The 1931 Search for a New Experimental Forest in the Ouachita National Forest

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PREFACE

While the Appalachian Forest Experiment Station had established its first experimental forest at Bent Creek in 1925, the Southern Forest Experiment Station (SOFES) had no such designated area upon the passage of the McSweeney-McNary Forest Research Act of 1928 (which formally codified the development of experimental forests). With the approval of Regulation L-20 on August 7, 1930, the U.S. Department of Agriculture Forest Service provided the process and protocols for establishing a "comprehensive" system of experimental forests and ranges and natural areas on national forest lands (Clapp 1931: 1). In addition to authorizing forest research of a "broad scope," the McSweeney-McNary Act "crystallize[d]" efforts to establish experimental forests to allow both for research and field-based demonstration of concepts (Clapp 1938: 834). Research in the shortleaf pine (*Pinus echinata*)-dominated forests on the Ouachita National Forest had started ramping up with the establishment of a "branch station" in Hot Springs, AR, in 1929 and an additional appropriation to the SOFES in FY1931 for additional management-oriented studies (SOFES 1930).

Within a few months of the publication of Regulation L-20, SOFES dispatched a three-person crew to scour the landscapes of the Ouachita National Forest in west-central Arkansas, apparently at the behest of J.C. Kircher, Regional Forester for the Eastern Region. The crew, W.G. (William Gustavus) Wahlenberg, Roy A. Chapman, and Carl F. "Ivy" Olsen were still early in their Forest Service careers but were deemed capable enough to be sent out to the remote Ouachita Mountains to evaluate these rugged lands for a prospective experimental forest. The author of this report, Wahlenberg, began working for the Forest Service in the Western United States in 1919 after receiving forestry degrees from the University of Maine and Yale University (Anon. 1976). For most of his early years, Wahlenberg worked as an assistant silviculturist with the Priest River Experiment Station (later, the Northern Rocky Mountain Forest Experiment Station), receiving an assignment to work on "forestation investigations" at the Savenac Nursery in northwestern Montana in 1920 (Wellner 1976). By 1929, Wahlenberg had moved to the SOFES and eventually became one of the Station's experts in silviculture. Toward the end of his career, Wahlenberg moved to the Southeastern Forest Experiment Station in Asheville, NC, and expanded his pine work to include silviculture in hardwoods as well. While Wahlenberg worked on many different research projects during his long Forest Service career (he retired in 1956), he is best known for his two monographs on longleaf (*Pinus palustris*) and loblolly (*P. taeda*) pines (Wahlenberg 1946, 1960). Chapman, a 1927 University of Minnesota graduate, had worked for the SOFES as a temporary field assistant in 1926 and received a permanent assignment with the Station in 1929. According to Philip Wakeley's early history of the Station, Chapman was particularly adept at statistics, having been trained specifically under Francis X. Schumacher in the Washington Office

(after this Ouachita trip), as well as receiving additional training during his undergraduate years at Minnesota (Barnett and others 2023, Wakeley and Barnett 2011). Olsen is less well documented than either Wahlenberg or Chapman. Olsen worked with Wakeley as a planting assistant in the early 1930s; his later work with the SOFES appeared to focus on the study of wildfires (Alexander and Taylor 2010, Wakeley and Barnett 2011).

En route to the Ouachita region, this crew visited with a number of persons familiar with the region and local logging/milling practices. Along with various past and present Ouachita National Forest staff, they met with two notable men, one a former and one a future Forest Service employee. William Logan Hall left the Forest Service after World War I and started a consulting forestry business in the Hot Springs, AR, area by 1925 (Clepper 1960). Albert E. "Wack" Wackerman was working for the Crossett Lumber Company in extreme southern Arkansas and northern Louisiana. He would soon be employed by the Station and would help Russell R. Reynolds with the establishment of the Crossett Experimental Forest (Bragg 2012).

Wahlenberg and his crew were not impressed with the forest conditions they found on the Ouachita National Forest. After weeks of searching, Wahlenberg would include only 10 watersheds in his report, of which he thought only two (Rock Creek and Irons Creek) had any promise for development into experimental forests. However, even these two watersheds were ill-suited for silviculture studies. They were small, irregularly forested, and logistically challenging. Wahlenberg made this clear in his concluding paragraphs. He recommended establishing a center for research in conjunction with the Ouachita National Forest, but to hold off on reserving land for an experimental forest until a later date. At the behest of the agency, Wahlenberg followed up this first trip to the Ouachitas with a second in the latter half of May 1931. He did some additional tree classification work, thereby adding some observations (but no new possible locations) on the forest conditions of the area (app. A).

This recommendation apparently did not sit well with the Washington Office. On May 20, 1932, Edward N. Munns, Chief of the Forest Service's Division of Silvics, sent SOFES Director Elwood L. Demmon a terse letter complaining about their inability to recommend an experimental forest (app. B). Demmon responded back that Wahlenberg's reports had been forwarded to the Southern Region for their consideration and constructive criticism, for which little or no feedback had been provided. Munns' reply to Demmon on June 4, 1932, noted he did not consider Wahlenberg's suggested projects sufficient. His arguments against the two watersheds primarily considered (Rock and Irons Creeks) were "unconvincing" given the need for forest management recommendations in the "uneven-aged and ragged" stands depicted in Wahlenberg's forests.

Munns' interest in seeing an experimental forest in the Ouachita Mountains eventually prevailed. A few years later, H.G. Meginnis of the SOFES proposed to build the infrastructure and preliminary program of studies for what would become the Irons Fork Experimental Forest. The experimental forest opened in late 1936 but was not formally established until July 19, 1940. Even though the reports by Wahlenberg did not provide a rosy assessment of the areas examined on the Ouachita National Forest, there were many good insights into the current forest conditions of the Ouachita Mountains. Wahlenberg understood the challenges of establishing an experimental forest in this area. His observations on the impacts and risks of fire were also important and his contemporaries in the forests of Arkansas (Bruner 1930, Hall 1939) shared his concerns. The needs of the Ouachita National Forest for useful management advice had to be balanced with the expense and difficulty of the task (especially in the midst of the Great Depression).

Note: With the exception of some minor formatting changes, redevelopment of some figures for clarity, and corrections to obvious spelling errors, we changed very little of Wahlenberg's original 1931 report. For example, their use of underlining to make points of emphasis has been retained, as has their table and paragraph structures. When possible, brief biographical information for individuals mentioned and other insights are included as footnotes in this report. Some of the plates (photographs) were not placed

in the original document; several others were mentioned in the other plate captions but not actually present in the report. All maps and plates (photographs) are public domain images created by the original report contributors and are presented in in the best quality available. Due to their poor quality in the report copies available, the graphs were all redrafted using the originals as templates (so the proportions should be consistent).

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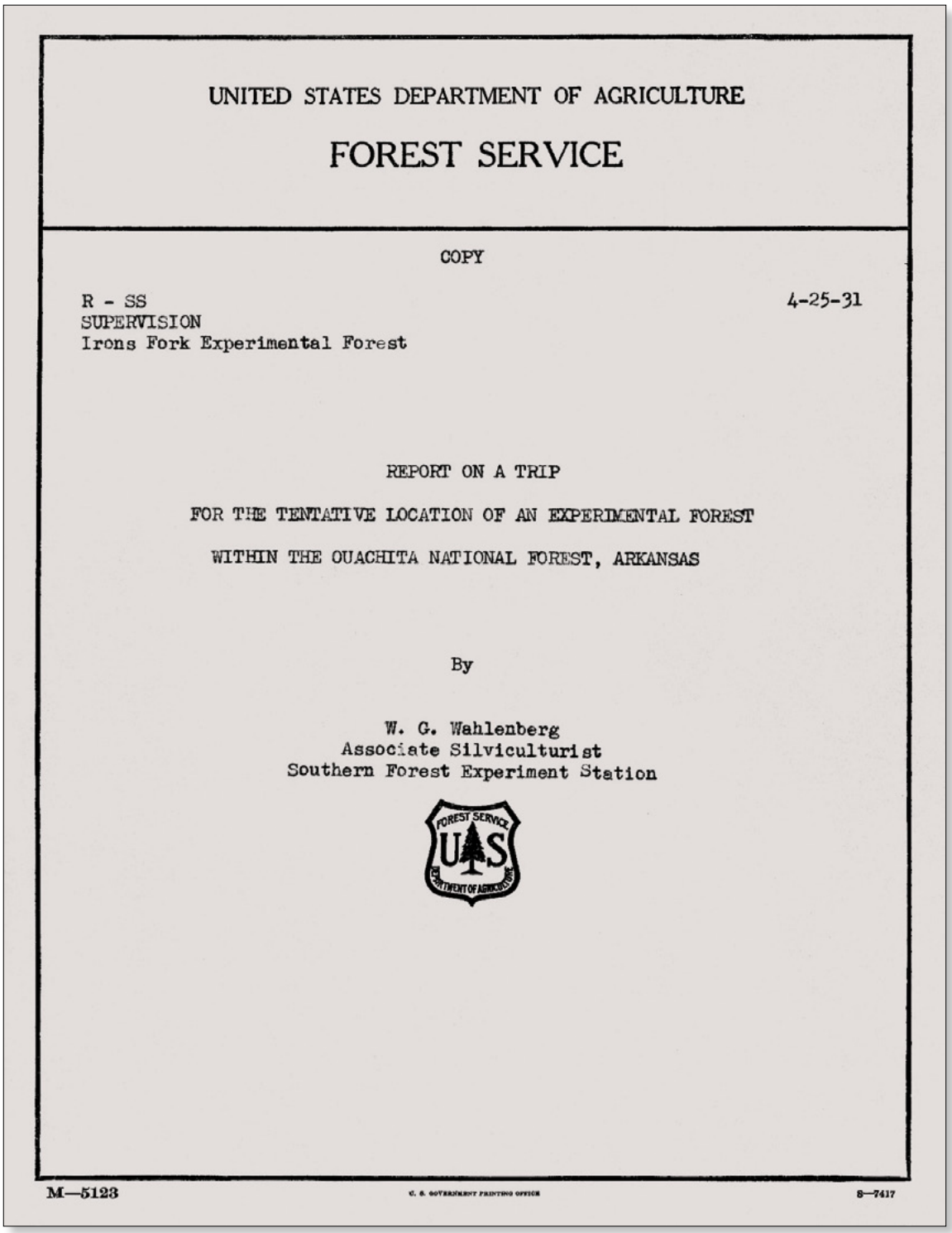

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4-25-31

REPORT ON A TRIP

FOR THE TENTATIVE LOCATION OF AN EXPERIMENTAL FOREST

WITHIN THE OUACHITA NATIONAL FOREST, ARKANSAS

By

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Associate Silviculturist
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Image of the title page for the original report by Wahlenberg.

R - SUPERVISION R-7
Branch Stations
Experimental Forests
Regional Forester,
Washington, D. C.

Washington, D. C.
Aug. 21, 1931

Dear Mr. Kircher:

The Acting Forester's letter of July 2 provided for the preparation of three final copies of the report on each Experimental Forest or Experimental Range. Upon further consideration it seems apparent that one copy of this report should be filed in the office of the Forest Supervisor, a second in the office of the Director of the Forest or Range Experimental Station, a third in the office of the Regional Forester and a fourth in the office of the Forester. It, therefore, will be desirable to prepare four copies of the final report rather than the three called for by the letter of July 2.

Very sincerely yours,
/s/ L. O. Kneipp
Acting Forester

P. S. This requirement also pertains to Cir. S-18 of August 14, 1931, "R - R-7, Natural Areas".

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INTRODUCTION

Objects of the Trip

1. Selection of a suitable area or areas for the concentration of experiments contemplated by the Southern Station. Such studies should gradually add to existing knowledge of basic silvical facts needed in management work.
2. Contacts with the National Forest personnel and other local foresters.
3. Preliminary observations on the growth of shortleaf pine.

PARTY, DATES, PERSONAL CONTACTS, AND FORESTRY NOTES

A three-man party, W. G. Wahlenberg, Roy A. Chapman, and C. F. Olsen, spent the period from January 21 to March 5, 1931 on the Ouachita National Forest.

In Baton Rouge (On January 19) we called on A. J. Streinz[1], formerly of the Ouachita, and discussed the possibility of finding suitable experimental areas and natural areas. At Perla, near Malvern (on January 21), we called on C. W. Strauss, of the Malvern Lumber Company, and a graduate of the Cornell forest school. On the 50,000 acres which the company controls, forestry investments have been cut to a minimum at this time because of the financial depression. However, they are experimenting with methods of silvicultural improvement through poisoning of the larger hardwood trees in pine stands. Mr. Strauss said that a commercial compound called "Boko" appears to be quite effective.

At Hot Springs we found Supervisor Shaw out of town. The protection and acquisition work of the Ouachita Forest were discussed with Conarro and Ochsner.[2] With Ochsner we visited a timber sale area being operated by the Dierks Lumber Company. This gave us our first definite picture of the virgin timber stands and some of the problems involved in the silvicultural marking of timber to be cut.

Three more days were spent in the field with Mr. Ochsner (January 22, 23, and 24) visiting three possible areas for experimental forests on the Jessieville and Womble ranger districts, and small experimental plots at Big Fork for the study of growth and brush disposal methods. This trip provided an opportunity for very helpful discussions of timber problems on the ground.

The experimental forest idea was also discussed later with Supervisor Shaw at Hot Springs and at Mena, and with each of the district rangers at their headquarters. These men all gave us the benefit of their ideas, and suggested that we examine certain areas believed to be most

[1] Augustine J. Streinz was a 1923 University of Minnesota forestry graduate who worked in various capacities for the Forest Service (including both the National Forest System and Research and Development) across the Southern United States.

[2] Ochsner is H.E. "Herb" Ochsner, who later became the assistant regional forester in charge of timber management for the Eastern Region.

promising. Thus the watersheds discussed in this report under the head of "Reconnaissance" were each selected on the basis of the knowledge of local forest officers. At Hot Springs we also called on William L. Hall[3] (March 5). He complimented the Ouachita Forest on its recent success in greatly increasing the efficiency of fire protection. When asked if he thought private forest interests could benefit from the results of silvicultural research conducted on the National Forest, he pointed out that although the higher and rougher parts of the forest are not at all typical of the surrounding country, many of the low ridges on the Ouachita are comparable with growing conditions outside the National Forest.

In his opinion the big problem of the region, aside from fire protection, is the proper management and utilization of second-growth stands.[4] Virgin timber problems are steadily diminishing. The mixed stands are important. As pure pine stands should be regarded ecologically as a temporary type, it is not wise to attempt complete conversion to pure pine. Gradual soil improvement will result from continued fire protection, of course, but the process will be hastened by the maintenance of a fairly complete cover, including some hardwoods.

Mr. Hall stated that the combination of grazing and forestry is not important in Arkansas, as in most situations silviculture represents the highest economic use of the land.

