TOWARDS SUSTAINABLE MANAGEMENT OF LOUISIANA'S COASTAL WETLAND FORESTS: PROBLEMS, CONSTRAINTS, AND A NEW BEGINNING

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ABSTRACT

Over 345,000 ha of forested swamps occur throughout the Mississippi River Deltaic Plain. Natural and anthropogenic changes in hydrology and geomorphology at local and landscape levels have reduced the productivity in many of these coastal wetland forests areas and have caused the complete loss of forest cover in some places. A summary and interpretation of the available science, suggestions for policy change, and a multidisciplinary (multi-responsibility) approach were needed to address these issues [in the context of private land]. In response, the Louisiana Governor's office formed a Coastal Wetland Forest Conservation and Use Science Working Group (SWG) and an associated Advisory Panel to provide the Governor with information and suggestions of strategies for environmental and economic utilization, conservation, and protection of Louisiana's coastal wetland forest ecosystem in the long-term. The process of engaging scientists, resource managers, and other stakeholders in this effort is described, and the recommendations of the SWG are presented relative to forestry practices and the potential for sustainable management of coastal wetland forests.

KEYWORDS. Baldcypress, tupelo, sustainability, regeneration, restoration,

INTRODUCTION

Louisiana is a state known for its wetlands (especially cypress swamps) and the slogan "A Sportsman's Paradise," but is not a state that has been known for its attention to the protection of the environment. However, the state has begun in recent years paying special attention to land loss from coastal erosion and subsidence and more recently to the loss of coastal wetland forests, especially cypress-tupelo swamps.

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Nearly all the cypress-tupelo forest in Louisiana today are second growth, originating as natural regeneration after logging about 100 years ago. The area of greatest commercial timber production included all of the alluvial floodplain of the Mississippi River but mainly was concentrated in the area south of Baton Rouge (Mattoon, 1915). Some of these forests never regenerated, or did regenerate but later converted to treeless marsh or open water. The actual acreage and amount of cypress-tupelo forests loss over time in south Louisiana has not been well documented primarily because of the various ways the resource has been measured in the past (Norgress, 1947; Mancil, 1972; Conner and Toliver, 1990). The period of maximum harvest was the 1890's through the 1930's (Figure 1), but other causes of forest loss, such as subsidence and saltwater intrusion through canals constructed for navigation and oil and gas exploration, continue to this day.

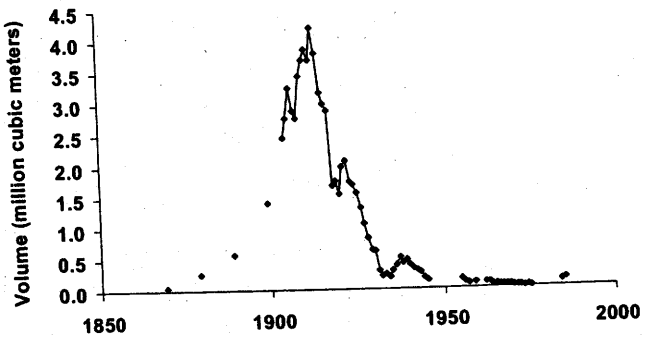

Figure 1. Volume of baldcypress cut in Louisiana from the late 1870's to the 1980's.

Much of the emphasis on reducing coastal loss and beginning coastal restoration focused on coastal marshes until the late 1990's. Conner and Toliver (1990) indicated that cypress-dominated ecosystems of coastal Louisiana have experienced widespread hydrological, biogeochemical, and biological changes over the past century, and declines in some populations have been apparent. Little is known about the present state of cypress ecosystems at the scale of the entire coastal Louisiana region. This knowledge gap developed because of physical inaccessibility and lack of active forest management following the period of intense logging in the early 20th century. Several factors have raised concern regarding the long-term viability of Louisiana's coastal wetland forests. These include: the increasing number of scientific reports of cypress-tupelo forest death and decline beginning in the 1980's (Brinson et al., 1985; DeLaune et al., 1987; Allen, 1992; Conner, 1993; Gresham, 1993; Williams, 1993; Pezeshki et al., 1990; Krauss et al., 2000; Conner and Inabinette, 2003); the cypress-tupelo forest decline along the highly visible Interstate 10 and 55 access corridors to New Orleans; and the recent interest in the harvest of cypress in Louisiana, including the building of a new cypress sawmill at Roseland, Louisiana, and the marketing of cypress garden mulch.

