:

Type	Low (M bd. ft.)	Medium (M bd. ft.)	High (M bd. ft.)
Yellow pine	2	4	8
Pine-hardwood	2	4	8
Short-rotation oak	2	4	8
Long-rotation oak	2	4	8
Stream-bottom hardwood	3	6	12
Cove hardwood	4	8	16
Yellow-poplar	5	10	20

Cutting cycles for selection compartments where a low level of sawtimber growing stock volume is left will probably be 30 years, for medium level 20 years, and for high level 10 years.

Extensive vs. Intensive Stand Improvement

On all compartments, extensive (commercial) thinnings and stand improvement will be carried on as often as required, on a sound business basis. In addition, the aforementioned extensive measures are being compared with intensive types of stand improvement. The extensive and intensive levels of management are defined by two sets of treatment prescriptions, which are briefed below:

Extensive
1. Improvement cutting
2. Thinning for softwood pulpwood, merchantable as defined in cutting rules

Same stand as shown in previous picture, after all merchantable sawtimber has been removed.

Intensive

1. Both the extensive treatments listed above
2. Weeding
3. Cull girdling
4. Liberation cuttings
5. Laurel replacement
6. Site preparation
7. Pruning
8. Noncommercial thinning

In general, the extensive measures are those that pay their way currently.

Comparison has been provided by means of selected paired areas (subcompartments). Sufficient numbers of these areas are treated by each method to provide replicated sampling within all types and conditions present.

Silviculturally, intensive improvement cutting is a necessity in most mountain hardwood stands, but the economic feasibility has never been determined. The planned experiments will prove or disprove economic feasibility.

Farm Woodland Management

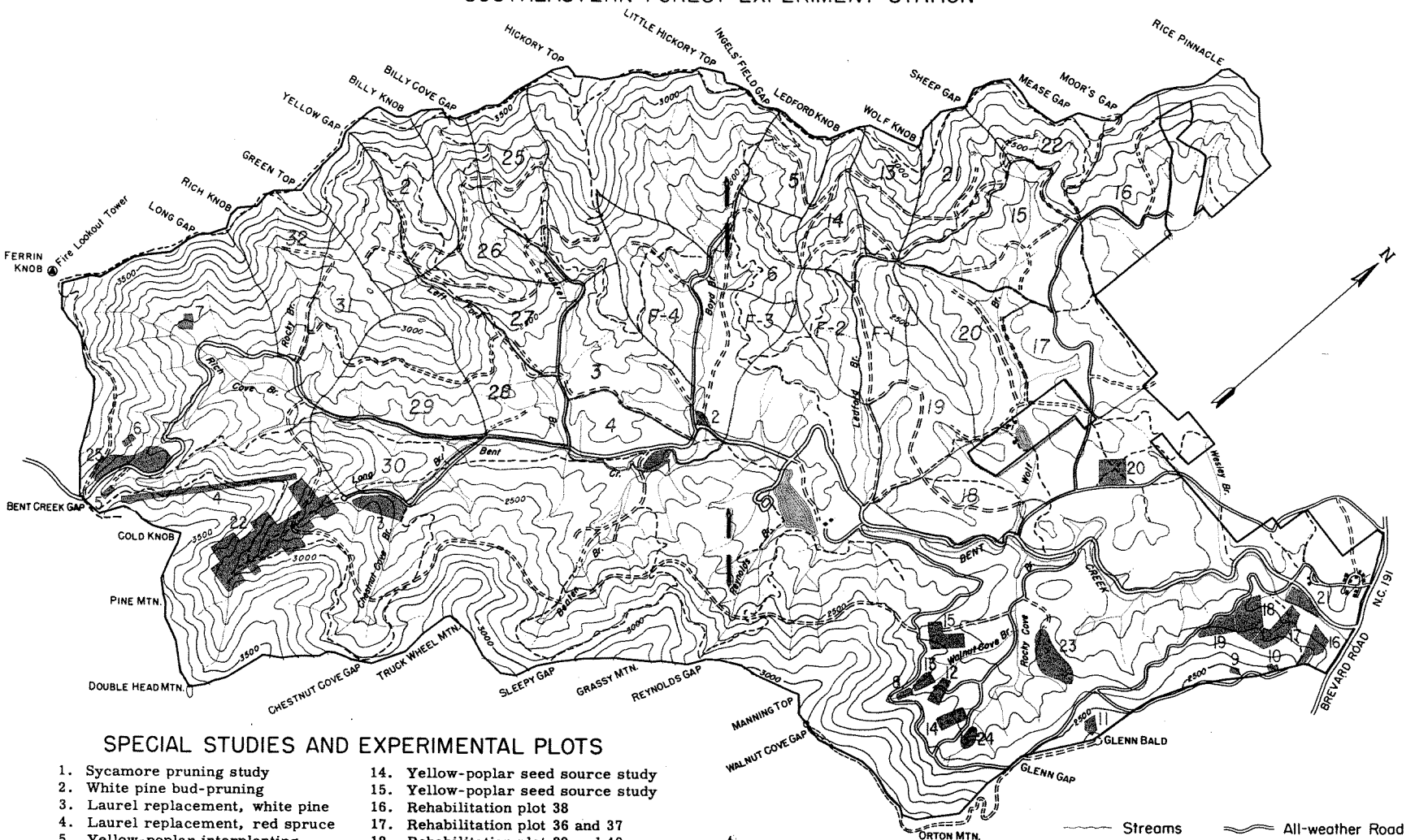
In addition to compartments managed commercially, four compartments are being operated as farm woodlands. These areas are representative of many farm holdings within the territory in that they have suffered from past use and abuse, yet with improvement and care are still capable of satisfactory timber production. Each is subdivided for management purposes according to the occurrence of forest types and conditions. The combined areas are composed of about 30 percent white oak type and about 25 percent pine-hardwood type, with pure pine, stream-bottom hardwood, pure poplar, and red oak types on the balance of the area. Although two-thirds of the entire stand is classified as sawtimber, many of the trees are culls or are highly defective because of the past practice of burning the woods and cutting only high-quality trees.

