

Through research, industry, the state and the federal government are searching for new knowledge that will show the way to more efficient and profitable management of the state's timber resources

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Loblolly pine plot in naturally regenerated stand at 16 years of age. It was pre-commercially thinned 5 years ago to 8' x 8' spacing and was recently thinned to 80 square feet of basal area. Five cords were removed, leaving 17.4 cords per acre.



Injecting radioactive isotopes in a turkey oak to study uptake and to delineate the extent of root systems

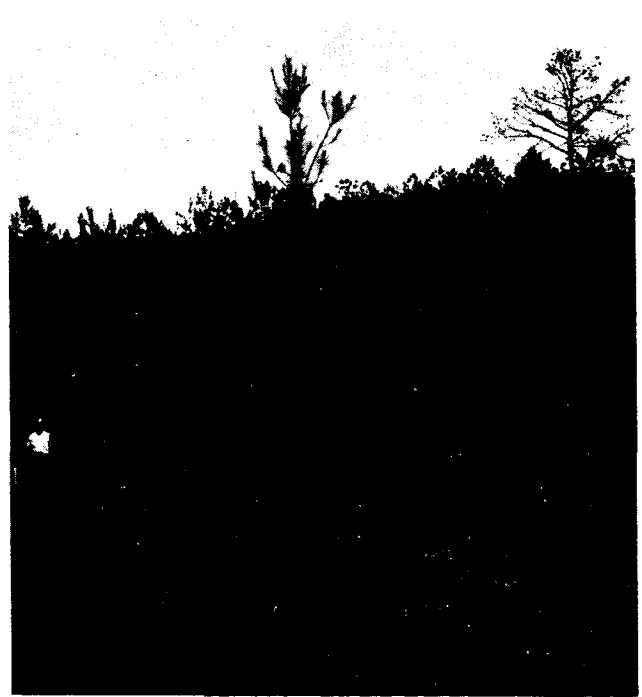
The Expanding



At right, the proper use of upslope strip head fires on Piedmont pine sites often help keep small undesirable hardwoods under control



Gully before treatment. In a year it was stabilized by grass cover



Area nine years later—a good stand of pine has been established

Role of Research—Public and Private

In a state where more than 60 percent of the land area is forested, where soils and climate are conducive to fast tree growth, where extensive forest management is giving way to intensive forest management, foresters and landowners are seeking solutions to problems that vary from the biological to the economic, from a wetland problem to a harvesting difficulty. Hence the many and varied research activities in South Carolina.

Who is Doing Forest Research?

At the risk of omitting someone, here is a list of landowners and agencies known to be doing forest research in South Carolina:

The Catawba Timber Company, International Paper Company, West Virginia Pulp & Paper Company, Union Bag-Camp Paper Corporation, Clemson University, South Carolina State Commission of Forestry, Atomic Energy Commission, and the U.S. Forest Service's Southeastern Forest Experiment Station.

There are four experimental forests within the state dedicated to research: the Clemson Experimental Forest in

Oconee County, Calhoun Experimental Forest in Union County, the Santee Experimental Forest in Berkeley County, and the Westvaco Experimental Forest in Georgetown County.

In addition to these formally designated experimental forests, private, state, and national forests provide experimental areas too numerous to mention.

Research Activities

Clemson University—Clemson's Department of Forestry research encompasses a wide range of investigation including introduction of species, genetics, tree-site relations, viability of seed, forest soil micro-organisms, tree diseases, nutrition of forest trees, economic aspects of forest management, and harvesting of forest products. The University's arboretum, which is probably the largest in the state, has, at the present, more than 270 tree species not native to the Piedmont of South Carolina. Along with this introduction of exotics, an active program in forest genetics is being pursued so as to take the advantage of compatible domestic and introduced species as potential

sources of improved stock for South Carolina.

Clemson University and the South Carolina State Commission of Forestry have cooperated in a series of studies to test fenuron pellets in what promises to be a very effective method of controlling scrub oak in South Carolina's Sandhills. These were hand application trials. In addition, helicopters have been used, testing 10, 15 and 20 pound rates per acre during each month of the year to determine the most effective period and rate of application.