Consequently, concern over the decline of swamp forests in South Louisiana has increased in recent years. It was feared that their harvest might not be followed by viable regeneration or long-term establishment of new forests. Such problems could leave large areas of open water where swamp forests currently stand. Section 905(b) of the LCA Reconnaissance Report concludes that, despite current restoration efforts, swamps could be reduced as much as 93,000 ha by the year 2050. These figures do not include additional losses that may occur with the renewed interest in harvesting existing baldcypress forest in south Louisiana or losses to development and agriculture. With logging predicted to increase over the next 20 years, additional forest losses are also likely.

Over the years, several programs have been established to develop strategies to minimize or halt coastal wetland loss. In 1971, Louisiana established the Louisiana Commission on Coastal and Marine Resources to examine needs in coastal areas. Between 1970 and 1973 an assessment of

coastal erosion problems and potential planning approach were developed. The final report (Gagliano et al., 1972) from this effort became the prototype for restoration and planning in the state. The Federal Coastal Zone Management Act of 1972 added encouragement to the state's efforts. Louisiana's State and Local Coastal Management Act of 1978 established a Coastal Zone Management boundary in Louisiana. A series of other state and private activities between 1978 and 1988, including incorporation of the Coalition to Restore Coastal Louisiana, encouraged further efforts for coastal protection.

In 1989, the Louisiana Legislature passed the Louisiana Coastal Wetlands Conservation, Restoration and Management Act (Act 6 of the second extraordinary session) that established a structure for coastal restoration that included 3 main components:

> (1) the Wetlands Conservation and Restoration Authority. Chaired by the Governor of Louisiana or governor's designee, the Authority consists of cabinet level members of the Departments of Natural Resources, Wildlife and Fisheries, Transportation and Development, Environmental Quality, Agriculture and Forestry, and the Commissioner of the Division of Administration, who develops an annual "Wetlands Conservation and Restoration Plan;"
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> (2) the Governor's Office of Coastal Activities and the Office of Coastal Restoration and Management within the Department of Natural Resources coordinate and manage components of Louisiana's coastal restoration program; and
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> (3) a constitutionally dedicated fund for restoration projects or matching requirements to federal dollars, administered by the Department of Natural Resources was created.

The Federal Coastal Wetland Planning Protection and Conservation Act (CWPPRA), also commonly referred to as the Breaux Act, was passed in 1990. CWPPRA was the first national mandate for restoration of Louisiana's coastal wetlands. It required the development of a comprehensive plan for coordinating restoration projects to ensure the long-term conservation of the coastal wetlands of Louisiana. It also called for an annual priority project list authorized for construction dollars.

The 1998 Coast 2050 Plan was developed as the foundation for the May 1999 Reconnaissance Report, "Section 905(b) (U.S. Water Resources Development Act, WRDA 86) Analysis of Louisiana Coastal Area, Louisiana-Ecosystem Restoration." The report recommended the implementation of feasibility studies contingent on the execution, in year 2000, of a Feasibility Cost Sharing Agreement with the State of Louisiana through the Department of Natural Resources (amended in 2002; Federal Register, [2002]). In the spring of 2002, the U.S. Army Corps of Engineers held public scoping hearings, soliciting input from federal, state and local agencies, Indian tribes and other interested parties. This set the stage for seeking programmatic authorization for funding under WRDA to implement strategies from the Coast 2050 Plan through the Louisiana Coastal Area (LCA) Feasibility Study designed to foster restoration and protection of Louisiana's coastal ecosystem. The LCA Ecosystem Restoration Study was completed in November of 2004.