The cutting plan for these farm woodland compartments calls for the removal of some products annually from each, with the expenditure of such labor and the use of such equipment as a farmer could provide. Current cutting on all compartments is aimed at the gradual removal of all defective and poorly formed trees and trees of low-value species. Until this program has been accomplished and the stands put into a healthy growing condition, the annual rate of cutting will probably exceed the annual rate of growth. Thereafter, annual cuts will be reduced or perhaps made periodic, to allow the desired level of growing stock to be attained, after which cutting will be sustained at about the same level as annual growth.

Two of the compartments, designated F-1 and F-2 on the compartment map, are being managed for small products such as small saw logs, pulpwood, and fuelwood; the other two (F-3 and F-4), to produce large, high-quality products such as large saw logs and veneer logs. Pulpwood and fuelwood are removed in thinnings from appropriate areas and from topwood incidental to sawtimber operation. Other products such as locust posts and dogwood bolts are cut and sold when markets permit.

Separate records maintained for each area show products removed, man-hours employed, and dollars received.

BENT CREEK EXPERIMENTAL FOREST
OF THE
SOUTHEASTERN FOREST EXPERIMENT STATION



SPECIAL STUDIES AND EXPERIMENTAL PLOTS

1. Sycamore pruning study
2. White pine bud-pruning
3. Laurel replacement, white pine
4. Laurel replacement, red spruce
5. Yellow-poplar interplanting
6. Yellow-poplar interplanting
7. Yellow-poplar interplanting
8. Red oak seed source study
9. Yellow-poplar plantation
10. Red pine plantation
11. Red pine plantation
12. Oriental chestnut plantation
13. Oriental chestnut plantation
14. Yellow-poplar seed source study
15. Yellow-poplar seed source study
16. Rehabilitation plot 38
17. Rehabilitation plot 36 and 37
18. Rehabilitation plot 39 and 40
19. Rehabilitation plot 41
20. Short rotation plot
21. Arboretum
22. Harvest cutting study
23. Control of inferior trees
24. Control of inferior trees
25. Control of inferior trees

8 Experimental Plot & No.

5 Compartment Boundary & No.

Streams — All-weather Road

Contours — Woods Road

Buildings — Foot Trail

SCALE
0 ¼ ½ ¾ 1 Mile

CONTOUR INTERVAL 100 FEET

Pulpwood, with a delivered value of $30.00, produced in a 2-acre improvement cut on the Bent Creek farm woods.

