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Silvics and the Wetland Forest

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Within the Coastal Plain of the Southeastern States, there are nearly 18 million acres of wetland forest. The extent of this woodland area varies considerably from state to state. In the Coastal Plain of Virginia only about 15 percent of the commercial forest is on wetland; at the other extreme are North Carolina and South Carolina where the proportions are 45 and 40 percent, respectively. At one time, much of the wetland was forest with large pine, red and white oaks, gum, and cypress. Now, only remnants of the original forest remain. Premium prices commanded by the high quality trees among these remnants, and the current efforts of landowners to make all forest land produce its fair share of timber products, have caused an intensive search for better methods of managing the wetland forests. On some forest holdings large capital investment programs are already underway, or planned, to increase wetland productivity.

A knowledge of the nature of forest trees, how they grow, reproduce, and respond to changes in their environment make up the broad field of forestry called silvics. In effect, silvics is the biological basis for silvicultural practice. The silvics of the wetland forest is made difficult by the large number of tree species involved; about 70 different ones of some commercial importance are found. Furthermore these may grow in diverse locations such as wet flats, bays, swamp and stream bottoms. Obviously this briefly described complex of species and sites requires considerable investigation before general prescriptions for intensive cultural practices can be made with confidence.

Perplexing problems facing forest managers include the classification of wetland site conditions, selection of species best suited for production on each site, and development of sure-fire techniques for establishing desired species. The determination of species-site compatibility would not be difficult under natural conditions. More often than not, we are forced to deal with stands in a run-down condition as a result of repeated high grading and uncontrolled burning. The situation is further complicated when natural water levels are altered by controlled drainage systems intended to improve accessibility or increase the land's productivity for pine. A brief discussion of the heterogeneity of the sites making up the wetland forest and the research underway by the Southeastern Forest Experiment Station Center at Charleston, South Carolina should help to clarify the scope of this problem.

Site is dependent upon the climatic, soil and biotic interrelationship for its qualities. As might be suspected, the term "wetland forests" covers a broad range of site conditions. Furthermore, wetland sites are not always nicely separated from one another by sharp lines of demarcation. Changes between them often occur gradually as adjustments take place between land form, soil, vegetation, and water level. It is not at all unusual to find fingers of one wetland site intruding deeply into that of another nearly or even completely enclosing it. Still, four very general classes of sites can be recognized from among these variations; they are the aforementioned wet flats, bays, swamps, and stream bottoms.

Wet flats are level, or nearly level, poorly drained lands. Natural drainage is slow because of a lack of stream dissection, the presence of a relatively impermeable layer in the subsoil, high ground-water levels, or some combination of these factors. Some wet flat soils have developed from unconsolidated beds of sands which contained little silt and clay and, as a result, are course textured. Mixed with the surface soil may be noticeable amounts of organic matter that sometimes infiltrates downward, as in the St. Johns soil series, and causes cementing of the sandy subsoil. Pine species, either singly or in mixture, usually are the dominant vegetation on this type of soil.

At the other extreme are wet flats with finer textured soils, developed from beds of clay or silt with varying amounts of sand. Two examples of these soils are the Coxville series and its heavier and more poorly drained associate the Bladen series. Hardwood species are more abundant on these more fertile lands. The forest cover is often a mixture of pine and hardwoods or one in which the hardwoods predominate.

The Appalachicola National Forest has thousands of acres of poorly drained slash and longleaf pine flats which are comparatively low revenue producers. One reason is an overabundance of soil moisture during wet seasons which not only lowers site productivity but also reduces timber values because of high extraction costs. Recently the Southeastern Forest Experiment Station (Charleston Research Center), in cooperation with the Florida National Forests, installed a study to determine the effects of controlled drainage on tree survival and growth. Under observation are newly planted trees, a 3 year old slash pine plantation and a 20 year old slash pine stand.

In addition, West Virginia Pulp and Paper Company researchers are working with personnel from the Charleston Research Center in an attempt to relate soil water levels and other selected soil variables to the survival and growth of sweetgum, baldcypress, swamp tupelo, water tupelo, and loblolly pine seedlings planted on drained land. This study is located near Summerville, South Carolina, where soil conditions are similar to those found throughout the wetland forest area.

Finally, the South Carolina National Forests are cooperating with the Charleston Research Center in an experiment on a wet savannah site within the Francis Marion National Forest. This study compares the survival and development of four pine species planted on an area degraded by frequent wildfires.

Bays are also of considerable importance in the Coastal Plain. They are nearly level, to slightly depressed, areas on the lower terraces where surface soils are highly infiltrated with organic matter or covered with peat. Surface layers are underlain at various depths by soils which vary in texture from sand to clay. During wet periods precipitation and seepage from upland sources keep the bays saturated with water. In contrast, the water level falls so low in dry periods that the organic accumulations become flammable. The prevalent vegetatation is a dense tangle of evergreen shrubs, vines, and small trees under scattered pond pine. Loblolly pine is a frequent associate of the pond pine in the northern portion of the Coastal Plain. Farther to the south, however, it is replaced by slash pine.