Although much of the past efforts towards halting coastal erosion and restoring wetlands have concentrated on marshes, over 345,000 ha of swamp forests occur in the deltaic plain of the Mississippi River and many are in decline. Natural and anthropogenic changes in hydrology and geomorphology at local and landscape levels have reduced the productivity in most coastal wetland forests and have caused the complete loss of forest cover in some places.

This paper outlines the formation of the Louisiana Governor's Science Working Group (SWG) on Coastal Wetland Forest Conservation and Use and an associated Advisory Panel. The process of engaging scientists, resource managers, and stakeholders in this effort is described, and the recommendations of the SWG are discussed relative to forestry practices and the potential for sustainable management of coastal wetland forests.

ENGAGEMENT PROCESS

In 2002, the Governor's Office hosted a meeting of forestry and natural resources professionals to discuss concern over the future of coastal wetland forests, especially cypress-tupelo forests. The meeting was called in light of the concern over increased interest in harvesting, the perceived decline in the condition of some south Louisiana wetland forests, and the need for information regarding factors affecting sustainable management of these forests. Renewed interest in the forested wetland resource by the forest industry and private loggers had begun to target the second-growth cypress in areas logged 80-100 years prior. The renewed interest in harvesting coastal forests, in particular cypress forests, also raised questions about environmental issues and the ability of some of these forests to regenerate. There was concern that regeneration and sustainability of the swamp forests might not be receiving adequate consideration in coastal and other wetland areas of southern Louisiana. It was recognized that research into the impacts of harvesting practices in the largely changed landscape of the coastal wetland forest was generally lacking. For example, although some research indicates that sprouts from cypress stumps will reforest harvested lands (Ewel et al., 1989), little published long-term scientific evidence was readily available to support this premise.

A comprehensive analysis of current scientific knowledge and existing field evidence for conditions conducive to regeneration and successful establishment of Louisiana's coastal wetland forests was needed. In early 2004, the Governor's office commissioned a group of scientists to conduct a comprehensive assessment of the current knowledge and conditions in Louisiana's coastal wetland forests. The SWG on Coastal Wetland Forest Conservation and Use was comprised of a group of scientists with expertise in coastal wetland forest issues.

The mission of the SWG was to provide information and guidelines for the long-term utilization, conservation, and protection of Louisiana's coastal wetland forest ecosystem, from both environmental and economic perspectives. To accomplish this mission, the following objectives were developed by the SWG:

1) Gather and synthesize scientific information available on regeneration, growth, and potential harvesting effects on coastal wetland forests.

2) Gather and summarize field information on general characteristics of previously harvested cypress and tupelo forest stands to evaluate their potential to regenerate, become established, and remain vigorous.

3) Review existing laws, regulations, policy, and guidelines affecting coastal forestry activities (and current forest conditions).

4) Develop science-based, interim guidelines for the conservation and utilization of coastal wetland forests.

5) Identify critical areas of priority research needed to refine these interim guidelines.

A policy oriented Advisory Panel on Coastal Wetland Conservation and Use was also established by the Governor's Office to advise the SWG. The SWG was able to hear concerns and needs of various interest groups within the Advisory Panel, including private landowners, environmental groups, forest industry, non-government organizations, and state and federal agencies through regular input from the Advisory Panel. Regular interaction between the SWG and the Advisory Panel encouraged a balance between conservation, restoration, and use of coastal renewable natural forest resources.

FINDINGS AND RECOMMENDATIONS OF THE SWG

The SWG published a draft report and solicited comments from the Governor's Advisory Panel and the public "at large." The comments submitted to the SWG and to the Governor's office were reviewed by the SWG and were considered in the writing of the Final Report that was submitted

the Governor's office April 30, 2005. For details on the recommendations of the SWG, see the final report at www.coastalwetlandforestswg.lsu.edu.