Regarding intermediate cuttings, he said that thinnings should not be made before the stand is 25 to 30 years old and the trees have a clear length of about one and one-half log. In order not to interfere with proper development of clear length and height, thinnings should not be heavy. Private operators can not figure on removing material smaller than pulp wood; that is, anything less than 3 or 4 inches at the small end of about 5 inches d.b.h. Fifty cents a cord is usually paid. The old rule of avoiding all cultural investments until they pay for themselves must be followed except in experiments.

Mr. Chapman was interested in obtaining Mr. Hall's ideas on poisoning of hardwoods. Hall felt that this work holds forth much promise. He said that because of the lateral diffusion of arsenic solutions in the sapwood, the girdling cuts need not be continuous. Light hacks that little more than sever the cambium are sufficient and make for a cheap operation. He also said that trees killed by poison do not have as bad an effect as girdled trees in increasing fire hazard, because, although the small twigs all drop off quickly, the larger branches [go to] pieces gradually while the tree as a whole remains standing.

In returning to New Orleans, we stopped at Sigman's stave mill at Monticello, Arkansas. The plant was not in operation, but there were 2 million staves in their yard, enough for 100,000 barrels at the rate of 19 to 20 staves per barrel. Much of this was red oak, which can be used for lard barrels without treatment. Impregnated with paraffin, it can be used also for tight cooperage for pickles, coca cola, etc. At Crossett, Arkansas (March 6), Wackerman[5] showed us a logging operation in a splendid stand of hurricane[6] timber. Cutting is done to an approximate limit of 13 inches d.b.h. and 10 inches in the top. Loblolly in

[3] William L. Hall was a Kansas State College graduate who originally started working for the U.S. Department of Agriculture, Division of Forestry in 1899 and then the Forest Service (between 1905 and 1919); by 1925 he had established himself as a private consulting forester in Hot Springs, AR, and remained there until his death in 1960 (Clepper 1960).

[4] It is clear from this report that both Hall and Wahlenberg were very much contemporary in their disdain of fire in southern pine ecosystems. They were focused on developing the commercial utility of managing shortleaf pine forests and viewing old-growth timber as a resource to be exploited (see also Hall 1939). This perspective influences the rest of this report and the ultimate recommendation of Wahlenberg against establishing a new experimental forest at that time on the Ouachita National Forest.

[5] Wackerman is Albert Edward Wackerman, a forester with degrees from the University of Minnesota and Yale University. Wackerman was working for the Crossett Lumber Company in Crossett, AR in 1931, but by 1933 would be working for the Southern Forest Experiment Station (Bragg 2012).

[6] This is a reference to tornado damage, not the larger tropical systems we currently call hurricanes.

favor over shortleaf for seed trees. Crooked trees and limbs from tops are sold to a mill at Bastrop for pulp wood at 50 cents per cord. Last year 500 fires burned over 12,000 acres, about 3 per cent of the holdings, and were held to an average size of 27 acres. The property comprises about 60 per cent pine and 40 per cent hardwoods. The mill of 80 million capacity now cuts about 55 million feet.

NOTES ON THE GENERAL FORESTRY SITUATION ON THE OUACHITA

The National Forest

The Forest is an irregular stand of virgin and second-growth shortleaf pine mixed in varying degrees with low-grade stands of oak, gum, and other hardwoods. Loblolly pine occurs to a very limited extent, and only in the eastern portion of the Womble district. The topography is rough, consisting of a series of low mountain ranges. The soil is thin and rocky, much of it a Hanesville stony loam.

Of the total timbered area of 618,541 acres, 381,496 acres are classed as old growth and 237,045 acres second-growth. However, some of the younger virgin timber is very similar to second-growth where openings in the stand have permitted relatively rapid development. Areas not producing in commercial quantities amount to 138,505 acres.

The total stand of pine is estimated at 858,983 M board feet and 234,000 cords, while the hardwood stand is estimated at 100,000 M board feet.

Form and Management

From the management standpoint, the Forest is essentially a many-aged group selection forest of shortleaf pine, with a deficiency of pole-sized trees. In many places the stand is even-aged by groups originating from hurricane or severe fire damage. The rotation adopted for the Hot Springs Working Circle[7] is 120 to 140 years. Trees 18 inches in diameter can be produced in this period. The cutting cycle for this Circle is 37 years.

Sale of Timber

Timber is sold largely to operators who purchase several million feet at a time, such as the Dierks, Caddo River, and Black Springs Lumber Companies. But the local topography, timber stands, and the rapidly-developing road system are such as to make small sales practicable. Small mills can often be located when sales of at least 200 M feet can be assured. In small experimental cuttings, logs can probably be hauled by motor truck to the mills in nearby towns.

Hardwoods

The hardwoods mixed with pine and occurring in pure stands on the upper slopes, particularly north slopes, are as a whole very defective and without prospect of any appreciable intrinsic value for many decades. Because the hardwoods can not pay the cost of independent logging, they can not be marketed at this time except insofar as the cost of removal may be charged to the stumpage price of pine removal in the same operation. Some of the oak is an exception to this. The best and most accessible of the oaks are now being sold for stave and heading material (Plate 1). In most instances only a small

[7] In forestry parlance, a "working circle" is a geographically centered planning unit in which management practices are generally standardized by forest type. At the time of this report, a working circle would have likely encompassed an entire ranger district (Hrubes 1976).

portion of the tree can be utilized because of branchy, poorly-formed tops, and because of rot and worm-holes in the timber (Plates 2 and 3). Future stands of hardwoods from present stands of sprouts reproduction will also be of doubtful value because of defects traceable to numerous fire scars resulting from fires that occurred during the last half of the nineteenth century.

Experiments in eliminating hardwoods from the stand by girdling or poisoning are under way. An area on Irons Creek (Oden District) that would benefit from such work is shown in Plate 4.

Injuries

Cumulative injury to standing pine timber by fire is considerable. Siggers[8] examined 60 stumps on the Big Fork area and found 49 percent with butt rot. In young growth, fires do most damage to shortleaf pines between 1 and 3 inches in diameter. Smaller trees frequently sprout and larger ones often escape death.

Normal losses from disease, insects, wind, etc. were not estimated. Windfall is not serious except as the result of hurricanes. Drouth in 1930 caused the loss of most one and two-year seedlings, and apparently injured or killed many over-mature hardwoods and some pines.

Fire Protection

Fires have been frequent since early settlement of the region at about the time of the Civil War, but during the last few years the National Forest organization has been giving intensive fire protection at a cost of about 5 cents per acre annually. Of the 300 fires

[8] Siggers is Paul V. Siggers, a forest pathologist with the U.S. Department of Agriculture's Bureau of Plant Industry, working with the Southern Forest Experiment Station.

Left: Plate 1. White oak heading bolts 25 inches long and cut from trees about 18 to 24 inches d.b.h. All sound wood for tight cooperage. Rock Creek, Mena District, Ouachita National Forest.

Right: Plate 2. Typical white oak with defective broken top. Rock Creek, Mena District, Ouachita National Forest.

Left: Plate 3. Low utilization of white oak for cooperage. Note rot in the stump cut. The whole tree yielded but one sound bolt. Rock Creek, Mena District, Ouachita National Forest.

Right: Plate 4. An area needing silvicultural improvement by the removal of hardwoods, poor in quality and over topping the pines. The man is standing by a pine 8.7 inches d.b.h. Irons Creek, Ouachita National Forest.

which occurred inside the National Forest boundaries in 1930, 181 were on Government land, and 146 of these were started by lightning. The area burned over was held to an average of 15 acres per fire. In 1929, 1.34 per cent of the forest burned, and in 1930 only 0.99 per cent, as contrasted with 60 to 80 per cent burned on adjacent lands outside the National Forest boundary.[9] Damage to the forest in 1930 was estimated as $4,399 based on appraisals and allowing $1 per acre on timber in the protection type. On areas where fire burns over 100 acres or more, grazing is prohibited during the next three years. Public knowledge of this policy seems to be effective in preventing the start of many fires.

Growth Rate

A study made in 1927-1928 by A. J. Streinz, P. H. Bryan, and H. E. Ochsner, of the U. S. Forest Service, indicated that trees must be cut within 20 feet of a neighboring tree in order to have any effect in increasing its growth. Average growth per cent of stands, however, is greatly increased, probably doubled, after cutting, because of the removal of the slower-growing trees. A general decrease in the rate of growth over the entire Forest during the past 20 years may be attributed to site deterioration caused by fire. The average growth per acre per year is estimated by the National Forest men to be 50 to 60 board feet.

[9] The stark contrast with the area burned outside of the national forest is telling. Contemporary sources from this period (e.g., Bruner 1930, Hall 1939) also report the frequency of fire on private lands of Arkansas, and the motivations behind many of these woods-burners. While generally thought to be antithetical to good forest management, the use of prescribed fire (or managed wildfire) has now been embraced on the Ouachita National Forest to help manage for desired natural communities such as shortleaf pine-bluestem (*Andropogon)* open forests. Southwide, higher acceptance by the public of prescribed fire in many pine-dominated communities goes back generations.

Weather Records

Weather records are taken at Hot Springs, Waldron, and Mena. The average annual rainfall is about 45 inches. Although winter and spring are apt to have the most rain, the monthly distribution is very irregular from year to year. The growing season between last and first killing frosts is approximately from the first week in April to the first week in November.

KIND OF AREA DESIRED FOR EXPERIMENTAL USE

The experimental forest area or areas should be (1) representative in character, (2) readily accessible, (3) well protected, and (4) probably should cover 4,000 to 5,000 acres.

1. An area typical of the National Forest as a whole, if it exists at all, would be difficult to find because of the very variable conditions on the Forest. Under such circumstances, the results of experiments conducted on a typical area would be difficult to apply. What is needed is a small watershed sufficiently representative of the major problems of the Forest to provide the necessary material for the grouping of several studies, if this proves possible. Thus, although the average site and stand conditions on the area selected should not depart too far from the average for the Forest as a whole, it is essential that other conditions also be considered. The smaller, more fully-stocked portions of the stand should resemble numerous stands on other areas. The usual slopes, types, sites, and mixtures of species, together with some cut-over and recently-burned areas, should be included.
2. A readily accessible area is regarded as one which can be reached within an hour's travel time from a headquarters town. The number of such areas is limited at present, but is steadily increasing with the progress of road-building and improvement. An area somewhat less accessible now might be acceptable, if it meets other requirements to a high degree, and if present plans for road development promise to make it more accessible during the next year or two.
3. Satisfactory protection exists for most of the National Forest areas. To have the benefit of the best possible protection, an experimental area should preferably be so located as to be surrounded by Government land, be close to a lookout tower, and be within easy reach of fire-fighting crews. The feasibility of trails or motor ways serving as fire breaks on ridges should be considered.
4. The instructions accompanying the 1930 amendment of regulation L-20, which provides for experimental forests, give the desirable range in size of such areas as 1,500 to 5,000 acres. Size should be governed primarily by the complexity of the type and the growth rate of tree species. It would seem that an area approaching the upper limit of the above range would be suitable on the Ouachita because of the great irregularity of stand conditions.

Reconnaissance

The first step in selecting an experimental forest was a trip to become familiar with the National Forest as a whole, and to visit numerous areas suggested by local men. A trip was made around the Forest, visiting eleven[10] possible experimental areas, as shown on the attached map. This was a quick inspection tour on which no systematic measurements

[10] This is how it was originally written, although the list that follows and the map that is referred to only shows 10 experimental areas visited.

were taken, but the tracts as a whole were judged ocularly as to their relative fitness for the purpose. This trip yielded the following information:

1. Little Bear Creek

This is an area in the Jessieville ranger district, north of Hot Springs. (Air line distance, 22 miles). The area may be reached by driving two hours from Hot Springs to the nearest point on the Bear Creek road. From there, it is necessary to walk an hour across the head of Sugar Creek to the divide on the south side of Little Bear Creek at a point about two and a half miles from the lookout tower. The road used is in such condition as not to be passable after heavy rains. To reach the mouth of Little Bear Creek by road would take about two hours and fifteen minutes, by car, from Hot Springs. There is a trail from there up the south side of the drainage area. It would be necessary to walk two to three miles on this trail to reach the nearest point on the drainage area that would be of interest for experiments. This would be on the ridge on the south side and about one and a half miles from the creek.

There would be no opportunity to make small sales of forest products from this area until the Dierks Lumber Company comes in with a railway in Dry Fork, connecting with a route along the Trace Creek road to Jessieville.

The area appears quite representative of the Forest, although no definite information was obtained on the extent of virgin and second-growth timber stands, cut-over area, etc. This tract may lack the better sites.

The area is well-protected, there being a lookout tower on the east edge of the area at the head of the creek. Crews for fire-fighting could reach the area within an hour's travel time.

This area comprises a little over 5,000 acres of land and is considered somewhat large for the purpose.

2. Irons Creek (not to be confused with Irons Creek on the Oden District)

This is a smaller area in the northeastern part of the Womble district. (Air line distance from Hot Springs, 23 miles). The area can be reached in about forty minutes from Hot Springs, turning off Highway No. 6 at Joplin School House. It is necessary to walk only a quarter mile to the area. An expenditure of fifteen to twenty dollars would make the road to the area passable for a car, while one hundred dollars would probably be sufficient to make a road passable, one-half mile into the area.

The removal of small quantities of timber from experimental plots could be handled easily. Local people will gladly take out anything of this kind that they can get. No second-growth stands were observed on this area, but there are some such stands on recently-acquired land in the vicinity.

The area seems to have more oak timber scattered throughout the stand than is the case on much of the forest, but may be typical of the Womble working circle in this respect. The north slopes appear quite typical of the forest. The south slope is a little short from top to bottom, making it difficult to bring out any comparison of upper and lower slope conditions. Both north and south slopes are cut up with spur ridges in a way that would make sample plot studies difficult. The irregularity of the stand would also add to the difficulty of sample plot work. The timber is somewhat better than the average for the Forest. Four-log trees are not uncommon.

This area has good protection from a nearby lookout tower. The Government has title to all of the land, with the exception of forty acres near the mouth of the creek.

This area covers only about 1,300 acres of land.

3. Montgomery Creek

This area is in the Womble district, very close to the ranger station at Norman. (Air line distance from Norman, 3 miles). It is easily accessible, the far end or head of the creek being only four miles from the ranger station by road.

The south side of this drainage has been cut over for oak and pine. On the south slope (on the north half of the area), only occasional fine specimens of pine were removed in 1912 and 1914. A stand of young and old mature pine remains. The stand in the center of the slope is very open, but not quite as irregular as on Irons Creek (Area No. 2 above). The lower part of the slope is less steep and has a stand consisting mostly of hardwood, and only occasional pines. Reproduction is poor, on account of a fire since cutting, probably ten to eleven years ago. Based on the measurement of three trees, height growth is not so good as on Irons Creek, being sixty-one feet in eighty-one years. As based on two trees, diameter growth appears good, about three inches in the last fifteen years. Upper slopes are steep and rocky, with scattered timber.