International Paper Company—International Paper's main research effort is directed toward developing improved pine seed sources. Three seed production areas have been certified by the South Carolina Crop Improvement Association, and this past fall produced South Carolina's first certified pine seed. For greater improvement, the company is also developing seed orchards of slash and loblolly pine to fill future needs for pine seed regeneration. Another phase of their research is the growth and yield of sweetgum and the regeneration of water and swamp tupelo.

West Virginia Pulp and Paper Company — West Virginia Pulp and Paper has three research centers in South Carolina. In addition to their research in silviculture, mensuration, tree improvement, and land management, they have a very active development program in mechanical harvesting. In a pilot test a Canadian harvester, hydraulic loader, pallet prehauler pulled by a Tree Farmer Tractor, and a 5-pallet highway tractor-trailer are being evaluated; the aim is to increase harvesting efficiency.

In the mensurational and land management phase, a long-term, loblolly pine study has been established to determine optimum growing stock levels and rotations for a wide range of products or combination of products. Yields may be expressed in cords, board feet, cubic feet, weight, poles, piling, and dollars.

In addition to the company's own research, they have actively cooperated with Southeastern Forest Experiment Station since 1945 in many studies. The company pioneered with the station in the use of prescribed burning in the management of coastal plain loblolly pine. Studies of the long term effects of burning on the soil and vegetation are now in their 19th year, and show that a complete control of small hardwoods is possible with a series of annual summer fires with no detrimental effect to the soil or the pine overstory. In wetland timber types, the West Virginia Pulp and Paper Company is also cooperating with the Station in a

test species-site relationships. Survival and growth of water tupelo, swamp tupelo, baldcypress, sweetgum, and loblolly pine are being correlated with water-table levels and physical characteristics of the soil.

Catawba Timber Company — This company, a member of the Bowater organization, has research under way in reforestation and logging. A prehaul logging tractor was designed and built by the company's forest engineer. This machine has increased logging efficiency and minimized damage to forest land during harvesting operations.

Union Bag-Camp Paper Corporation — Union Bag-Camp has a broad forest research program covering many coastal plain problems and conditions from Florida to Virginia. In a major effort to pin down specifics on the growth and development of pine plantations in the coastal plain, the company is establishing a study replicated in all of their working circles over a three-year period. Local geology, site quality as determined from soils, site preparation treatments, and initial stand density are some of the variables involved.

To increase the knowledge of swamp hardwood management, the company established a thinning study five years ago in a shallow swamp hardwood stand, results indicate the level of growth that might be attained on such sites. With thinning regimes varying from an uncut control to 75 square feet of basal area, corresponding growth for the five-year period was from 16.8 to 7.6 cords per acre, or maximum periodic growth of more than 3 cords per acre per year on the uncut plots.

Savannah River Project, Atomic Energy Commission — The Atomic Energy Commission's forest holdings at the Savannah River project are administered by the U. S. Forest Service, with one phase of this work devoted to forest research. Cooperators in the research include the Forestry Department of Clemson University, DuPont Savannah River Laboratory, Upjohns Laboratory, and the Laboratory of Radiation Ecology operated by the University of Georgia.

Many studies involve the effects of radiation and use of isotopes. For example, at the Laboratory of Radiation Ecology research workers are observing the effects of high and low level radiation on trees, animals, insects, in slash and longleaf pine plantations and other parts of the forest community. Another study of great importance to the future space-age traveler is concerned with the stresses and functions of a small self-enclosed ecosystem that includes plants, animals, and decomposers.

Southeastern Forest Experiment Sta-

tion — In South Carolina, the Southeastern Forest Experiment Station is actively pursuing research work in timber management, fire, disease, insects, wood utilization, and watershed management. Two projects — those dealing with timber and watershed management in the Coastal Plain — are headquartered in Charleston; other work is centered in Georgia and North Carolina.