SWG Report Findings

The following summarizes the findings of the SWG:

Louisiana's coastal wetland forests are of tremendous economic, ecological, cultural, and recreational value to residents of Louisiana and the people of the United States and the world. The functions and ecosystem services of Louisiana's coastal wetland forests are threatened by both large- and small-scale hydrologic and geomorphic alterations and by conversion of these forests to other uses. Subsidence, sea-level rise, and levee construction are the principal large-scale hydrologic and geomorphic alterations responsible for the loss of Louisiana's coastal wetland ecosystems including coastal wetland forests. Cumulative effects of small-scale or local factors can be of equal or greater importance in coastal wetland forest loss and degradation to large-scale alterations. These factors include increased depth and duration of flooding, saltwater intrusion, nutrient and sediment deprivation, herbivory, invasive species, and direct loss due to conversion.

Under less severe impacts, many of the important functions and ecosystem services are lost or degraded even though the trees may be intact and the forest may appear unaffected. Without appropriate human intervention to alleviate the factors causing degradation, most of coastal Louisiana will inevitably experience the loss of coastal wetland forest functions and ecosystem services through conversion to open water, marsh, or other land uses.

Regeneration is a critical process of specific concern in maintaining coastal wetland forest resources. Successful natural regeneration of this resource in the 1920s was due to fortuitous conditions existing at that time and there is a lack of regeneration in coastal cypress-tupelo forests today.

In those areas where flooding prevents or limits the natural regeneration of the cypress-tupelo forest, artificial regeneration through tree planting is the only currently viable mechanism to regenerate the forest. Some swamps are altered to such a significant extent that even artificial regeneration is not possible. A field survey of eighteen previously harvested sites indicated that coppice or stump sprouting does not provide sufficient numbers of viable trees to reliably regenerate the forest, even under optimum conditions.

Conditions affecting the potential for forest regeneration and establishment are recognizable based upon existing biological and physical factors. The SWG developed a set of condition classes for the dominant wetland forest type in Louisiana's coastal cypress-tupelo forests. Assuming average rainfall conditions and no extreme or unusual events, the SWG set the general description of the three condition classes for cypress-tupelo as follows, but more details are included in their report:

SWG Condition Class I: Sites with Potential for Natural Regeneration

Sites generally connected to a source of fresh surface or ground water and flooded or ponded periodically on an annual basis (pulsing). These sites must have seasonal flooding and dry cycles, have both sediment and nutrient inputs, and are not subsiding.

SWG Condition Class II: Sites with Potential for Artificial Regeneration Only

These sites may have overstory trees with full crowns and few signs of canopy deterioration, but are either permanently flooded (which prevents seed germination and seedling establishment of cypress and tupelo) or are flooded deeply enough that when natural regeneration does occur during low water, seedlings cannot grow tall enough between flood events for at least 50% of their crown to remain above the high water level during the growing season. These conditions require artificial regeneration, (i.e., planting of tree seedlings). Water depth was restricted to a maximum of two feet for practical reasons related to planting and production of tree seedlings.

SWG Condition Class III: Sites with No Potential for either Natural or Artificial Regeneration

These sites are either flooded for periods long enough to prevent natural regeneration and practical artificial regeneration, or are subject to saltwater intrusion with salinity levels that are toxic to cypress-tupelo forests. Two trajectories are possible for these two conditions: 1) freshwater forests transitioning to either floating marsh or open fresh water, or 2) forested areas with saltwater intrusion that are transitioning to open brackish or saltwater (marsh may be an intermediate condition).

The current Louisiana Coastal Zone Boundary does not accurately reflect the full extent of Louisiana's coastal wetland forests and reduced focus on large scale restoration and protection activities outside the Louisiana Coastal Zone Boundary make these forest areas more vulnerable to loss and degradation from detrimental impacts.

SWG Recommendations

In its final report, the SWG made recommendations to the Governor's Office regarding actions that the state could take to conserve and protect these forests. In general terms, the SWG recommended the following:

- Place priority on conserving, restoring, and managing these coastal wetland forests.
- Recognize the set of three condition classes outlined by the SWG relative to regeneration of specific sites.
- Place priority on maintaining the hydrological regime of the most productive sites, while avoiding loss of the more sensitive sites.
- Place a moratorium on harvesting state owned Condition Class III forests and seek ways to delay harvesting those private forest lands not likely to regenerate, until conditions are changed (consider use of incentives).
- Help to ensure proper management and regeneration through written forest management plans with specifics on regeneration.
- Develop spatially explicit database and long-term monitoring efforts with regular updating to guide management.
- Recognize an expanded area for coastal forests conservation.
- Ensure that all agencies and organizations share and coordinate information, develop practices to prevent coastal wetland forest loss, and actively pursue restoration of degraded forests.
- Enhance ecosystem functions through hydrological management decisions related to construction and other activities in wetland areas.