A nearby lookout tower and the accessibility of the tract provide excellent protection for this area.

This area covers about 2,000 acres of land.

4. Rock Creek

This area is in the Mena ranger district, 6 miles northwest of the town of Mena, by road. (Air line distance, 4 miles). The lower end of this area is readily accessible, within a half-hour's travel time from Mena.

The area is not at all typical of the National Forest as a whole, having much more extensive stands of young second-growth timber resulting from the destruction of a good deal of the virgin stand by hurricanes. This is especially true near the headwaters of this creek, where areas may be found that are relatively well-suited to experiments with young timber and pole-sized stands. In the bottoms, stands of red and white oak, black gum, and occasional beech extend part way up the slope. The lower slopes are very rocky, having canyon-like walls in many places. Further up the slope, these steep, very rocky sides become more gentle and the soil appears less rocky on the surface than that observed on other areas. The watershed divide is about 750 feet above the main creek. The virgin timber is very patchy, and unsuited for sample plot work. A strip of private land in the creek bottom has been largely cut over, but bears a thick stand of advanced reproduction. Title to this land probably can be acquired.

More detailed information concerning this watershed is given later in this report.

This area is well covered by lookouts. Three fire tower men can view the area. Fire crews could reach the tract promptly from Mena.

This area covers about 2,900 acres.

5. Caney Creek

This area is in the southern part of the Mena district, 19 miles from Mena, south of the Shady Ranger Station. (Air line distance from Mena, 13 miles). The area can be reached

by driving one end a quarter hour from Mena and walking about one-half hour to reach stands that might be of interest for experimental use. It was necessary to make three fords at Cossatat Creek in order to reach Caney Creek. Two of these will be eliminated by a new road now under construction, but the third would be a barrier to a car in times of high water.

The north slope is relatively high from creek to ridge top, steep, rugged, and rocky. The pine stands scattered over much of the slope appear relatively even in distribution as compared with those previously seen, but the mixture of tree forms is great. Very old veterans do not seem to be abundant, but all other ages and sizes are mixed together, giving variety to each acre. Like most of the other areas, the irregularity of the stand is sufficient to make plot studies impractical, at least unless the plots are made very large. The topography on the south slope is broken up and the timber stand patchy. From the mouth of the creek, the ridge on both sides become noticeably lower and the slopes less steep. The sale of timber at the present time would necessitate removal of the logs to a portable mill five or six miles away.

This area, lying between Tall Peak and the Shady Ranger Station, has fair protection from fire.

This area is a long, narrow one, comprising about eight sections.

6. Short Creek

This drainage is in the same locality, lying immediately north of Caney Creek, and 18 miles from Mena. (Air line distance, 12 miles). It is a long, narrow area, covering about 3,800 acres.

The north slope is a very rocky, poor site, but not as much dissected as many. The opposite slope has very little pine. Near the center of the north slope, at one point, is a bend of scattered pine. In general, the soil is extremely thin and rocky, in many places being little more than talus slope, partially covered with leaves. The north slope bears evidence of a fairly recent sixty-acre fire. The very rocky nature of the surface soil is indicated by a gray color. The pines are young, or in the early mature class. The south slope bears a pine stand on its upper two-thirds. This appears to be a fair stand of two-log trees, but growing slowly.

Protection on this area, as for Caney Creek, should not be difficult. Short slopes make it relatively easy to keep fires of small size off.

7. Irons Creek

This area is in the Oden district, although included within the Mena working circle. It lies 19 miles northeast from the town of Mena, by road. (14 miles, air line). The area can be reached within one hour's travel by auto. A new road is planned to be built within the next year or two which will make it possible to reach the area in a shorter time.

The south slopes on this area have timber of average height, about three logs. Density of stocking appears to be above the average, due to closer spacing of timber in groups. Some of the groups of second-growth or advanced reproduction are very noticeable. There appears to be considerable immature and young mature timber also. Old mature and over-mature timber is possibly less abundant than on some of the other areas examined. However, the forest on this area appears to approach an all-aged stand more than any others seen. The watershed divide is about 700 feet above the main creek. There are numerous low ridges,

more or less parallel to the direction of the main creek, but the main slopes appear to be less cut up by small spur ridges than on other areas. There is a narrow strip of the so-called protection type of hardwood forest on the upper part of the main south slope.

The north slope appears to present better material for sample plot work than the south slope. Three or four of the relatively low parallel ridges just south of the main slope have short, not very steep sides and stands of timber that are not typical of the main lower north slope. Part of the north slope is not representative, the stand being very patchy and scattered, but with less hardwood and more pine reproduction than on most such slopes. The area as a whole appears to have less hardwood than many of the other areas, especially those near the shady ranger station.

About 100 acres of cut-over land are included within this area. As in many places on the Ouachita National Forest, there seems to be a deficiency of pole-sized pine timber.

More detailed information concerning this area is given later in this report.

This area is well protected from fires, there being a lookout tower 2 miles northeast of the area.

The area covers about 2,800 acres.

8. Freedom Creek

Freedom Creek is in the Cold Springs district about 15 miles east of Waldron by road. (13 miles, air line). The road through Freedom Creek at present is passable, but very rough and poor. With the improvement of this road, this area may be protected as easily as the others already described.

The south slopes have a good but irregular stand of pine near the base, on the gentler slopes or foothills. The upper south slopes appear to have thin soil. Rock out cropping is extensive and conspicuous. Much of the stand consists of immature trees. On this area the north slope is more uniform and better stocked than in many places on the forest. The best north slope stands are near the east end of the area. This drainage appears to have fewer hardwoods than the vicinity of the Shady ranger station. As in other parts of the Cold Springs district, the bottomlands and lower slopes have more reproduction and good advanced growth of saplings and small poles than in other districts.

The area embraces about 5,400 acres, including at present considerable areas of land in private ownership along the creek. Many of the old farms are reverting to forest, however, and will probably be acquired for National Forest purposes. The timber on this area has been appraised for sale.

9. Ramsey Creek

This area lies north of Freedom Creek and northeast from Waldron, about 24 miles by road. (19 miles, air line). The new motorway to be built this year on Petit Jean Mountain will make the area easily accessible from Waldron, within an hour's driving time. When this new motorway has been constructed, the facilities for protection will then be very good.

The approach to Ramsey Creek and Pidgeon Creek, a tributary, is through Jack Creek. The area near where Ramsey and Pidgeon Creeks join Jack Creek might possibly be suitable for an experimental forest. Various slopes along Jack Creek were cut over about ten years ago, but are now well covered with advanced reproduction and young growth. The young stands of saplings are extremely dense in many places. A west slope of Jack Creek just north of the forks may be found representative of many conditions in this

district, if not of the Forest as a whole. The north slope between Ramsey and Pidgeon Creeks is largely covered with hardwood, but has a small patch of pine on the lower part near the forks. The stand, however, does not appear to be suitable for sample plot work. Farther up Pidgeon Creek, the pine is scattered over more of the north slope, but here the percentage of hardwood is still high. The main part of this ridge is a northwest slope of Pidgeon Creek. The south slopes north of Jack Creek bear an exceptionally large percentage of pine, extending nearly to the top of the ridge, there being only a very narrow strip of protected type near the top.

The area as a whole covers about 5,400 acres, but it might be possible to pick out two or three thousand acres on Pidgeon and Ramsey Creeks for experiments.

10. Hole-in-the-Ground Creek

This area lies east of Irons Creek in the Oden district, and west from the Oden ranger station. (Air line distance from Mena, 19 miles). The road into this area is poor and not passable for a car much beyond the National Forest boundary.

The east part of this creek runs into a steep, rocky country with a very thin soil. The west fork is in similar country, with steep slopes, but has a better stand of pine. On both forks, the slopes are too steep to be representative, and are not suitable for plot studies. Hardwoods predominate near the tops of ridges. On the west slope, the pine stands are especially heavy along the brow of the ridge, where the slope breaks away to the north. This condition is common on the National Forest. Plate 5 shows some of the virgin timber near the creek bottom.

Protection for this area is fairly good, because it is small and not far from the ranger station.

The area embraces about 2,000 acres of land[11].

[11] [Note: Plates 6, 7, and 8 show further examples of stand and site conditions, but give no specific mention of what watersheds they were located in.]

Left: Plate 5. Stand of old shortleaf pine showing several younger age classes. The man is standing by a 23-inch pine. Hole-in-the-Ground Creek, Ouachita National Forest, Arkansas.

Right: Plate 6. A rocky west slope with hardwood and shortleaf pine growth on [thin] soil. Ouachita National Forest, Ark.

Left: Plate 7. An irregular stand of shortleaf pine virgin timber with some advance reproduction. Man standing by a defective red oak. Irons Creek, Ouachita National Forest.

Right: Plate 8. Many-aged condition of shortleaf pine forest with good young growth typical of the Cold Springs Ranger District, Ouachita National Forest. On Cold Springs road, Scott County, near Sebastian County line, Arkansas. Sample plots, if used at all in mixed and irregular selection-form stands, such as this or the one shown in Plate 11, would have to be very large and of doubtful practical value. Contrast this view, representing conditions on the Ouachita National Forest, with Plate 13.

SELECTION OF TWO OF THESE AREAS FOR FURTHER STUDY

As may be assumed from the above brief descriptions, none of the ten areas considered stood out as preeminently suitable for an experimental forest. On none of them could the sample plot method of studying timber be applied without great difficulty.

Two areas were elected for further study, not because of any conspicuous superiority for the purpose, but rather because of less marked disadvantages. The other eight areas were each dropped from further consideration because of some outstanding limitation. The process of elimination was used as follows:

1. Little Bear Creek is not sufficiently accessible.
2. Irons Creek (Womble district) is too much above the average for the forest in site quality.
3. On Montgomery Creek, the whole south side is cut over.
4. Rock Creek, by itself, does not have enough virgin timber. It has good stands of young growth.
5. Caney Creek is extremely irregular and relatively inaccessible.
6. Short Creek is too rocky, the main slopes are too short, and there is not enough pine.
7. Ramsey Creek has somewhat less distinct disadvantages, but has no stands suitable for sample plots of timber, except possibly one west slope which is not representative of any considerable National Forest area.
8. On Freedom Creek, the stand of timber on the south slopes is too irregular on the lower portions and the soil is too thin and rocky on the upper portions. Furthermore, much of the timber has already been appraised for sale.
9. Hole-in-the-Ground is too steep and not representative of any important forest problems.

Thus, Irons Creek (on the Oden District) seemed to have fewest disadvantages. Aside from the disadvantage of irregular topography and irregular timber stands, which is common to most of the areas, its greatest limitation is the lack of sufficient young timber for future experiments.

As Rock Creek has just such stands and could be worked from the same headquarters, Mena, it was given further consideration together with Irons Creek.

SURVEY OF IRONS AND ROCK CREEKS

Roads

Driving as far as the roads are passable, Rock Creek is 6.3 miles from Mena and Irons Creek 19 miles. The center of either area can then be reached by walking about one-half hour. These travel times will be reduced as roads and trails are extended. There are no present road plans that will affect Rock Creek, but Irons Creek is to be made more accessible in the near future. A national forest road of high priority may be expected to improve the last few miles of the route to the area. This road will probably be located so as to pass through the NW1/4 of Section 17 (T 1 S, R 28 W) northward through the pass near the center of Section 8, and thence down into the head of Turner Creek. If Irons Creek should be selected as an experimental forest, the construction of this road will be especially desirable because it will shorten travel time and will not traverse any of the areas likely to be used for experiments.

The road will also facilitate the removal of small numbers of logs by truck. This would be desirable, as many small experiments would probably not remove sufficient timber to justify the location of a portable mill specifically for the purpose. At present, the cost of logging and truck hauling of very small lots of logs from either Irons or Rock Creek would probably equal their stumpage value.

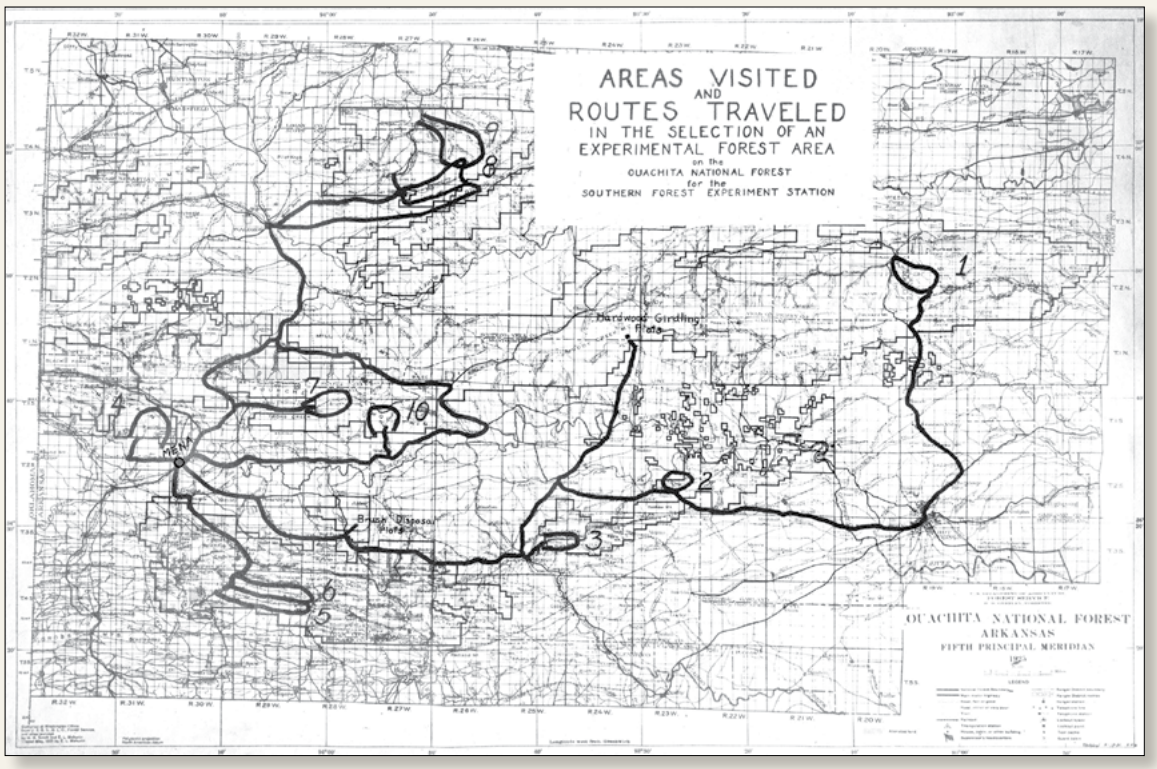
Another road having low priority in present plans may be constructed some time later following roughly the location of the present overgrown trail through the area as shown on the contour map. No specific estimates of the cost of such a road were made. As a rule, forest development road cost about $1,500 a mile, but mere auto trails can often be provided for one-tenth the cost. Such passable route to the interior of this area would increase its value for experimental use.