The station's timber management research activity in South Carolina is concentrated in Coastal Plain timber types. Here may be found some of the most productive forest land in the state, perhaps in the nation, and some of the most unproductive; some of the wettest, and some of the driest.

Because water, or the lack of it, has a tremendous influence on species composition and growth, studies of its effects are involved in much of our work. One example is a study located in a former scrub-oak thicket on the Sand Hills State Forest. The site was cleared and planted 9 years ago to slash pine. Turkey oak sprouts, grass, and pine trees are now competing for the limited soil moisture. The aim is to determine how much more moisture can be made available to the pines if either the oak sprouts or grass or both are eliminated and what effect this has on the slash pine growth. This study should provide a biological basis for determining the economic feasibility of eliminating any of these competitors.

An example of work at the other extreme of soil moisture is a study of swamp and water tupelo growing in a hydroedaphytron under saturated soil water conditions. Six water treatments are included; three have stagnant water and three have moving water. In each of the stagnant and moving treatments, water is held either at surface, at an 8-inch flooded depth or at an intermittent combination of the other two. First year results show considerable difference in seedling root and stem growth depending on the nature of the water and the soil-water environment created.

The Southern Forest Fire Laboratory has two prescribed burning studies in South Carolina, one in the Coastal Plain on the Francis Marion National Forest and the other in the Piedmont on the Clemson Experimental Forest. In the Coastal Plain the aim is to ascertain optimum intervals between hazard-reduction burns and the appropriate burning technique for the different intervals. While in the Piedmont the objective is to explore the possibility of using fire to control undesirable hardwoods in the understorey.

What triggers southern pine beetle outbreaks that reach almost catastrophic pro-



At the School of Forestry, Clemson University, images of the embryo inside pine seeds are examined on x-ray negative over viewing screen

Research

portions in a few weeks and then as mysteriously disappear? Several counties in South Carolina have experienced such outbreaks in recent years. Determining the relationships between climatological conditions and the rise and fall of a beetle epidemic is one approach being followed in a cooperative study with Clemson University.

The station's forest disease research work in South Carolina is conducted from the Forestry Sciences Laboratories in Durham, North Carolina, and Athens, Georgia, and consists primarily of field studies with littleleaf disease and the annosus root rot. Littleleaf-resistant trees have been found and are now being tested on severe sites at the Calhoun Experimental Forest. Because poor soil aeration, nitrogen deficiency, and periodic moisture stress are associated with littleleaf disease, the soils aspect is also being intensively studied.

Annosus root rot is potentially a very damaging disease. Although the damage caused by the disease for the South as a whole is low, South Carolina had the highest damage figures of any area included in a recent survey. On several plots in the state, damage has doubled in the 5 years the plots have been under observation. Research is aimed at developing information on the site and stand factors that are favorable to infection and spread of root rot and to gain a better understanding of the fungus movement through stumps and roots so that sound control measures can be developed.

Watershed management studies for the Piedmont are conducted on the Calhoun Experimental Forest and for the Coastal Plain area on the Santee Experimental Forest. The rolling clay hills of the Piedmont are subject to excessive erosion and high surface runoff. Gullied lands are quite common, and rehabilitating these gullies has been a main concern of research.

Two general principles are involved in healing up a gully. The first is the safe disposition of surface runoff which caused the gully initially, the second is to modify the intense microclimate on a gullied surface so that plants can become established. The watershed problems in the coastal plain are of an entirely different nature from those in the Piedmont, and are associated with wetland forest types. Drainage is not necessarily the solution, and in some cases may be quite detrimental. Although some tree species respond to drainage, others grow best under very wet situations. The work at Charleston in this field is aimed at increasing our knowledge of the hydrologic processes of these wetlands and their seasonal moisture patterns as well as learning the soil property changes induced by changing the water regime.

An impressive amount of research is being conducted by private interests and public agencies, but there are still many gaps in our fundamental knowledge of the basic factors affecting tree growth. As our knowledge increases, new doors will be opened that allow us to increase our efficiency in managing our forests.

Reprinted from
FOREST FARMER 24(8): 12-14, 28.