FOLLOW-UP

The collaboration between scientists and policy makers continues in the effort to implement SWG recommendations. The Governor's Office of Coastal Activities conducted several follow-up activities to the Science Working Groups Report. First, it conducted a series of four public hearings outlining the problems in coastal forests and the final report findings and recommendations of the SWG. The Governor's office then expanded and extended the Advisory Panels efforts to include formal input to the Governor's office relative to implementation of certain recommendations of the SWG, defining the coastal forest area to be used in the future, and providing its own suggestions about incentives and other needed actions by the Governor's office relative to coastal wetland forests. The Advisory Panel has met a number of times in a facilitated discussion format and is working towards a report for the Governor's office that will likely be finished before the end of the year.

An outside group composed of members of a number of members of the Advisory Panel is currently working on a set of Interim Forest Practices Guidelines relative to harvesting and regeneration of coastal wetland forests in Louisiana. A coastal forest regeneration research

meeting was scheduled for November of 2005 to prioritize research related to regeneration of coastal wetland forests.

Several other factors will also affect the nature and outcome of these activities. The U.S. Army Corps of Engineers (ACE) and the U.S. Environmental Protection Agency (EPA) are also involv in factors affecting wetland use in Louisiana. Questions have arisen regarding forestry exemptio to Section 404 of the Clean Water Act and the use of Section 10 of the Rivers and Harbors Act t regulate forest harvesting in wetlands. Currently there are a number of discussions and decisions pending with regards to these laws and there application in Louisiana wetlands. To date, both the EPA and the U.S. Fish and Wildlife Service (FWS) have recommended that the ACE consider a Programmatic Environmental Impact Statement regarding coastal wetland forests in Louisiana. Action on this remained unresolved at the writing of this paper. Louisiana's efforts in the U.S. Senate have been related to both funding of coastal restoration and altering ACE and EPA involvement in harvesting of cypress-tupelo swamps.

SUMMARY AND CONCLUSIONS

Not all entities in Louisiana recognize that coastal wetland forests are in trouble. However, the State has recognized the problem and began to place more emphasis on finding solutions to the problem. Establishment of the SWG on Coastal Wetland Forest Conservation and Use was a ma step forward in the process of finding science-based answers to the problems. The SWG consolidated the scientific knowledge related to the value and the condition of the coastal wetla forests. They made recommendations for change based on the science available to date. The sta of Louisiana has conducted public hearings and taken public comment on the SWG's final repo The next steps include: garnering input from the Advisory Panel based on the SWG recommendations and the need to strike a proper balance between conservation, restoration, an use of coastal wetland forest resources; develop methods to map SWG Condition Classes from remotely sensed data; establish a means of identifying the SWG Conditions Classes on the gro without the need to collect hydrological regime data from each site; provide a set of incentives encourage landowner conservation of coastal wetland forests; and develop and implement methods to restore coastal wetland forests.

Hydrology in much of South Louisiana has been altered over the years by factors including lev construction, pipeline operations, oil and natural gas exploration, shipping concerns, and subsidence. Current forestry practices have failed to take into account the impact of these chan on the regeneration and productivity of coastal wetland forests. Sustainable use of coastal wetl forests will require major changes in the State's efforts to restore sustainable processes (e.g. sediment and nutrient input, and flood pulsing), the careful coordination among agencies and industries working in coastal areas regarding hydrological management, and the willingness o forest industry and private landowners to do their part to ensure the future of these forests. A concerted effort towards producing sound research knowledge of these forests and their restor is also critical to their future.

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