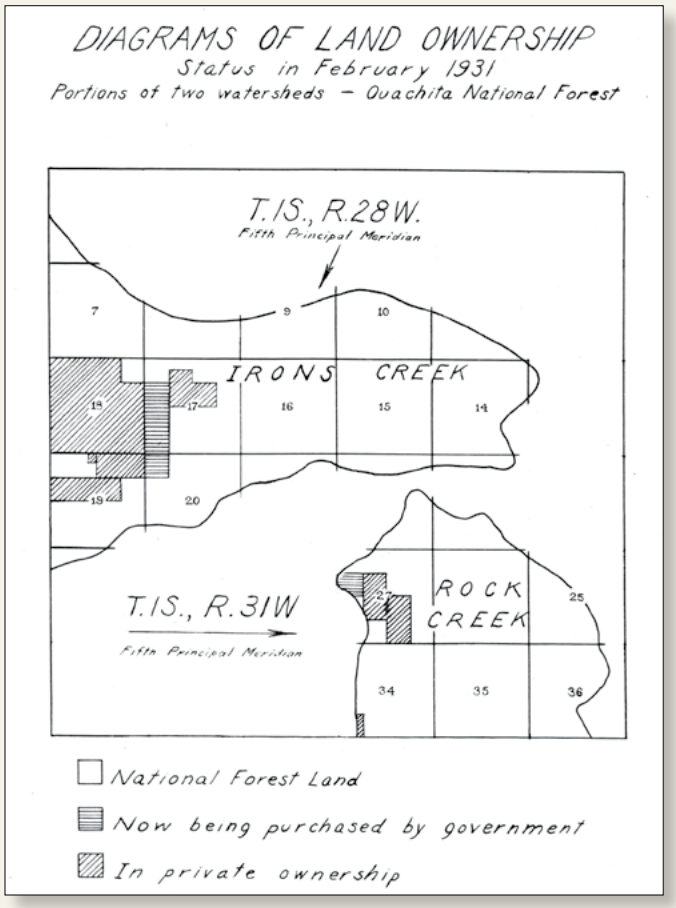
A third possibility is the construction of a motor way along the ridge in Sections 8, 9, 10, and 11, dividing Irons Creek from Turner and Rock Creeks on the north. This would increase facilities for fire protection and make the northern part of the area much easier to reach.

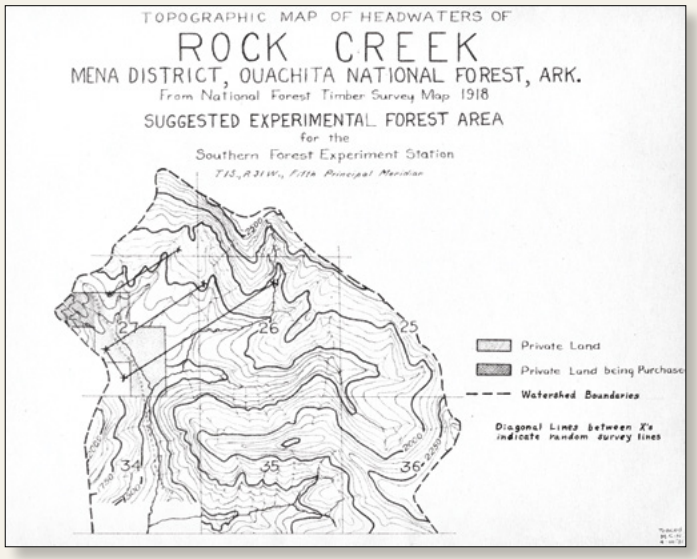
Maps and Descriptions

Attached to this report are the following:

1. Map of areas visited and routes traveled.
2. Diagram of land ownership, Rock and Irons Creek.
3. Contour map of Rock Creek. (Ouachita Timber Survey, 1918).
4. Contour map of Irons Creek. (Ouachita Timber Survey, 1918).
5. Type and drainage map of Irons Creek.(map 1,2,3,4,5)



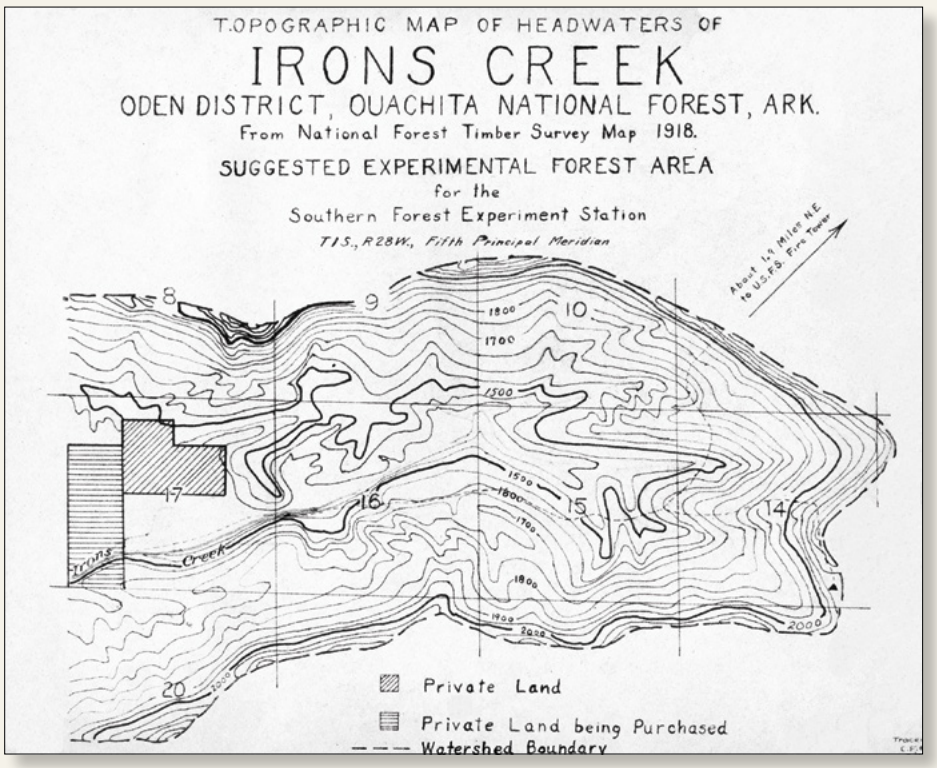


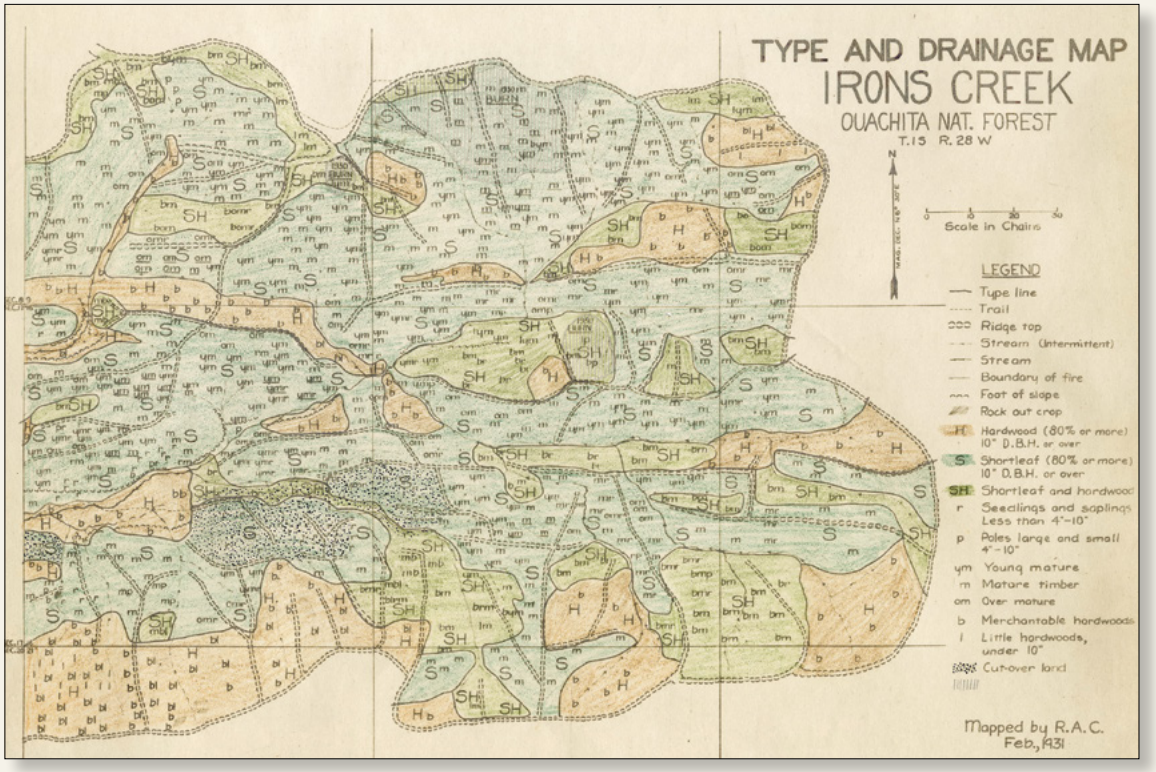


Top: Map 1. Map of areas visited and routes traveled. This travel map has been referred to in reporting the preliminary reconnaissance. It shows the location of the town of Mena, suggested as field headquarters.

Left: Map 2. Diagram of land ownership, Rock and Irons Creek. The land status diagrams show 160 acres of private land on Rock Creek that should be purchased if the area becomes an experimental forest. Irons Creek has no private land in the area contemplated for experimental use, east of Section 17.

Above: Map 3. Contour map of Rock Creek (Ouachita Timber Survey, 1918)





Top: Map 4. Contour map of Irons Creek (Ouachita Timber Survey, 1918). The contour map of Rock Creek shows topography rather too cut up to facilitate sample plot work. Irons Creek is better in this respect, and the general direction of the main ridges is east and west, like the majority of those in the Ouachita National Forest. Neither map shows the local details of topography which must be considered in sample plot studies.

Bottom: Map 5. Type and drainage map of Irons Creek. In constructing the type map, lines were run north and south twenty chains apart on Irons Creek, using staff compass and chain (3-chain steel tape). All lines "checked in" to control points within a quarter or half chain. This applies also to the traverse used to tie-in the survey with General Land Office corners.

The map shows the headwaters region of Irons Creek, the portion best suited for experimental use. Table 1 shows how the total acreage is divided between types and sections:

TABLE 1. SUMMARY OF AREAS
Irons Creek, Oden District, Ouachita National Forest, Arkansas. T-1-S, R-28-W. Section

Section No.	Shortleaf Pine	Shortleaf and Hardwoods	Hardwoods	Totals
	---------- Acres ----------			
9	276	96	39	412
10	334	37	51	422
11	43	27	31	100
14	136	82	91	309
15	345	233	62	640
16	449	38	155	642
21			121	121
22	42	27	45	114
23		14	12	26
Total	1626	553	607	2786
Burned over in 1930				110
Cut-over land				103

The figures are approximate because the type lines in many cases are not definitely distinguishable on the ground. The map clearly shows that the most extensive stands of hardwoods occur on the main north slope and the north sides of minor ridges. Scattered symbols give some conception of how the main age classes are scattered. Reproduction is fairly abundant, but not well distributed. It was entered on the map only where it formed a conspicuous part of the stand. With continued protection and selection cuttings there is no indication of any need for special studies of reproduction.

The cut-over area of 103 acres, being relatively small, about 4 per cent of the whole, would not lessen the value of this tract for experimental use.

The burned areas show covering 110 acres (about 4 per cent) are only the latest ones, those of 1930. These were light fires except on the steep slopes of draws.

No type map of Rock Creek was made, the Survey being confined to random lines, as shown on the contour map. This was done because the experimental use of only a part of Rock Creek is contemplated. A portion of the area having good young growth was selected as the best supplement available for the older stands on Irons Creek.

Observations on soil conditions can be stated briefly, as no systematic sampling was done on either watershed. Irons Creek soil appears to be a reddish-brown clay loam on the tops and on both north and south sides of the lower ridges. The north slope was observed to have less clay and to be more friable than the other situations. All samples were found to be strongly acid to a depth of 2-1/2 feet. On Rock Creek, the surface soil is a light brown sandy loam in the surface foot, more reddish and containing more clay below, having less surface rock than Irons Creek, but acid at all points, and otherwise quite similar to Irons Creek soil.

There are many mineral claims and prospects on the Ouachita National Forest. Most of these are for slate, but no good quality slate has yet been found. It contains small invisible fractures that make it go to pieces very quickly from weathering. No conflicts with prospecting interests are anticipated.

Recreation use of Irons and Rock Creeks had so far been confined to occasional hunting. Having free range, the hunters probably add less to the fire risk than would be the case if certain areas were posted against their trespass.

Collection of Field Data

On the Irons Creek area, temporary sample plots were taken regularly at 20-chain intervals. These were circular quarter-acre plots, 62 in all, thus covering 15-1/2 acres, or about 0.6 per cent of the total area of 2,786 acres.

All pines 4 inches and over, and all hardwoods 10 inches and over were tallied by 2-inch diameter classes. The numbers of all pines under 4 inches were estimated as seedlings less than 3 feet tall or saplings from 3 feet tall to 2.9 inches d.b.h. Numbers of small hardwoods, regardless of condition, falling in the 4 to 10 inch diameter range, were estimated and recorded as poles, although probably not over 10 per cent would be straight and sound enough to be utilized as poles.

No volume estimates were made in the field, but fairly complete measurements were made of trees on each plot. For several pines 6 inches or over in diameter, the following data were recorded by plots: d.b.h., total height (Abney level and tape), age, number of rings in last inch of radius, number of inches of radius in the last ten years, crown class, crown size, and shape of top. A few such measurements, with the exception of heights and crown descriptions, were taken on predominant hardwood species when the plots fall in areas typed as pure hardwood.

On Rock Creek, these data were collected on a more restricted portion of the area, while running the random lines. There, 44 plots (11 acres in all), spaced five chains apart, were recorded in similar manner.

This information, summarized on the following pages, was gathered primarily to aid in judging the suitability of the two areas for experimental forests. For this purpose, stand and site estimates, as compared with similar information for the National Forest as a whole, seem most important. However, the observations were made detailed enough to yield some further comparisons, and accurate enough to be of some value in planning future studies of growth.