One of the most valuable farm woodland products is locust posts. Any posts produced in excess of farm needs can usually be marketed at a profit.

Summary of Compartments

Management of the total of 28 compartments can be summarized as follows:

Treatment	Number of Compartments
Commercial management	
Clearcutting	
(1) Short rotation	3
(2) Long rotation	3
Selection	
(1) Low residual volume	6
(2) Medium residual volume	6
(3) High residual volume	6
Farm woodland management	4
Total	28

SPECIAL STUDIES

Silviculture

Establishment

Laurel replacement, white pine (29, 32, 33)
Special Studies map, location 3

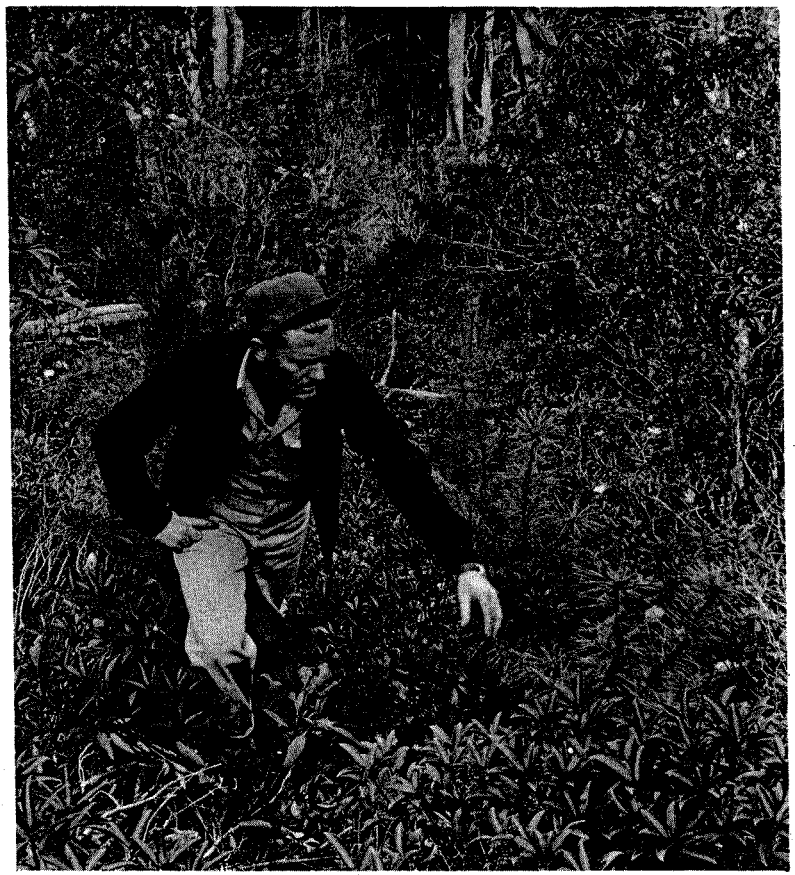
Laurel and rhododendron occur throughout the Southern Appalachians and frequently form such dense thickets or "slicks" that the natural establishment of timber-producing species is impossible. These thickets provide food and refuge for game, and satisfactory ground cover where timber production is undesirable or impractical. However, many potential timber-producing areas are being occupied, and it is on these areas that the replacement of laurel and rhododendron by commercially valuable species is recommended.

Date installed.--March 1945

Object.--To test on a pilot-plant basis the replacement of laurel with white pine by means of strip cutting and planting.

Results to date.--White pine can be satisfactorily established by planting seedlings in a lane cut approximately three-fourths as wide as the thicket is high. The planted trees will outgrow competing laurel or rhododendron sprouts, and will overtop them before the lane closes.

****



White pine planted in cleared strips through laurel thickets can outgrow sprout competition, and emerge from the strips before the laurel lane closes.

Yellow-poplar interplanting
Special Studies map, locations 5, 6, and 7

Many openings were created in Southern Appalachian forests through the death and subsequent removal of the chestnut. It was of prime importance that these openings be occupied as promptly as possible by seedlings of desirable species so that the depleted stands might begin to replace the growing stock loss thus suffered.

