Research is Improving Management, Understanding Effects, and Restoration

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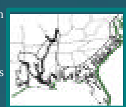
Improved Management

Bottomland Hardwood Silviculture

Southern bottomland hardwood forests are found on about 13 million hectares, along major and minor rivers, streams, and swamps from Virginia to Texas. These forests are ecologically diverse, supporting upwards of 70 commercial tree species and other non-commercial trees and shrubs. Successful management of these diverse ecosystems is complex, requiring an understanding of the unique biological requirements, silvical characteristics, and growth patterns of each species. My research has concentrated on understanding ecosystem processes and ecological functions of these systems, the effects of harvesting on these processes, and on the more practical aspect of securing adequate oak regeneration following harvest.



Present extent of bottomland hardwoods in the South

Iatt Creek Ecosystem Management Study, (Kisatchie National Forest, LA) Iatt Creek is a reference wetland, long-term study site, part of a south-wide study of forested wetland functions. These wetlands provide a baseline for assessing ecosystem structure and function that is critical to maintenance of biodiversity. Iatt Creek is an approximately 900 acre bottomland hardwood stand on the Winn Ranger District. Site has been instrumented for hydrology and meteorology, and is the focus of several on going studies, including vegetation dynamics, decomposition and nutrient cycling, and bird communities. A canopy access tower provides the ability to measure whole-tree physiological parameters and provides data for use in models of stand response to global climate change.

Iatt Creek in Summer

Iatt Creek in Winter

Regenerating bottomland hardwood forests following harvest usually depends upon advance regeneration and/or sprouting of the cut stems. However, the low regeneration success of desirable species illustrates our need to better understand regeneration dynamics in floodplain forests. Studies of the environmental factors that influence survival and growth of advance regeneration are helping to determine whether survival and growth of advance regeneration can be enhanced by pre-harvest treatments. A very useful but qualitative system for assessing the regeneration potential of clearcut bottomland forests was developed by Bob Johnson in the 1970s. We tested the system quantitatively and found that it gave too much weight to small seedlings of red oaks and green ash. We provided managers with probabilities for estimating stocking directly.

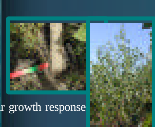
Intensive Plantation Culture

Fertigation of cottonwoods

Reduced timber harvest levels on public land in the United States and increasing emphasis on sustainable forestry on private land has shifted production of woody biomass to the southern states. Private landowners are interested in more intensive culture of fast-growing trees. High biomass production rates, as much as 36 Mg ha^{-1} yr^{-1}, make *Populus* ideal for short rotation intensively managed systems. Four commercially available clones of Eastern cottonwood were established in a fertigation experiment in March 2000 in Stoneville, Mississippi. Fertigation is the term given to the system for delivering soluble nutrients in irrigation water using drip-irrigation technology.

The objectives of the study include determining growth response (height, dbh, biomass) to five combinations of nutrients and water additions; examining morphological and physiological control of production efficiency; and monitoring fertilizer movement and risk of groundwater contamination. Four clones were chosen for their differences in phenology and crown architecture, but all are considered adapted to moderate to good site conditions and used in commercial plantations in the Lower Mississippi Alluvial Valley. The four clones are used operationally; three were selected from native populations along the Mississippi River (ST66, ST72, ST75) and one is from an east Texas population (S7C15). Cuttings were established according to operational practice, including soil ripping, fertilizations with 112 kg ha^{-1} soluble nitrogen fertilizer applied in the planting slit, pre-emergent competition control and spot control of Johnson grass during the growing season. Cuttings were planted in mid-March 2000 and began to leaf out in April.

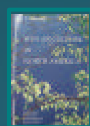
Distribution Manifold



First year growth response

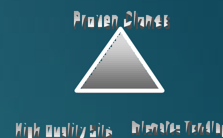
Guide to Cottonwood Culture

Poplars are some of the fastest growing trees but interest in growing them has fluctuated and objectives have shifted. Currently, most poplar plantations are established for pulpwood or chip production on rotations of 10-years or less. Growing poplars in plantations is challenging and good establishment the first year is critical to long-term success. Successful poplar culture depends on three things: planting the best quality stock on high-quality sites and providing timely and appropriate cultural treatments. A new book describes poplar culture in North America, including a chapter on ecology and silviculture of plantations.