The Forest Supervisor (office at Hot Springs, Arkansas) furnished average stand and site figures for the Oden Working Circle as representative of the National Forest as a whole. A comparison of these figures with those obtained on Irons and Rock Creeks is of interest.

Average Stand Comparisons

Table 2 and Figure 1 show how the areas compare as to numbers of trees per acre. The essential facts in the table may be most readily seen in the chart.

Rock Creek has three or four times as many pines per acre in the 4 to 8 inch class as Irons Creek. It also bears over twice as many pine saplings as Irons Creek. The presence of this young growth on the Rock Creek area, much of which came in following hurricane destruction of the previous stand, probably very large accounts for there being an average

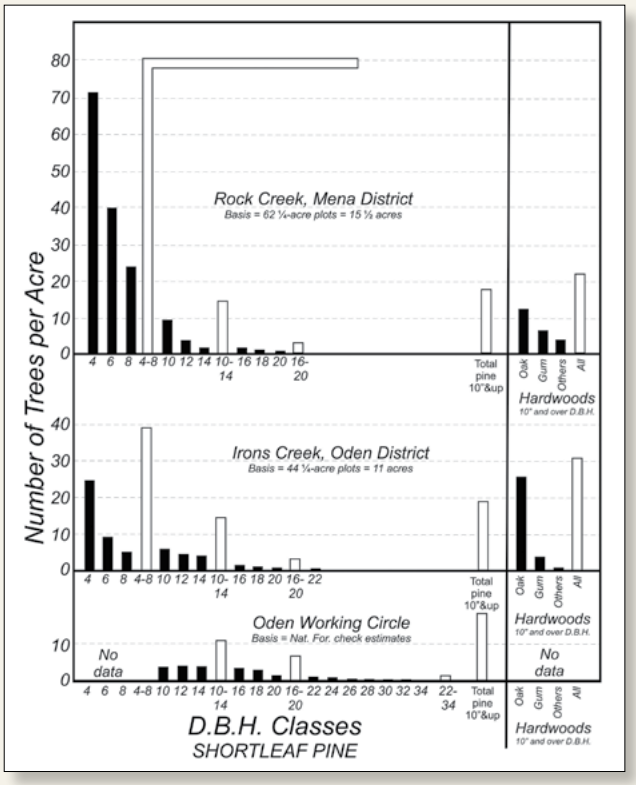


Figure 1. Stand charts, shortleaf pine and hardwoods, Ouachita National Forest.

of less than half as many pine seedlings per acre on Rock Creek as on Irons Creek. In the number of trees 10 inches and over in diameter, the two watersheds both average almost the same as the Oden Working Circle as a whole, about 18 per acre. The main difference in distribution by diameters is that the Oden figures indicate more and larger veteran trees than either of the small watersheds. On the other hand, ten-inch trees are about twice as abundant on Irons Creek and three times as abundant on Rock Creek as in the Oden Working Circle.

Regarding the average number of hardwood trees per acre, no useful comparisons are available. Although the stand table indicates that Irons Creek averages about nine more hardwoods per acre and has twice as much oak timber, this may be ascribed to the use on Rock Creek of random strips picked to represent the pine type rather than the hardwood type. Hardwoods were not adequately sampled on Rock Creek.

So far as the general character and distribution of pine is concerned, Irons Creek appears to be as nearly typical of the National Forest as any single small watershed that could be selected. Rock Creek alone is not typical. If both areas, the headwaters of Irons Creek and a portion of Rock Creek, could be reserved, a fair sample for experimental use would be secured.

SITE CONDITIONS AND RATES OF GROWTH

Site Quality

It would be desirable to have the average site quality of the experimental forest areas correspond closely with that of the National Forest as a whole.

Taking the Oden Working Circle as representative of the forest, the average site index was computed as 47 feet in 50 years. This is an average based on 130 dominant and co-dominate trees less than 100 years old, measured in National Forest check estimates. A similar average for Irons Creek, based on 45 measured trees in 9 scattered plots, is 46.4 feet in 50 years. The figure for Rock Creek, based on 29 trees in 9 plots, is 47.4 feet in 50 years. Variation in site quality is naturally greater over the larger areas. It was not computed for the Oden Working Circle, but for Irons Creek the index for the nine separate plots varied from 35 to 54, with a standard deviation of 6 feet. On Rock Creek, the index ranged from 41 to 51 feet, with a standard deviation of 5 feet.

Although Rock Creek shows a site index one foot greater, with a standard deviation one foot less than Irons Creek, probably the result of sampling a smaller area of slightly better sites, these small differences are not considered significant. The essential point is that in site quality the two areas correspond closely with each other and with the Oden Working Circle as a whole.

Growth Rates and Age Groups

Concerning the shortleaf pine timber only, the stand and site comparisons already made possibly furnish sufficient information for the purpose of selecting a suitable experimental forest area. However, some additional comparisons of the timber were made to show its rates of diameter growth. These studies will be of most use as a basis for further study of tree development, but as they may have some descriptive value here, some of the growth charts are included in this report.

TABLE 2. STAND COMPARISONS
Irons and Rock Creeks compared with the Oden Working Circle, Ouachita National Forest. (Stand Table figures in three forms)

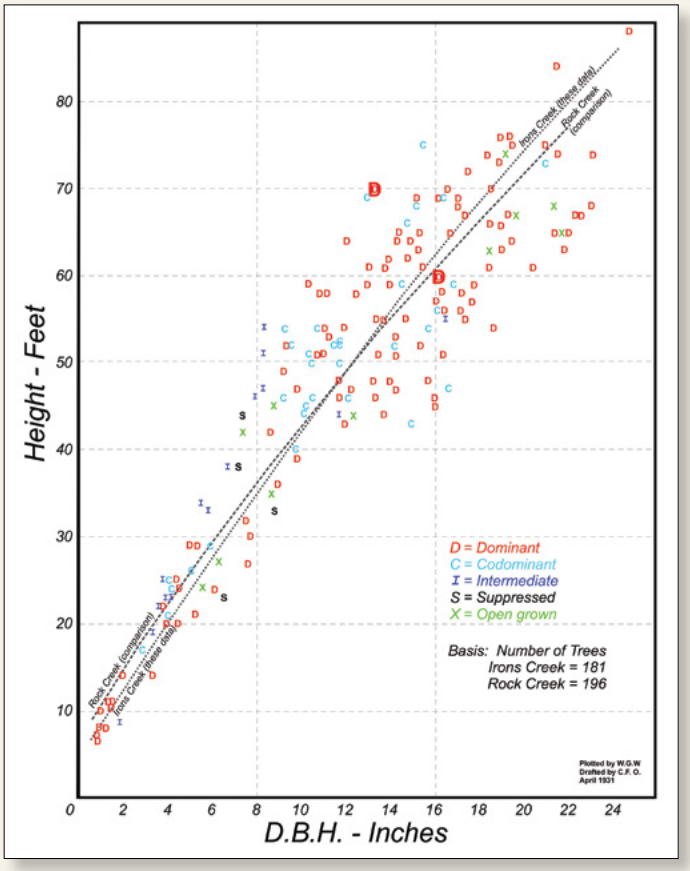
Shortleaf pine by diameters Hardwoods by species group	Number trees per acre by diameter or species classes			Proportionate distribution by diameter or species classes			Diameter and species classes in terms of distribution on Oden W.C.		
	Irons Creek	Rock Creek	Oden W.C.	Irons Creek	Rock Creek	Oden W.C.	Irons Creek	Rock Creek	Oden W.C.
	---------- No. ----------			---------- % ----------			---------- % ----------		
Seedlings under 3'	92.7	49.9	--			--	--	--	--
Saplings 3'H. to 4"D	125.7	292.5	--			--	--	--	--
4" DBH	24.8	71.5	--	63.1	53.0	--	--	--	--
6" DBH	9.3	39.7	--	23.7	29.4	--	--	--	--
8" DBH	5.2	23.8	--	13.2	17.6	--	--	--	--
4-8" DBH	39.3	135.0	--	100.0	100.0	--	--	--	--
10" DBH	6.1	9.4	3.4	31.8	53.7	18.6	179.4	276.5	100.0
12" DBH	4.8	3.6	3.7	25.0	20.6	20.2	129.7	97.3	100.0
14" DBH	4.1	1.8	3.7	21.4	10.3	20.2	110.8	48.6	100.0
10-14" DBH	15.0	14.8	10.8	78.2	84.6	59.0	138.9	137.0	100.0
16" DBH	1.7	1.6	3.2	8.9	9.1	17.5	53.1	50.0	100.0
18" DBH	1.2	0.7	2.3	6.2	4.0	12.5	52.2	30.4	100.0
20" DBH	0.6	0.4	1.0	3.1	2.3	5.5	60.0	40.0	100.0
16-20" DBH	3.5	2.7	6.5	18.2	15.4	35.5	53.8	41.5	100.0
22-34" DBH	0.7	--	1.0	3.6		5.5	70.0		100.0
All pines 10" and up	17.5	18.3	100.0	100.0	100.0	104.9	95.6	100.0	
Hdwds 4-10" and up	34.2	34.4	--						
Hdwds over 10" DBH									
White oak	14.9	9.7	--	48.5	44.5	--	--	--	--
Red oak	10.8	2.4	--	35.2	11.0	--	--	--	--
All oaks	25.7	12.1	--	83.7	55.5	--	--	--	--
Black gum	3.4	4.0	--	11.1	18.3	--	--	--	--
Red gum	0.6	2.0	--	1.9	9.2	--	--	--	--
All gums	4.0	6.0	--	13.0	27.5	--	--	--	--
All oak & gums	29.7	18.1	--	96.7	83.0	--	--	--	--
Other hardwoods	1.0	3.7	--	3.3	17.0	--	--	--	--
All hdwds 10" & up	30.7	21.8	--	100.0	100.0	--	--	--	--

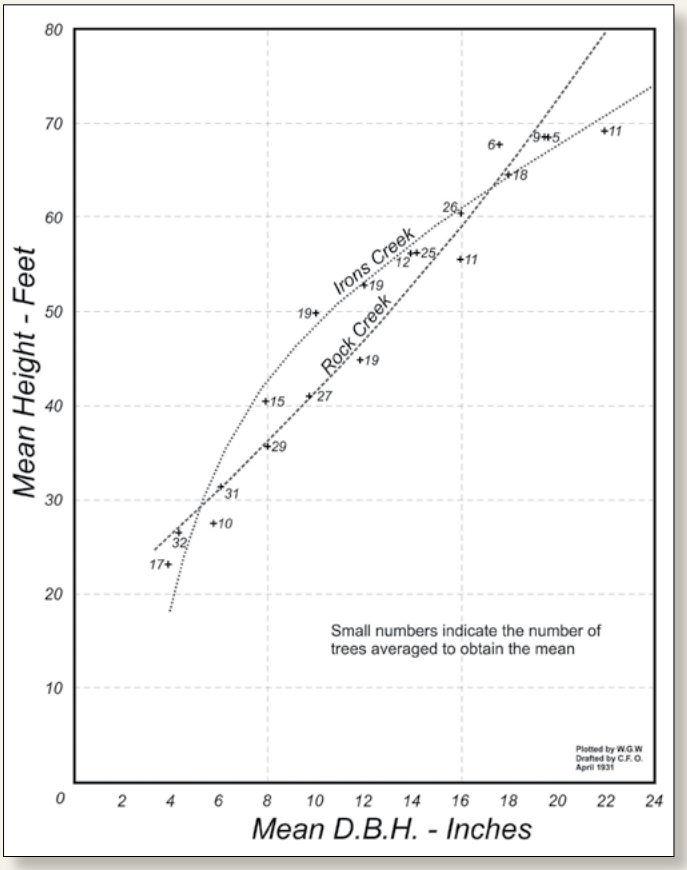
NOTE: Figures for seedlings and saplings are compiled from plot estimates. Other figures for pines on Irons and Rock Creeks are compiled from plot tallies of measured trees. Oden Working Circle data are taken from National Forest check estimates. The number of hardwoods 4-10" D.B.H. is based on estimates. Perhaps only 10 percent of these trees would have any value as poles. Many of the larger hardwoods are also defective.

Figure 2 shows how the individual tree measurements for Irons Creek scatter when height is plotted over diameter. The chart for Rock Creek was so similar that it is not reproduced here. Curves were drawn free-hand for both areas. For comparison, the Rock Creek curve is shown superimposed on the Irons Creek chart. The difference amounts to only a foot or two in height, Rock Creek showing the greater height for small diameters and Irons Creek the greater for the larger diameters. The smaller amount of rock in the surface soil on Rock Creek may account for the apparently more rapid early growth of the dominant stand there, while the later falling off may be due to differences in competition or local fire history.

In placing the curves, slightly greater weight was given to the dominant and co-dominant trees than to other crown classes, because the charts were used in site determination. Somewhat different curves result from the same data averaged by diameter classes, disregarding crown classes. Plotting averages more clearly defines the curves, as shown in Figure 3. Preference was given to this chart in making approximations of volume growth.