Research into the silvical peculiarities of bay sites has been underway on a limited scale for some time by various organizations. Problems that make forest research so complicated on other wetland sites are reinforced by a few that apply particularly to bays, such as; difficult working conditions, inaccessibility, high cost of research, high risk of wildfire and the organic nature of the soils. In toto, they discourage expanded research efforts.

The swamps are very poorly drained, wet depressions or lowlying areas where water stands at or above the soil surface throughout most of the year. Water levels are not static on swamp sites, and may fluctuate in depth from a few feet to fifteen or more feet depending upon location. Included in this category are the depressed areas of waterlogged sands typified by soils in the Rutledge series; lowlying, heavy clays in the Bayboro series; and a broad group of unclassified swamp soils that range in texture from loams to clays. All of these soils vary widely in organic matter content. Swamps occur in ponded depressions interspersed among pinelands and as the lowest lying areas in wet flats and bays. They are also found stretched out into long ribbon-like bodies along stream courses and as broad belts of forest adjacent to the larger alluvial rivers. Among the forest cover types found on swamp sites are pondcypress, slash pine-swamp tupelo, sweet bay-swamp tupelo-red maple, and relatively pure or mixed stands of baldcypress, swamp tupelo and water tupelo.

For the past two years the Charleston Research Center has been studying site conditions associated with water tupelo, swamp tupelo, and sweetgum growing in a Santee River Swamp. The site variables showing best correlation with the total height of water tupelo are; land elevation, soil texture and reaction, and water level. Most of the year to year variations in radial growth is accounted for by changes in the average springtime temperature and precipitation, and the length of time the swamp is flooded. There is a definite tendency for radial growth to increase with increased flooding. This should alert foresters to the possibility that the best productivity from water tolerant species may result from high water levels. Indiscriminate lowering of groundwater levels by drainage without a clear understanding of the effects on species-site adaptability and timber yield may prove to be as risky as pitching pennies in the dark -- and vastly more expensive.

The fourth broad class of wetland sites -- stream bottoms -- support at least a dozen recognized forest cover types on about twice as many soil series. Some of the materials forming stream bottom soils have washed down from the Piedmont. An example is the Chewacla-Georgetown-Wehadkee soil complex. The Bibb, Johnston and Hyatt soil series are mainly of Coastal Plain origin. Among the variations in stream bottom soils are fine sandy loam over plastic clay, loamy fine sand throughout the soil profile, clay surface soil underlain by stratified layers of sand and clay, and mixed Alluvium varying widely in its proportions of sand, silt and clay.

The lower, more poorly drained stream bottom and front lands form habitats for the sugarberry-American elm-greenash type, the overcup oak-water hickory type, and stands of cottonwood, willow, sweetgum and water oak. On ridges within the bottoms and on terrace slopes, red and white oaks, yellow-poplar, pine, sweetgum and other hardwoods combine to produce forest stands which vary considerably in their composition from one locality to the next.

Studies of the site variables affecting the successful establishment of forest regeneration on bottomlands were started about ten years ago on the Santee Experimental Forest. In one of them, two 30-acre stands of mixed hardwoods and pine are in the process of being converted to many aged stands through the application of single-tree selection cuts. Detailed analyses of the openings made for regeneration purposes and standwise inventories of the reproduction cast some doubt on the suitability of the selection system for regenerating the more valuable but intolerant species such as cherrybark oak. Consequently, another stand of 85 acres was cut to hardwood and pine seed trees two years ago. On this area seed production is being compared with that of triangular seed traps specially designed to catch acorns as well as all other seed. In addition, seed-seedling ratios are being determined on permanent sample plots adjacent to the seed traps. Other factors under evaluation include the windfirmness, growth and bole sprouting characteristics of seed trees.

Where the growing stock has been reduced to culls, low grade trees, and uncommercial species through cutting, workable type conversion methods utilizing planting and direct seeding are needed. To this end tests have been made on small plots comparing (1) underplantings released after one growing season with plantings made on cleared plots; (2) plantings on first bottoms with those established on terraces; (3) the survival and growth of planted conifers and hardwoods; and (4) direct seeding with the planting of oaks. Based on the results from the small plot studies, larger, pilot plant tests are in progress.

Heavy losses of acorns to rodents have restricted more extensive trials of direct seeding. Acorns that escape rodents produce seedlings that grow as well, or better than planted trees. We have coated acorns with two types of Arasan Endrin formulations. The repellent coatings did not prove to be as effective on acorns as they have on pine seed. Investigations with caged squirrels and cotton rats have helped us to understand the reasons for failure and we plan further research on this problem.

The foregoing discussion has dealt in a very general way with a description of wetland forest sites and the silvical research now underway in each of them at the Station's Charleston Research Center. The gaps in the knowledge of wetland silvics are obvious to those who are familiar with the research in this field. Inasmuch as the soundness of wetland forest silviculture depends upon the breadth and the scope of knowledge in the science of silvics, it is easy to see that present forest practices are somewhat shaky. No more incentive than this should be necessary to encourage more intensive silvical research in the wetlands.