Date installed.--Spring 1936

Object.--(1) To compare planting with natural restocking in small openings created by the removal of dead chestnut, and (2) to evaluate deer browsing damage on both planted and natural reproduction.

Results to date.--There is an apparent superiority both as to number and size of planted stock over natural reproduction. Both appear entirely adequate, however. No marked difference attributable to deer browsing between fenced and unfenced areas is evident, except in one location where the deer were channeled through the plot by steep hills.

****

Red oak seed-source study
Special Studies map, location 8

Tree improvement, whether it is accomplished by cross breeding or by the careful selection of seed trees, is receiving more and more attention. One possibility in this connection is that certain geographic strains may show superiority in form, rate of growth, or in some other characteristic. This study is being made in cooperation with the Maria Moors Cabot Foundation of Harvard University.

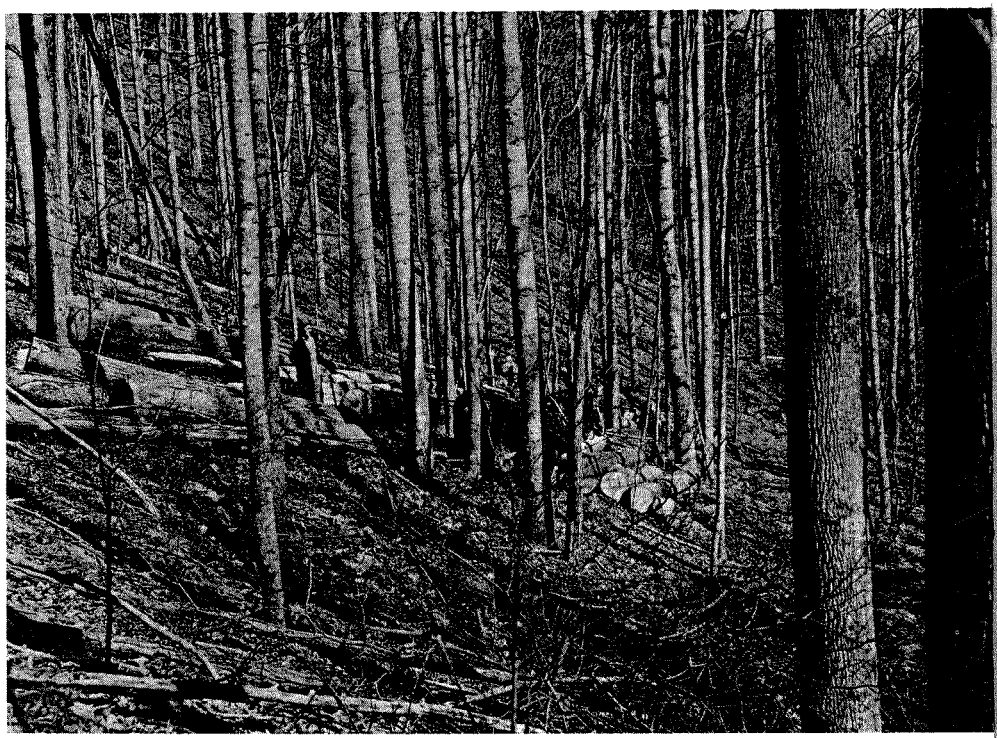
Date installed.--Spring 1953

Object.--To compare the growth and development of red oak (Quercus rubra) from six sources spread over

the range of the species.

Results to date.--Survival for the first year averaged about 91 percent. Although it is too early to draw definite conclusions, it does appear that the more northerly seed sources have a higher survival, but that southern sources have a greater rate of growth.

****



Partial cutting in a fine second-growth stand of yellow-poplar.

Yellow-poplar seed source study
Special Studies map, locations 14, 15

This is one of our fastest-growing and most valuable species. It occurs over a wide range of sites and geographical locations. If superior strains exist, the determination of this fact would be of considerable value.

Date installed.--Spring 1954

Object.--To compare the survival and growth rate of sixteen sources of planting stock; also, to determine whether geographic races of the species exist, and if so which is superior for Southern Appalachian conditions.

Results to date.--No results are available at the end of the first growing season. First-year survival is estimated to be 95 percent.