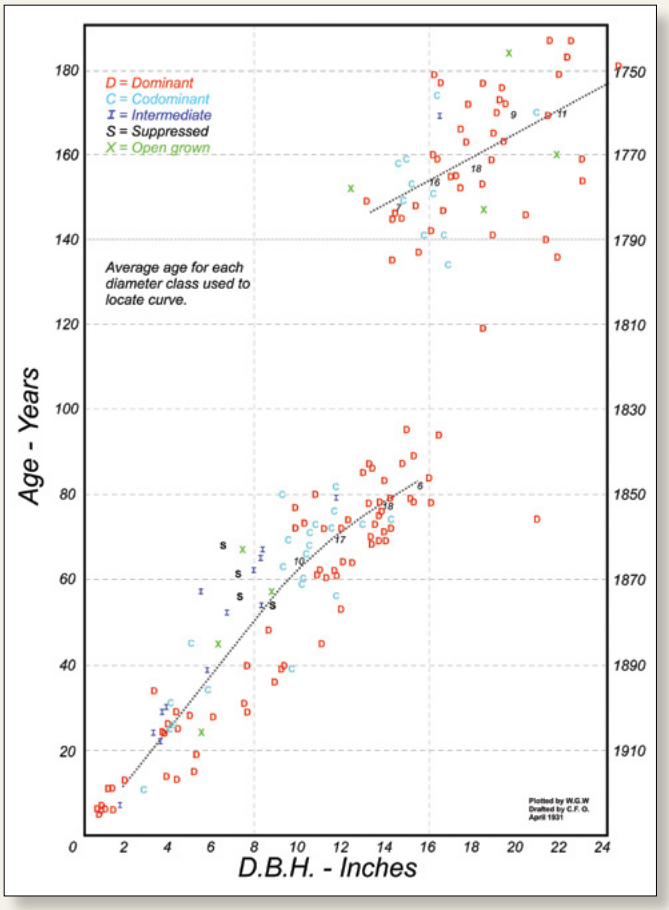
Similar charts were made to show the relation of age to diameter. The most important condition shown in Figures 4 and 5 is the distinct grouping in age classes. Irons Creek shows two age groups, one under 100 years; the other over 130 years. Rock Creek shows three groups by age 0 to 40, 50 to 70, and over 100 years. The age groups are made up of small patches of more or less even-aged stands, especially on Rock Creek. Thus, in Figure 5, no single curve could picture the true condition. Separate curves were not drawn because the two younger groups are so even-aged that existing variations in diameter

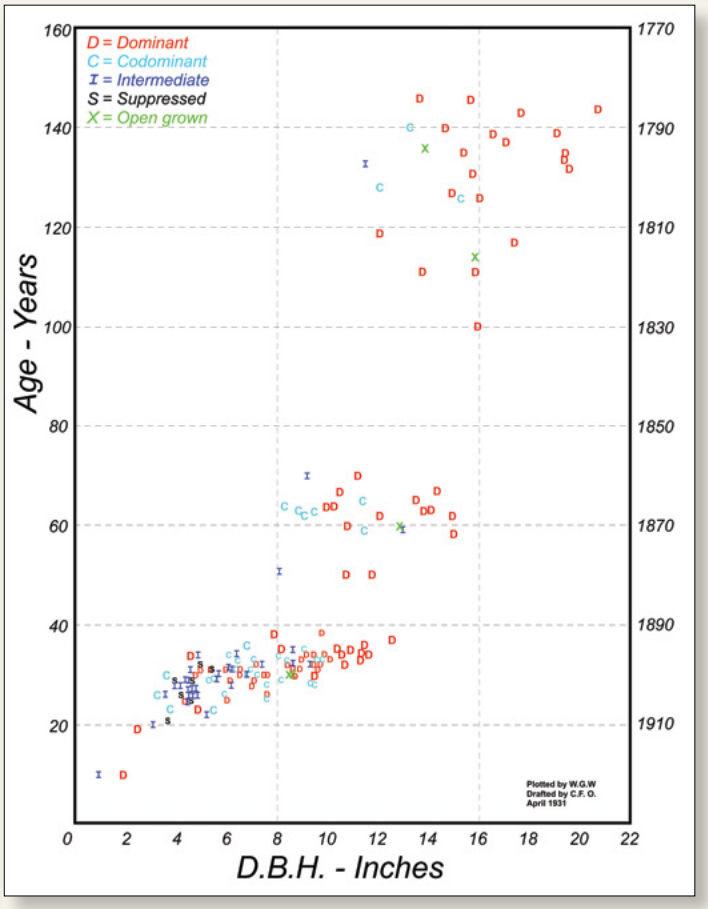




Left: Figure 2. Shortleaf pine height and crown class by d.b.h., Irons Creek, Oden District; and Rock Creek, Mena District, Ouachita National Forest, Arkansas.

Right: Figure 3. Shortleaf pine mean height by d.b.h., Irons Creek, Oden District; and Rock Creek, Mena District, Ouachita National Forest, Arkansas.





Left: Figure 4. Shortleaf pine age and crown class by d.b.h., Irons Creek, Oden District, Ouachita National Forest, Arkansas T1S R28W.
Right: Figure 5. Shortleaf pine age and crown class by d.b.h., Rock Creek, Mena District, Ouachita National Forest, Arkansas T1S R31W.

must be largely attributed to growing conditions rather than age. Forest fires undoubtedly played an important part in separating the age groups, although windfall from hurricane felled many stands. Fire history was studied by counting rings of tree growth fire scars on several of the older trees. Beginning at about the time of the Civil War, when the region was first settled, fires were frequent until about 1926. Fires burning between 1893 and 1926 were severe enough to scar the larger trees and occurred about every 6 years on Irons Creek and every 4 years on Rock Creek on the portions of these areas studied. Fires first started by the pioneer settlers were naturally most destructive because of the accumulated litter fuel and dense stand of young growth. These fires offer a very logical explanation for the existence of a distinct age class over 100 years old. The trees in that age class were large enough to be resistant to fires about 70 years ago. The cumulative effect of the numerous later fires has made the forest very patchy and irregular.

The typically irregular nature of much of the forest is shown in Plate 9. Plates 10 and 11 represent other irregular though better-stocked portions of the virgin forest.

The grouping of age classes was again shown in plotting height over age. Here, again, the points were so scattered that no curves could be drawn except with the help of averages. Then straight-line curves were located for each age group separately. These showed that on Irons Creek, trees about 35 years old grew in height about .6 foot per year, those twice as old .4 foot, and those in the 160-year class nearly .4 foot in height

per year. These are averages based on such variable material that they would be useless except in indicating general trends. Rock Creek showed similar, though slightly more rapid height growth.

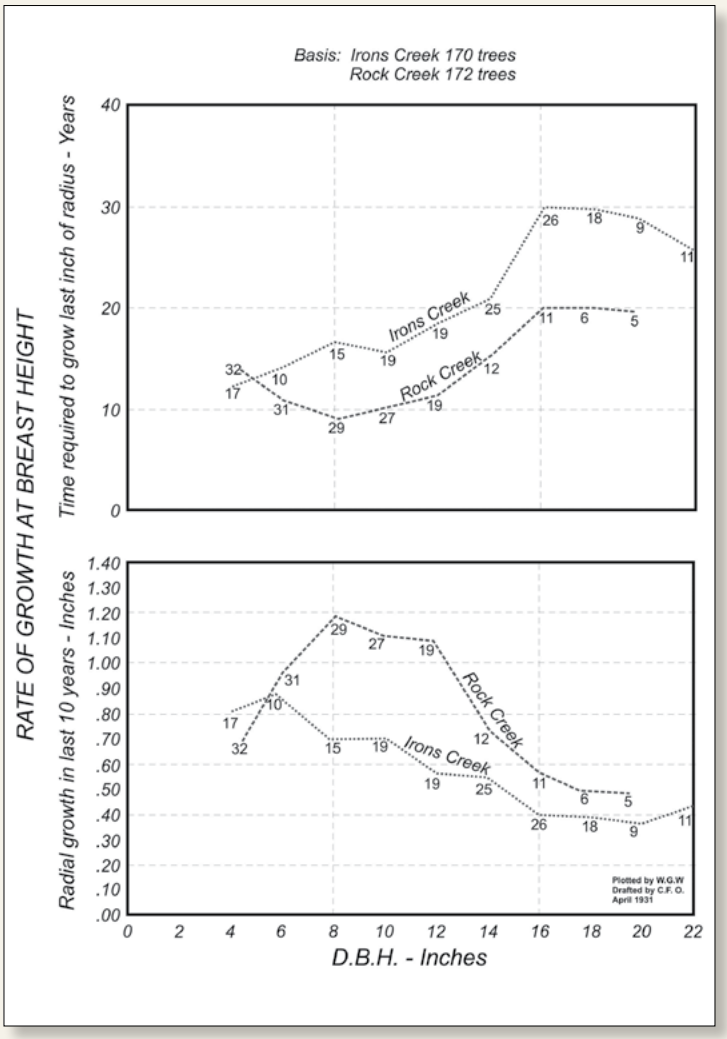
A comparison of the rates of radial growth on the two areas is shown in Figure 6. Apparently, the development from one 2-inch diameter class into the next has required from 5 to 10 years longer on Irons Creek than on Rock Creek.

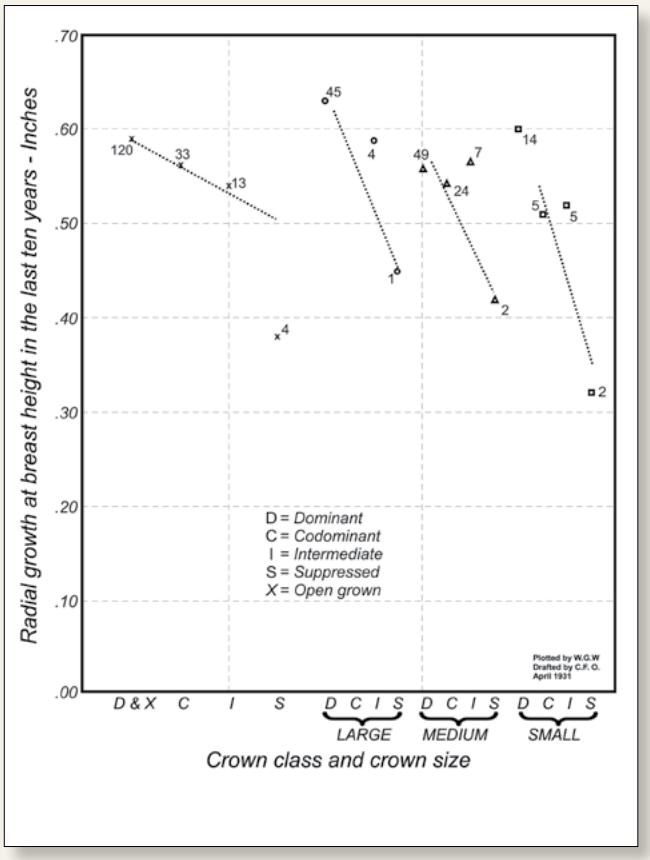
Figure 7 indicates slower radial growth for the inferior and smaller crown classes on Irons Creek.

Although no field estimates of volume were made, rates of volume growth were approximated by the use of the stand tables, growth curves already given, and a local volume table (Table No. 49, made by Jones in 1912).

Lacking data on rates of mortality, it was assumed that each diameter class contained the same number of trees ten years ago as at present. As there probably were more trees in several of the classes at that time, the estimated volume increment may not be sufficiently conservative for some purposes, yet accurate enough for the present description of the areas. The results are given in Table 3.

It may be seen that the volume growth per acre per year as compared to the 38 board feet for the Oden Working Circle as a whole, is only 91 per cent as much for Irons Creek





Left: Figure 6. Shortleaf pine growth rate by d.b.h., Irons Creek, Oden District; and Rock Creek, Mena District, Ouachita National Forest, Arkansas.

Right: Figure 7. Shortleaf pine radial growth by crown class and size, Irons Creek, Oden District, Ouachita National Forest, Arkansas. T1S R28W. Basis: 170 trees.

and 75 per cent as much for Rock Creek. This is largely due to fewer trees per acre, rather than site differences. Comparing the stand per acre in board feet with the Oden Working Circle, Irons Creek has about two-thirds and Rock Creek has one-third as much volume. This is gross volume, no deduction having been made for defect.

TABLE 3. APPROXIMATION OF VOLUME GROWTH
Based on stand tables, radial growth studies, and Jones volume table (No. 49), made in 1912, Ouachita National Forest.

PRESENT TIME					TEN YEARS AGO				VOLUME GROWTH		
DBH Class	Av. Ht. from curve	Av. vol. from v.table curves	Av. No. trees per A.	Av. Vol. per acre	Ave. DBH	Av. Ht. from curve	Av. vol. from v.table curves	Av. volume per A.	10 years	1 year	Per cent of Oden growth
in.	ft.	bd.ft.	No.	bd.ft.	in.	ft.	bd.ft.	bd.ft.	bd.ft.	bd.ft.	%
IRONS CREEK T 1 S, R 28 W, Oden District											
12	53.0	76.0	4.8	364.8	10.9	50.5	60	288.0	76.8		
14	57.0	121.0	4.1	496.1	12.9	54.8	97	397.7	98.4		
16	60.7	183.0	1.7	311.1	15.2	59.3	153	260.1	51.0		
18	64.3	271.0	1.2	325.2	17.2	62.9	233	279.6	45.6		
20	67.6	378.0	0.6	226.8	19.2	66.3	330	198.0	28.8		
22	70.7	515.0	0.7	360.5	21.2	69.6	457	319.9	40.6		
								1743.3	341.2	34.1	90.7
ROCK CREEK T 1 S, R 31 W, Mena District											
12	46.6	63.0	3.6	226.8	9.8	40.7	(37)	(133.2)	(93.6)		
14	52.5	107.5	1.8	193.5	12.6	48.5	78	140.4	53.1		
16	58.7	175.0	1.6	280.0	14.9	55.3	133	212.8	67.2		
18	65.2	276.0	0.7	193.2	17.0	60.8	219	153.3	39.9		
20	72.1	414.0	0.4	165.6	19.0	68.6	339	135.6	30.0		
								775.3	283.8	28.4	75.4
ODEN WORKING CIRCLE National Forest Check Estimates											
12	53.0	76.0	3.7	281.2	11.0	50.7	61	225.7	55.5		
14	57.0	121.0	3.7	447.7	12.9	54.8	97	358.9	88.8		
16	60.7	183.0	3.2	585.6	15.2	59.3	153	489.6	96.0		
18	64.3	271.0	2.3	623.3	17.4	63.3	242	556.6	67.7		
20	67.6	378.0	1.0	378.0	19.3	66.5	337	337.0	41.0		
22	70.7	515.0	0.5	257.5	21.3	69.7	464	232.0	25.5		
24	73.9	669.0	0.3	200.7	23.5	73.2	662	198.6	2.1		
								2398.4	376.6	37.7	100.0

NOTE: As the demonstration of results of practical forest management as a whole is not contemplated, the area will not necessarily be managed on a sustained yield basis, although the use of timber should be conservative. The withdrawal of three or four thousand acres for management by the experimental station should not noticeably interfere with local National Forest administration.

Left: Plate 9. Old field stand of shortleaf pine 50 feet high in 39 years near Cold Springs road, Scott County, Arkansas. The sample plot method of study is well adapted to stands of this kind, because they are pure, even-aged, regular, and well stocked. Comparable plots of relatively small size can often be installed. Unfortunately, such stands are not typical of any extensive areas in private ownership and are seldom found within the present boundaries of the Ouachita National Forest.

Center: Plate 10. Young mature stand of shortleaf pine showing group character of stand, Rock Creek, Ouachita National Forest. This picture illustrates a common condition on the Ouachita. Here, in order to clarify the proper policy in marking trees for cutting, the trees must be studied individually and in relation to small groups rather than in stands. The ordinary sample plot method is not well adapted to such a study.

Right: Plate 11. An even-aged stand of shortleaf pine, Irons Creek, Ouachita National Forest. Man boring tree 10.5 inches d.b.h, 48 feet tall and 70 years old. Here, there are 292 pines per acre ranging from 4 to 14 inches in diameter and 20 hardwoods from 10 to 14 inches in diameter. Although such stands exist over relatively small areas, studies of methods of commercial thinning by the sample plot method would be advisable in stands of this kind before many years have passed.

PURPOSES TO BE SERVED BY THE EXPERIMENTAL FOREST

The primary purpose of setting aside an experimental forest area on the Ouachita National Forest is to provide a place for the more intensive or long-time silvicultural studies that can be advantageously concentrated on a representative area.