Coppiced stand

Three-year-old eastern cottonwood plantation on a Commerce soil (high site quality)

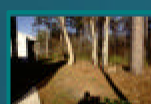


Key elements of growing cottonwood

Improved Management

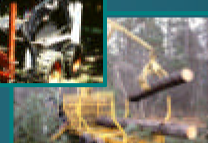
Managing Fuel Loads at the Wildland Urban Interface

Prescribed fire is used routinely in the South to reduce fuel loading and decrease the risk of catastrophic wildfires; to improve forest health; and to manage threatened and endangered species. With rapid human population growth, and increasing urban/wildland interface, the ability to use prescribed fire in essentially suburban environments is practically impossible. Nevertheless, fuel reduction treatments still are needed in fire-dominated "urban woodlands." Alternatives to prescribed burning may involve mechanical reduction of current fuel loads and maintenance of low-risk understory through herbicides. Techniques are needed that can effectively reduce fuel loads through mechanical means, and are acceptable to homeowners. Additionally, utilization scenarios need to be identified for this class of raw material to make removal economically attractive to operators. An integrated system is being developed that will manage fuel loads in urban woodlands through mechanical means. Four aspects of this research and development project include: (1) developing a vegetation management system that reduces current fuel loading by removal of small diameter, understory material and converts understory vegetation to low risk vegetation such as grasses; (2) validates the effectiveness of this system in reducing risk of catastrophic wildfire; (3) demonstrates the economic viability of the system by using low-cost harvesting methods and developing uses for the removed material; and (4) tests homeowner acceptance of the system by using focus groups in system design and by demonstrating the system in selected suburban areas in the South.



Wildland Urban Interface—Croatan National Forest, NC

Some equipment options



Ecological Effects

Harvesting Impacts in Bottomland Hardwoods

Floodplain forests have been harvested for nearly 200 years. Only in the last 15 years, however, has information on the ecological effects of harvesting become available. Hydrology drives processes in floodplain forests, and timber harvesting usually has no long-term effect on hydroperiod. Harvesting followed by natural regeneration poses no threat to ground or surface water quality, as long as Best Management practices are followed. Decomposition rates may increase, but the this seems to be controlled by wetness of the site. Vegetation productivity appears, at least in the short term, to be maintained at pre-harvest levels. Species composition is influenced by harvest method, both of woody species and amphibians.

Cottonwood logs at Tendal Lumber Co., LA in 1928

Ecological Effects

Management Effects on Soil Carbon

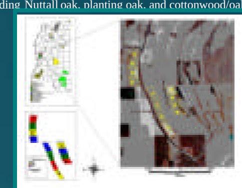
Forests play an important role in the global carbon cycle and contain more carbon than is found in the atmosphere. Forests in the US contain about 50 billion metric tons of carbon. Although forest management is a controversial topic in negotiations implementing the Kyoto Protocol to the UN Framework Convention on Climate Change, most observers agree that afforestation activities will qualify for carbon sequestration credits. The need remains, however, for an accounting system at the sub-national level to account for effects of forest management systems on carbon pools and fluxes, and for information on major components of the forest carbon budget. My research will focus on three management scenarios and the effect on carbon cycling and carbon sequestration: afforestation, fire, and land use change.

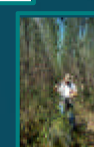
Restoration

Bottomland Hardwoods

Forest cover has declined globally, from an estimated 6 billion ha of "original" forest extent to the present 3.45 billion ha. Global assessments of forest condition identify the factors causing loss of forest cover and degradation of remaining forests, including changing land use, increasing demand for fiber, and exogenous stresses such as global climate change and loss of biodiversity. Many areas in the southern United States are experiencing disturbances and stresses that negatively affect ecological stability. Restoration of the myriad communities of bottomland hardwoods and the diverse communities of fire-dominated pine forests is the subject of intense interest in the southern United States, which mirrors international efforts to counteract these negative trends. My research on bottomland hardwood restoration will continue, centering on work at the Sharkey Restoration Site and other continuing studies.

Sharkey Restoration Site, Mississippi—In 1995, through the transfer of lands from the Farmers Home Administration to the U.S. Fish and Wildlife Service and USDA Forest Service a partnership was formed to restore this abandoned farmland while providing information to the public. This area is located in the LMAV in Sharkey County Mississippi and is known as the Sharkey Restoration Site. Work at the Sharkey Restoration Site is demonstrating several approaches to restoration, from the lowest intensity "let nature do it" to an intensive approach to afforestation which provides a landowner with options to produce income from timber, and provides opportunities to manipulate restored stands in the future to further enhance wildlife habitat. The main study is a large-plot study/demonstration of four levels of restoration intensity: natural succession, direct seeding Nuttall oak, planting oak, and cottonwood/oak interplanting.





Cottonwood interplanting study, first year (above) and third year (right)

Looking for ways to improve establishment, including protection and competition control

Restoration

Shortleaf Pine-Bluestem

Restoration of shortleaf pine savanna requires several changes in management. First, sawtimber rotation is lengthened from 70-80 years to 120 years, which allows longer retention of suitable cavity trees for the red cockaded woodpecker, and results in a larger and higher-quality pine sawtimber at harvest. Second, the pine component is subjected to a low thinning to reduce overstory basal area. Third, the hardwood midstory component, which developed in the 60-year period of fire exclusion, must be removed. Fourth, periodic prescribed fires are reintroduced on a three- to five-year cycle to reestablish the native prairie flora. Rootstocks and seed for these woodland savannah plants are still viable in the area, and no special effort other than reintroduction of burning is needed for their reestablishment.

Pine-Hardwood to Shortleaf Pine-Bluestem System