****

Development

Sycamore pruning study
Special Studies map, location 1

Timber of large size and high quality is scarce, and becoming increasingly so. Large size and high quality are usually closely correlated because large trees have shed their lower branches and have covered the limb stubs with knot-free wood. This process can be greatly accelerated by properly timed pruning. Careful pruning of white pine, for example, will return handsome dividends. The advisability of pruning many of the other species is as yet largely untested.

Date installed.--April 1948

Object.--To determine if and how sycamore can be profitably pruned, through a comparison of cost and resulting values.

Results to date.--Quantitative results are not yet available, but two interesting observations have been made: (a) Practically all pruning wounds less than 1 inch in diameter healed over completely in the first growing season, and all wounds healed in 2 years. (b) Pruned trees showed slightly less diameter growth, but an increase in height growth over unpruned trees.

****

White pine pruning by conventional method (15)

That selected white pine crop trees can be profitably pruned has been widely accepted for many years. A study established in 1936 at the Toccoa Experimental Forest, in Union County, Georgia, has shown that if pruning is done at an early age, wounds heal over in from 5 to 8 years and that up to one third of the live crown may be removed without affecting growth. The financial advantages attributable to pruning have been computed from a sample of the pruned and unpruned trees which were cut and sectioned. The net profit thus determined, based on the harvest of 80 pruned trees per acre, ranged from $900 to $1000, depending on the size of the tree at time of pruning.