The following list of silvicultural problems include those on which the Southern Station should work, either alone or in cooperation with the administrative organizations. They have been listed roughly in order as judged by their importance, urgency, and feasibility of obtaining results without excessive cost.

1. Mixed Type (Shortleaf-hardwoods)

Silvicultural improvement and liberation cuttings (m)

a. Girdling and poisoning of hardwoods, cleaning, thinning. Growth of pine following release from hardwoods (ME)
b. Accelerated growth study.

2. Second-growth pine, including young mature stands

Thinning (and pruning) (Mt)

a. Commercial Thinnings (5 inches d.b.h. and over)
b. mprovement Thinnings Methods of cutting young mature groups (Mc)

c. Tree classification (variation in growth rate as related to conspicuous characteristics, similar to Dunning's method of classification in California)
d. Accelerated growth study (on old sale areas)
e. Sample plot study of cutting in fully-stocked groups
f. Treatment of slow-growing understocked stands Rate of restocking of cut-over areas and old fields (Mr) Growth of understocked stands of different densities (ME) Fire injury (Pf)

3. Old Virgin Pine

Condition of residual stand (and volume per acre) (Me)
a. Tree classification as related to growth
b. Tree classification as related to seed production
c. Tree classification as related to mortality
d. Accuracy of strip estimates
e. Slash disposal

4. Hardwoods

Growth and reproduction of white oak (ME-Mr)
Utilization of inferior species (Mu)

The problems of the mixed type are placed first because so little is known at present of the relation between the pine and hardwoods in the mixed stands, where hardwoods are abundant, and in the pine stands, where there are also many hardwood trees. Second-growth problems are given precedence over virgin timber problems because their importance is increasing, and because the study of virgin timber, though important, has relatively more complications that might delay the accumulation of useful information until the need for it is largely past. Hardwood studies are placed last because they have such small value at present and promise so little in the near future.

The order of importance of projects listed under these headings is less clear. For instance, the Ouachita Forest might wish to see a study of fire damage at the top of the list. A thorough economic study on which to base the distribution of protection funds would be valuable, but is not contemplated by the Station. The idea of tree classification is made prominent for both virgin and merchantable second-growth, because it would appear to be better suited to the conditions than the usual sample plot method. Yet, it may be of limited value, and should be dropped unless a fairly clear and simple scheme like Dunning's can be devised.

The list, therefore, is tentative. It is given only to show our present conception of the silvicultural studies deserving attention during the next few years. Obviously, many of these problems could not be satisfactorily solved on any single or limited area. Photographs included with this report illustrate some of the material available for the study of these problems. Accompanying Plates 8 to 16 are some comments on problems and methods.

ADVANTAGES AND LIMITATIONS OF IRONS AND ROCK CREEKS

Briefly, the area on the headwaters of Irons Creek has these advantages:

1. It is believed to be as representative of the Ouachita Forest as a whole as any other single readily-accessible area of its size available.
2. It is nearly as accessible as could be expected of any such area, and will become more so with the consummation of present road construction plans.

3. It is well protected according to the present status of protection facilities for the National Forest. The area is surrounded by Government-owned land and is within two miles of a fire lookout tower. Protection can be improved by construction of a motor way on the ridge of the north boundary.

4. The size of the area, 2,786 acres, is sufficient to provide material for many desirable studies without undue cost or interference with National Forest administration.

Its limitations for the purpose must not be overlooked, even though most of them are common to any area than could be selected.

No one area can be typical of such varied conditions as exist on the Ouachita. Many experiments should not be concentrated on any one area, as to do so would make the results of very limited value in practice.

5. Very few areas on a forest so irregular as the Ouachita lend themselves to studies by the permanent sample plot method. Great difficulty in sample plot work is anticipated on Irons Creek. Sample plots of a size that are economical to handle can not deal with average conditions. They can only be applied to the relatively small and more uniform portions of the stand.

6. Irons Creek has very little young pole-sized timber—not enough for experiments.

Rock Creek is readily accessible and is so located as to receive better than average protection, but is not sufficiently representative of the National Forest to serve, by itself, as an experimental forest area. In conjunction with Irons Creek, it can be worked from the same headquarters, and it possesses just one outstanding feature of value. It has some of the small pole-sized stands in which Irons Creek is so deficient. A small area of five or six hundred acres within the watershed would be sufficient to fulfill this supplementary purpose. For administrative convenience, it might be advisable to reserve a larger area with more definite topographic boundaries. Such an area might include the 1785 acres at the headwaters of the drainage and shown on the contour map within Sections 22, 23, 25, 26, and 27.

CONCLUSION

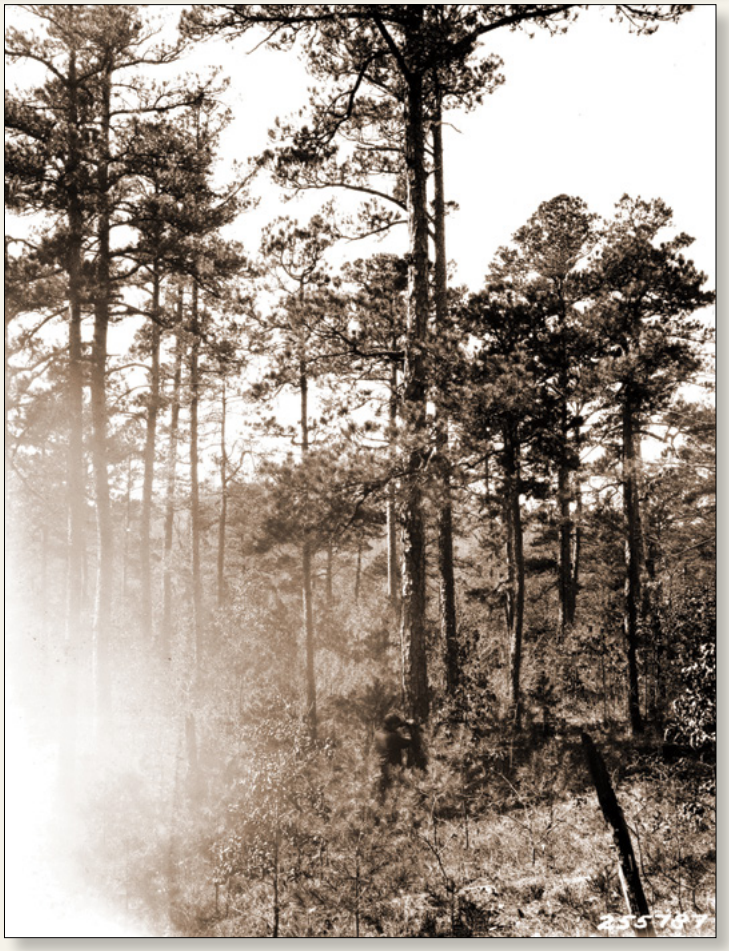
These 1785 acres on Rock Creek, together with the 2786 acres on Irons Creek (as shown on the type map), or 4571 acres in all, are the best material we have yet been able to locate for an experimental forest on the Ouachita.

The proposed program of studies does not fit the material available well enough to insure that the bulk of the timber on the proposed experimental forests, is reserved, would be used for a considerable time, possibly resulting in deterioration on Irons Creek. Perhaps such a relatively small economic waste could be tolerated for the sake of research, yet it is doubtful if reservation of the proposed experimental forests could be justified where so few studies could be concentrated advantageously upon them.

By concentrating our research work on the Ouachita Forest at one or more centers, it may be possible to group together enough of our studies to justify the formal establishment of an experimental forest at a later date. Until this concentration proves to be practicable, it is recommended that final decision as to the reservation of an experimental forest on the Ouachita National Forest be deferred. (plate.12,13,14,15,16)

Top left: Plate 12. Stand of shortleaf pine timber on private land adjacent to the Ouachita National Forest. Man boring into tree 67 years old, d.b.h. 11.2 inches, height 61 feet, Irons Creek. Some such stands as this are being added to the national forest in the present program of acquisition. However, much of the land being acquired is less fully stocked because of frequent fires and long abuse.

Top right: Plate 13. Mature and over-mature stand of shortleaf pine showing typical flat top tree in the foreground, 19.4 inches d.b.h, and 53 feet high, and a 2-log tree rotten in the center, Irons Creek, Ouachita National Forest. These are 2 to 4-log trees averaging about 3 logs. Total heights probably range from 45 to 85 feet. Thirty-three pines from 8 to 26 inches in diameter and one 10-inch black gum were tallied on an acre. Permanent sample plots in such stands as this would be of most value in a study of the normal rates of mortality over a period of years. Such information is needed by the national forest in order to judge the effect of withholding mature and over-mature trees because of relative inaccessibility of stands, the desire to maintain cover, or "fire insurance" seed trees, or for the purpose of spreading the allowable cut over the period required to bring the growing stock of the forest to normal.



Right: Plate 14. Stand of young mature shortleaf pine lightly cut over 10 to 12 years ago showing good reproduction. Tree on the right: 119 years old grew 0.6 inch in the last 10 years and 0.18 inch in the previous decade. Tree in the center has 2 ½ logs to 8-inch top, total height 55 feet, age 121 years, growth 1.55 inches in 10 years following cutting and 0.5 inch in the decade before cutting, Rock Creek, Polk County, Ouachita National Forest. This situation suggests the possibility of learning something of the conditions under which accelerated growth may be expected after cutting by a study of old timber sale areas. In few, if any, situations on the Ouachita National Forest are there any acute problems in securing adequate natural reproduction. On the other hand, the problem of handling over-stocked stands of reproduction is becoming evident. See Plates 12, 20, and 21.[1]

[1] Only Plates 1 through 16 are in the original report copies we have. The other plates may have been deleted from the submitted report and the captions not corrected.

Left: Plate 15. Stand of small poles on Irons Creek. Man measuring tree 5 inches d.b.h., 32 years old, and 32 feet high. This stand is typical of many on the Cold Springs District, Ouachita National Forest, which are scarce on Irons Creek. This patch covers only about 1/10 acre. Such stands large enough for thinning plots have not been found on Irons Creek.

Right: Plate 16. Pole stand of shortleaf pine that has come in since cutting. Note stump near man in picture and large tree in foreground. Age of average dominant tree: 20 years; 4,000 trees per acre, Rock Creek, Ouachita National Forest, Arkansas. Stands like this and those shown in Plates 19 and 20 are common in some districts on the Ouachita National Forest. A study of growth rates and possible thinnings in such stands would be well worthwhile.

APPENDIX A
Follow-up report written by Wahlenberg

PROGRESS REPORT ON THE LOCATION OF AN EXPERIMENTAL FOREST IN THE OUACHITA MOUNTAIN REGION

by

W.G. Wahlenberg

June 17, 1931 This memorandum supplements the report of April 25, 1931 which gave the details of the first trip. Wahlenberg and Heyward have since spent thirteen days (May 18 to 30) on the Ouachita National Forest in starting tree classification work. At this time no more watersheds were examined specifically from the viewpoint of possible reservation for experimental use, but the trip afforded the opportunity for further observation of local conditions and discussion on the ground with Messrs. Demmon, Shaw, Hartman, Ochsner, and Paddock. Thus, although we have few new data at this time, it seems worth while to reiterate some of the thoughts expressed in the first report, bringing them up to date in an effort to crystallize our ideas.[12]

ORIGINAL OBJECTIVES

We set out to find a small watershed suitable for an experimental forest. Such a topographic unit was sought in preference to one designated by arbitrary boundaries or legal subdivisions, not only because it would facilitate special protection measures and logging operations, but also for the purpose of getting samples of all important conditions close together. If adequate samples of the desired conditions could be had on one reasonably small drainage, it would be ideal. Accordingly, we searched only for suitable watersheds.

The relative suitabilities of ten watersheds were compared as to character of timber sites and stands, accessibility, protection, and size. The last three points were relatively easy to judge, but suitable character involved many considerations. Presumably an experimental forest should be typical, or at least fairly representative, of the National Forest or general region it is to serve. This region comprises about two million acres of which 80 to 90 per cent will probably be publicly owned. Most of it is already within National Forest purchase boundaries where title to the land is steadily being acquired by the government. In looking for an experimental forest we kept in mind a small watershed which would represent (1) the principal conditions affecting timber growth, such as various aspects, slopes, exposures, soils, etc.—forest sites in the broadest sense—and (2) stands not too far above average stocking that would lend themselves to experimental treatment—that is sufficiently uniform in some places to permit finding fairly comparable experimental plots—while in other places providing samples of different conditions such as cut over land and recent burns. We hoped to include virgin shortleaf stands suitable for a study of methods of cutting by the usual sample plot method.

More attention was paid to virgin shortleaf pine than to pine second growth or hardwoods.

[12] There are some new names mentioned in this supplemental progress report. Heyward is probably Frank D. Heyward, who specialized in forest soils with the Southern Forest Experiment Station before moving on to other positions in Georgia and Louisiana. E.L. Demmon was the station director at this time; and Shaw, Hartman, and Paddock were not mentioned in Wakeley and Barnett (2011).

RESULT OF THE FIRST TRIP

Comparison of the ten apparently most promising watersheds revealed none suitable for the purpose. The hope of finding something really typical of a large area was abandoned, but it was hoped to find a fairly representative area, and one which was well stocked with virgin shortleaf pine, at least in part, so that sample plot studies could be made. In this, too, we were disappointed. All of the areas had only very irregular virgin stands of pine, none of the them suitable for studies of cutting by the customary sample plot method. The application of this method to average virgin conditions, of course, would not be utterly impossible, but the cost would be prohibitive because of the necessity for very large plots.

In this work no intensive study of reproduction is contemplated. The survey of Irons Creek indicated a sufficient number of seedlings and saplings already on the ground as advanced reproduction to make a satisfactory stand (see table 2 of the first report) provided they were well distributed. Further analysis of the data from this survey shows that the distribution is not sufficiently regular now (see table A.1 of this report), but reproduction in adequate amounts may well be expected to follow conservative cutting and silvicultural improvement work.

Table A.1. Distribution of advanced reproduction of shortleaf pine (up to 4" d.b.h.) and hardwoods (between 4" and 10" d.b.h.)

Cover type or general aspect	Shortleaf seedlings (0' to 3' high) per acre:			Shortleaf saplings (over 3' and under 4" d.b.h.) per acre:			No advanced pine reproduction	Pine seedlings or saplings or both	Hardwoods 4" to 10" d.b.h. per acre		Basis: Number of ¼ acre plots
	None	0-200	Over 200	None	0-200	Over 200			Range	Ave. No.	
	%	%	%	%	%	%	%	%	No.	No.	No.
Shortleaf	29	50	21	38	38	24	21	79	0-180	32	34
Mixed	9	91	0	9	73	18	0	100	12-124	48	11
Hardwood	36	64	0	36	57	7	29	71	0-100	36	14
Northerly	29	63	8	29	54	17	21	79	0-100	32	24
Southerly	27	55	18	36	50	14	14	86	0-180	48	22
Flat	30	70	0	20	50	30	10	90	8-100	40	10
All plots	27	61	12	32	49	19	19	81	0-180	40	59

Estimated stand per acre based on counts on each of 59 quarter acre plots. Percentage of total plots having specified stand is shown. Irons Creek, T. 1 S, R. 28 W., Ouachita National Forest, Arkansas.

There is need for a survey of old sale areas, where the history is known, to show the extent and distribution of reproduction following cutting, but this can best be done extensively using temporary plots. The "stocked quadrat" method advocated by Haig (Jour. For., Vol. 29, No. 5, May 1931)[13] would be very suitable for this purpose. Because many areas have been satisfactorily restocked regardless of variations in methods of conservative cutting, the reproduction phase of methods-of-cutting studies on the Ouachita is considered much less important than the study of growth of the residual stand. Growth studies in remnants of the virgin pine stands also can best be made by the extensive examination of temporary plots or by the use of a classification of individual trees (similar to Dunning's, J.A.R. 36-9, 1928).[14] How we were forced to these conclusions can best be

[13] Haig, I.T. 1931. The stocked-quadrat method of sampling reproduction stands. Journal of Forestry. 29(5): 747–749.

[14] Dunning, D. 1928. A tree classification for the selection forests of the Sierra Nevada. Journal of Agricultural Research. 36(9): 755–771.

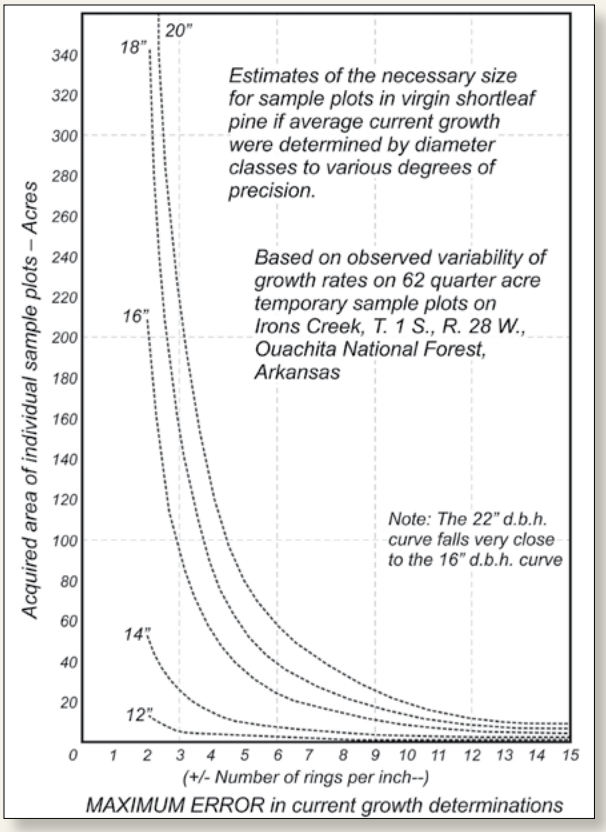


Figure A.1 Sample plot size estimation for virgin shortleaf pine based on diameter.

shown by a statistical analysis of the size of plots needed were we to attempt to study average virgin pine conditions by the permanent plot method. Irons Creek, at the head of Posey Hollow, is as nearly average as any area found. Here growth data were taken on 15½ acres contained in 62 quarter acre plots scattered regularly 20 chains apart over 2786 acres. The variability of current growth, as shown by the number of rings in the last inch of radius, was analyzed to show the number of trees needed in each diameter class in order to get results reliable within specified limits of accuracy. Then the average area which would have to be included in a plot to provide the required number of trees was computed from the general stand table (Table 2 of the first report) for the same tract. The method is shown in table A.2, and the results in table A.3, and figure A.1.

Table A.2. Illustration of method of estimating the necessary size of sample plots if the growth of virgin shortleaf pine is to be studied under average conditions on the Ouachita National Forest.

D.B.H. Class	Average number of trees per acre	Mean current growth --- No. of rings in last inch	Standard deviation (σ)	Standard error (S.E.) for Max. error of ± 2 rings. S.E. = M.E./3	Number of trees required $n = \sigma^2/(S.E.)^2$	Number of acres needed per plot
In.	Trees	Rings	Rings	Rings	Trees	Acres
12	4.8	18.5	5.25	0.6667	62	13
14	4.1	20.8	9.82	0.6667	217	53
16	1.7	29.8	12.60	0.6667	357	210
18	1.2	29.8	13.52	0.6667	411	343
20	0.6	28.7	11.43	0.6667	294	490
22	0.7	25.6	8.05	0.6667	146	208

Basis: Average stand table and variability in current growth as measured on 62 quarter acre temporary plots on Irons Creek, T. 1 S., R. 28 W.

Table A.3. Estimates of the number of trees and size of plots needed (before cutting) to yield average current growth data reliable within set limits of maximum error expressed in numbers of rings in last radial inch.

D.B.H. Class	Max E. = ± 2		Max. E. = ± 3		Max. E. = ± 5		Max. E. = ± 10		Max. E. = ± 15	
	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres	Trees	Acres
12	62	13	28	6	10	2	2	1	1	¼
14	217	53	96	24	35	8	9	2	4	1
16	357	210	159	93	57	33	14	8	6	4
18	411	343	183	152	65	55	13	14	7	6
20	294	490	131	218	47	78	12	20	5	9
22	146	208	65	93	23	33	6	8	3	4

These estimates show that the idea of applying different methods of cutting on different forty-acre tracts and keeping close records of results on only a ten-acre permanent plot within each forty would be useless. Errors in current growth averages could easily amount to 30% for the diameter classes with which we are most concerned (10" to 20" d.b.h.). The estimates, too, are conservative because they are based on the stand before cutting. Thus they are bare minima and would have to be increased to allow for the reduced stocking of residual stands. Manifestly we cannot have several hundred acres in each plot and keep accurate records on each tree as these estimates would seem to indicate.

It might be contended that if we disregard diameter classes and simply take a sample of the stand as a whole as a basis of comparison of different cutting methods, significant contrasts in subsequent total growth of whole plots might be determined. Possibly this could be done, but the results would be useless, as variation in stands is too great to permit application of such results elsewhere on the Forest.

Irregularity in virgin stands is obviously too great to permit the use of customary permanent plots for the study of average growth conditions. The method might be applied in a limited way to better stocked portions of young mature stands, but in most places there are small groups of virgin trees which could be more effectively handled on the basis of individual tree classification. Our first report gave a detailed description of Irons and Rock Creeks as possible experimental areas. At that time virgin timber was regarded as the main problem and we were still hoping to find a fairly typical area. Irons Creek was given most consideration because of the nature of its virgin stands. Rock Creek was selected as a convenient small watershed well stocked with small second growth. Now Irons Creek appears somewhat less suitable because relatively less importance is attached to the problem of the original stands. Rock Creek is not favored because other areas more suitable for studies in second growth, though not watershed units, have since been found.

Our failure to find a suitable area may be attributed in part to setting up too high ideals and hopes. It was also very largely due to an inadequate picture of local conditions to start with and a vague conception of the real problems and their relative importance. In lowering our sights we must also decide where to aim.

REVISED OBJECTIVES

A single experimental forest of less than 5000 acres in the Ouachita Mountain region cannot be expected to be fully representative of all the conditions with which local forest management must contend. Small areas suitable for useful experiments may be more easily selected if we abandon the idea of a topographic unit.

It would seem also that too much emphasis has been placed on the problems of virgin timber which will probably be largely cut out in about fifteen years. The needed information on rotation age, mortality, etc. can be had from temporary plots and a few long strips permanently marked for repeated observations. If such work, together with an attempt to clarify marking rules by means of tree classification, is all that needs to be done in virgin timber, no experimental areas need be specifically set aside for the purpose. It would be better to scatter the work on different parts of the forest. Such action would also fit in better with the ideas of administrative officers of the Ouachita.

Too little emphasis has been placed on the problems of second growth which is becoming conspicuous as advanced reproduction in many places. Improvement thinnings in sapling stands are badly needed. The technique has not been worked out, although practice has already begun under provisions of the Knudson Law[15] which provides for the investment of a portion of timber sale receipts for silvicultural improvement of cutting areas. Commercial thinning of young mature timber of hurricane origin also needs investigation.

Methods of making these intermediate cuttings should be worked out in relatively uniform even-aged stands of young timber by the establishment of permanent sample plots. The results should be useful in National Forest timber sale practice where small groups and clumps of similar stands are encountered.

The problems of the mixed type, though difficult to study, rank high in importance because so little is known of the interrelationship of pine and the hardwoods, and because the mixture is so extensive. Experiments to learn how to get rid of the present generation of worthless hardwood are underway. Successful control of the mixture should be followed by studies of accelerated growth in the pines released.

The list of problems in the first report (Apr. 25, 1931, pp. 34-35) is tentative. Criticism by the National Forest and Regional Office is invited. The sooner this program can be crystalized, the earlier it will be to select a suitable area, if one is desired and if it can be found at all.

The possibility of having a natural area reserved in connection with the experimental forest has been considered although no areas have been reported upon with this specific use in mind. Wahlenberg plans to give it some attention on his next trip to Arkansas.

It would seem best to reserve as a natural area some tract having a particularly well stocked stand of virgin pine. The more nearly average virgin stands on the Ouachita Forest are too badly understocked, too irregular, too defective, and too sad a remnant of abuse to be worthy of preservation. At least one relatively good stand of shortleaf should be set aside.

[15] Actually the Knudson-Vandenberg (K-V) Act of 1930 established a trust fund to take a portion of timber sale receipts and reinvest them into the various activities in the timber sale area, including reforestation, wildlife habitat improvement, fuels reduction, noxious weed treatments, road improvements, and more.

Since hardwoods are a permanent part of the forest, the selection of a natural area should not disregard them. To be of most interest to botanists and ecologists, a natural area should not be "average" in this regard either.

Preferably it should include a large number of hardwoods species. Assuming that it may be possible to find a small natural area where past fires have been relatively infrequent, it might be well worth protection and reservation in order to illustrate the course of plant succession under conditions of less flagrant abuse.

These two objectives in the selection of natural areas would be difficult to combine in the same tract or with an experimental forest on the Ouachita. It would be better to have separate small areas, one in pure pine, the other in pure hardwood, and possibly a third in the mixed type. The last would be for the observation of the ecological relationship of pine and hardwood. As its qualifications would be less exacting, it could probably be taken adjacent to an experimental area, if one is selected.

The possibility of locating a suitable area for an experimental forest outside the National Forest purchase boundaries has not been seriously considered. From a protection standpoint it would be much better to keep the experiments inside. Much of the land outside has been cut over, or, being held for that purpose, is not for sale. Further inquiry into the situation should be made however, together with a last attempt to locate an area inside the national forest.

PROCEDURE

A trip to the Ouachita region is planned for the fall of 1931. As a last chance in locating an experimental area it is planned to view the forest from lookout towers or from an airplane, or both, following up any new prospects.

Inquire into the possibility of finding a suitable area outside.

Examine possible natural areas.

Revisit different districts, in company with local forest officers whenever possible, to locate suitable areas for carrying on our work with or without an experimental forest.

Proceed with a study of tree classes.

APPENDIX B
Correspondence between E.N. Munns and E.L. Demmon

R – SS
Branch Stations
Experimental Forests
Ouachita

May 20, 1932.

Director,
Southern Forest Experiment Station, New Orleans, La.

Dear Demmon: I recently had a talk with Mr. Evans, of Forest Management in Region 7, concerning the possibility of an experimental forest on the Ouachita. Frankly, he and I are greatly disappointed in the fact that the Station has not been able so far to determine upon a suitable area. I very much hope that the selection of such an area will not be too long delayed. What are the Station's plans for a further consideration of the Ouachita? Do you contemplate soon making a further study on the ground, or is it your intention to let matter slide for the time being? I am asking because it may be that if a party is in Arkansas a month from now I might be able to go over some of the areas with you.

Very sincerely yours,
[signed] E.N. Munns
Chief,
Division of Silvics

R – SS
Branch Stations
Experimental Forests
Ouachita

May 27, 1932.

Assistant Forester,
Branch of Research, U. S. Forest Service, Washington, D. C.

Dear Sir: Reference is made to Mr. Munns' letter of May 20th relative to the establishment of an experimental forest on the Ouachita National Forest. One reason for the extended delay in selection of an experimental forest on the Ouachita Forest has been on account of the press of other work which seemed to us to take precedence. We have advised you of the consideration which was given the matter by Wahlenberg as a result of two special trips to the Ouachita Forest for that particular purpose. The results of those trips were contained in Wahlenberg's memoranda dated April 25, 1931 and June 17, 1931. Copies of Wahlenberg's memoranda were forwarded to Region 7 and we had hoped to have the benefit of their comments and criticisms, particularly on the tentative list of projects which, in our opinion, seemed to offer possibilities for intensive research. These suggestions are listed on pages 33 to 35 of Mr. Wahlenberg's memorandum dated April 25, 1931 (designated R – SS Supervision). We had not contemplated further consideration of work on the Ouachita until some time later on in the year. However, if it is possible for Mr. Munns to visit the Ouachita some time in the near future, we will make arrangements to spend a little time with him on the ground, discussing the possibilities of locating a suitable experimental forest area and at the same time conferring with the Administrative men. We would plan on having Wahlenberg and Bull[16] there at that time and I will plan to be there at the same time. We would appreciate it if we could have a little more definite information as to just when Mr. Munns could meet us in Arkansas. We could then make our plans accordingly.

Very truly yours,
Director

[16] Bull is Henry "Hank" Bull, who is described by Wakeley and Barnett (2011) as a specialist in pine thinnings who also worked in hardwood silviculture and dendrology with the Southern Forest Experiment Station.

R – SS June 4, 1932.
Branch Stations
Experimental Forests
Ouachita

Director,
Southern Forest Experiment Station, New Orleans, La.

Dear Demmon: In reply to your letter of May 27: I have already furnished you with comments on Wahlenberg's memorandum of April 25, 1931. I do not believe I commented upon the tentative list of projects on pages 33-35. My feeling is that this proposed work does not constitute a series of projects as we look upon them, but a series of minor studies. My criticism of this proposed work is that it is not definitely tied together to make a comprehensive attack upon the big silvicultural problems of this Arkansas section. Wahlenberg's argument against the two areas with which his report chiefly deals, is unconvincing because I feel confident that sample plot work not only will be possible but is highly necessary in the uneven-aged and ragged forest such as is depicted in the series of photographs he includes. I shall let you know as soon as plans have matured whether it will be possible for me to participate in a trip to the Ouachita this summer.

Very sincerely yours,
[signed] E.N. Munns
Chief,
Division of Silvics