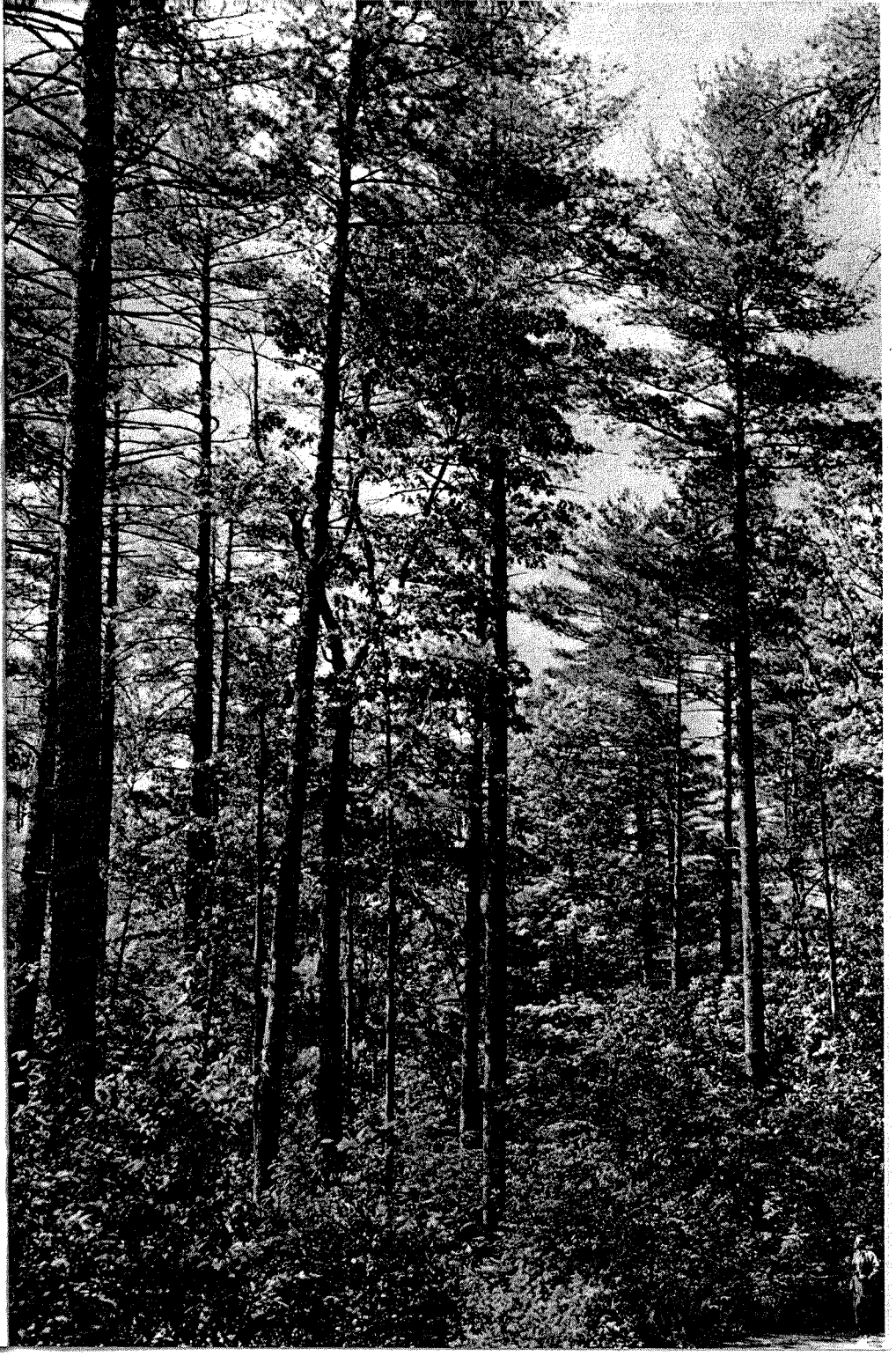
****

White pine bud pruning study (22)
Special Studies map, location 2

Although having the same ultimate goal as conventional methods--the production of knot-free lumber--the bud pruning approach is quite different. Here, starting at about age 5 all lateral buds are removed, leaving one basal whorl. This process is repeated at least once each year, until 17 feet of limb-free stem has been produced, after which further crown development is undisturbed.

Date started.--1950

Object.--To explore the possible use of bud pruning for white pine.



A fine stand of white pine at the Toccoa Experimental Forest, Union County, Georgia.

Results to date.--Bud pruning does not appear to be desirable for white pine because this species has a tendency all through the growing season to replace the lateral buds removed. One serious consequence has been the much greater incidence of the white pine weevil in bud-pruned trees as compared with unpruned trees.

****

Control of inferior trees (23)
Special Studies map, location 23

Because cull or otherwise unmerchantable trees constitute a problem on many forest properties, the determination of effective and economical methods of eliminating them is important. This study, the largest to date in the Southern Appalachians, is for the most part a test on mountain species and under mountain conditions of methods used successfully elsewhere. Species include oaks, red maple, sourwood, hickory, laurel and rhododendron. Treatments include various combinations of oil or water with 2, 4, 5-T used as a basal spray, on stumps, and in frills; Ammate crystals on stumps and in cups; axe girdling; machine girdling; and 2, 4, 5-T with machine girdling.

Date started.--1955

Object.--To determine the most effective means of controlling undesirable mountain hardwoods.

Results to date.--No results as to the relative effectiveness of the treatments are yet available. Time studies made during the installation of axe and machine girdling showed a sizeable advantage in favor of the machine. By both methods, treating hickory was much more time-consuming than treating any other species.

****

Stand rehabilitation study (37, 40)
Special Studies map, locations 16, 17, 18, 19

Vast areas in the Southern Appalachians are in an unsatisfactory condition as regards quantity and quality of timber and rate of growth. If these stands are to provide satisfactory returns, it is imperative that measures be taken to improve their productiveness.

Date installed.--1930

Object.--To find the best method of preparing ragged and uneven stands for systematic management. Treatments compared with an uncut area included clearcutting, cutting to a flexible 15-inch diameter limit, and quality selection.

Results to date.--An analysis of 20 years' growth showed board-foot growth per acre to be greatest on the quality selection area, with the check area, diameter-limit cutting, and clear-cut area following in descending order. Total cubic-volume growth has been greatest on the clear-cut area, followed by diameter-limit, selection, and check.

A highly satisfactory stand of sprout origin is growing on the clear-cut area. This coppice growth shows considerable promise, and should develop into a valuable stand with some assistance in the form of cultural work.

****

Severity of cutting study
Special Studies map, location 22

Under management, how does severity of cutting affect the residual timber stand, and its subsequent reproduction and growth?

Date installed.--1936

Object.--To determine the effect of various severities of cutting on growth of residual stand, and on the kind, amount, and development of reproduction which follows; also, to determine the influence of degree of cutting on the formation and development of water sprouts on the stems of the remaining trees.

Results to date.--Analysis of growth on the 50 one-acre plots involved during the initial observation period showed it to be related to residual volumes as expressed by the equation: Annual growth per acre, bd. ft. = 80 + 19.3M (where M equals growing stock in thousand board-feet). Most abundant reproduction, largely of light-seeded species like black birch and yellow-poplar, was found on clear-cut or heavily cut areas when observed 7-1/2 years after the cutting. Since new stems below breast height were not counted at that time, no adequate comparisons between all species are possible.

Water sprouts that developed after the opening up of the stand have not been numerous enough to degrade the remaining old-growth trees.

The study was installed in a wild stand, and represents the first attempt at management on the area involved. It is to be expected that many of the findings would differ if a similar study were carried out on an area already under management.

****

Soils-Site-Growing Space

This field of work, essentially neglected for many years in this region, will include several important studies. The most important studies will be those correlating soils, physiography, and geology, with the site indices of the more important timber species of the region. These studies will utilize a series of 500 permanent fifth-acre plots, installed throughout the compartment management study and designed to provide interim compartment results by means of 5-year remeasurements.

Soils-site index study

Date started.--July 1953

Object.--(a) To correlate site index for several species with the most important soil properties and physiographic features. (b) To establish relative site index values by species on a given site. (c) To compare the accuracy of site index as predicted from the soil with site index as determined by conventional methods.

Results to date.--Comparative site indices have been developed for white pine, Virginia pine, shortleaf pine, pitch pine, yellow-poplar, scarlet oak, black oak, and chestnut oak.

****

Finance

Time-Cost Studies

These studies are essentially complete and have been reported in items 2, 3, 5, 6, 9, 10, 11, 12, 24, 25, 26, 27, in the publication list. Additional studies covering the testing of new or specialized equipment will be added as conditions permit.

Log and Tree Value Studies

Hardwood tree grades and values (4, 7, 8, 14, 16, 18)

A system of hardwood tree grading has been developed, based on grading the butt log only. This system antedated the adoption of standard Forest Service log grades, but was later adapted to them. Included were the determination of tree values and financial maturity sizes for the major Southern Appalachian species. Similar information on minor species is being added currently.

****

Yellow pine tree grades and values

This study will compare yields and values for southern yellow pine with those produced by mountain yellow pine, and will later be extended to yellow pine tree grading.

****

Because of a wide range in hardwood lumber values the grading of individual trees can readily be justified. The butt log grading system developed at Bent Creek is accurate and easily applied.

PUBLICATIONS BY

RESEARCH CENTER STAFF

1947 - 1955

(1) BARBER, J. C.
1953 Tree planting at the Bent Creek Experimental Forest. Southeast. Forest Expt. Sta. Paper 27.

(2) CAMPBELL, ROBERT A.
1946 Pine pulpwood production. Southeast. Forest Expt. Sta. Tech. Note 66.

(3) _____
1947 Farm woodland earnings. Forest Farmer 6(9):4.

(4) _____
1948 Twenty years' growth of yellow-poplar. Forest Farmer 7(5):22.

(5) _____
1948 Estimating your logging and milling costs. South. Lumberman 176(2209): 50, 52, 54, 56. April 15.

(6) _____
1950 Farm woodland management at the Bent Creek Experimental Forest, report for the years 1946-1949, inclusive. Southeast. Forest Expt. Sta.

(7) _____ PRICE, H. R., and MORIN, R. A.
1950 Timber estimating by tree grade. South. Lumberman 181 (2273):243-245. Dec. 15.

(8) _____ 1951 Tree grades, yields and values for some Appalachian hardwoods. Southeast. Forest Expt. Sta. Paper 9.

(9) _____ 1951 Farm woodland management at the Bent Creek Experimental Forest, report for the years 1946-1950, inclusive. Southeast. Forest Expt. Sta.

(10) _____ 1952 Timber cutting and skidding costs in the Southern Appalachians. South. Lumberman 185(2321): 189-191. Dec. 15.

(11) _____ 1953 Logging methods and costs in the Southern Appalachians. Southeast. Forest Expt. Sta. Paper 30.

(12) _____ 1954 Labor requirements as influenced by volume cut per acre on the Bent Creek Experimental Forest. Southeast. Forest Expt. Sta. Research Note 51.

(13) _____ 1954 Farm woodland management in the Southern Appalachians. Southeast. Forest Expt. Sta. Paper 41.

(14) _____ 1955 Tree grades and economic maturity for some Appalachian hardwoods. Southeast. Forest. Expt. Sta. Paper. 53.

(15) _____ 1955 Does it pay to prune white pine in the Southern Appalachians? South. Lumberman 191(2393): 179-180. Dec. 15.

(16) _____ 1955 Hold that poplar! South. Lumberman 191(2393): 150-151. Dec. 15.

(17) DOOLITTLE, W. T. 1948 White pine blight in relation to site and thinning. Jour. Forestry 46(12): 928-929.

(18) _____ 1948 Black locust post volume table. Southeast. Forest Expt. Sta. Research News No. 2.

(19) _____ 1949 and CAMPBELL, ROBERT A. Pruning pays. Forest Farmer 8(8): 7, 9.

(20) _____ 1950 and BYRAM, GEORGE M. A year of growth for a shortleaf pine. Ecology 31(1): 27-35.

(21) _____ 1953 Growth and survival of hybrid poplars. South. Lumberman 187(2345): 178-179. Dec. 15.

(22) _____ 1954 Bud-pruning attracts white pine weevil. Southeast. Forest Expt. Sta. Research Note 63.

(23) _____
1955 Axe or machine girdling? South. Lumberman 191(2393): 152, 157. Dec. 15.

(24) McCLAY, T. A.
1948 Profits from chestnut oak tanbark. Jour. Forestry 46(4): 298-299.

(25) _____
1948 Skidding pulpwood by use of jeep. Forest Farmer 7(10): 6.

(26) _____
1949 Farm woodland management at the Bent Creek Experimental Forest, report for the years 1946, 1947, and 1948. Southeast. Forest Expt. Sta.

(27) _____
1949 Returns from Southern Appalachian experimental farm woodlands. South. Lumberman 179(2249): 219-221. Dec. 15.

(28) RENSHAW, J. F.
1955 Farm woodland management at Bent Creek. Farmers Federation News 36(3): 4-5.

(29) WAHLENBERG, W. G.
1950 From brush to pine; how to convert rhododendron brush areas to stands of white pine timber. South. Lumberman 180(2261): 40-41. June 15.

(30) _____
1950 Epicormic branching of young yellow-poplar. Jour. Forestry 48(9): 417-419.

(31) _____
1950 A long-term test; a quarter century of forest regrowth in a cutover and cleaned Appalachian cove. South. Lumberman 181(2273): 183-187. Dec. 15.

(32) _____ and DOOLITTLE, W. T.
1950 Reclaiming Appalachian brush lands for economic forest production. Jour. Forestry 48(3): 170-174.

(33) _____
1951 Converting mountain brush to stands of pine timber. Forest Farmer 10(10): 7, 14.

(34) _____
1951 Planting in the Appalachian spruce-fir type. Jour. Forestry 49(8): 569-571.

(35) _____
1951 A technique for hand planting of forest trees in the Southern Appalachians. Southeast. Forest Expt. Sta. Paper 12.

(36) _____
1952 Thinning yellow-poplar in second-growth upland hardwood stands. Jour. Forestry 50(9): 671-676.

(37) _____ 1952 How to harvest; effects of cutting methods in growing Appalachian hardwood. South. Lumberman 185(2321): 175-178. Dec. 15.

(38) _____ 1953 Use of a short-handled planting hoe in the Appalachians. Southeast. Forest Expt. Sta. Research Note 26.

(39) _____ 1953 Modifying nursery stock to fit modern planting methods. Tree Planters Notes 14: 4-5.

(40) _____ 1953 Three methods of rehabilitation for depleted Appalachian hardwood stands. Jour. Forestry 51(12): 874-880.

(41) _____ 1953 A 37-year test of thinning Appalachian white pine. South. Lumberman 187(2345): 180-183. Dec. 15.

(42) _____ 1955 Six thinnings in a 56-year-old pure white pine plantation at Biltmore. Jour. Forestry 53(5): 331-339.

NOTES