CONSERVATION OF LOUISIANA'S COASTAL WETLAND FORESTS

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ABSTRACT

Large-scale efforts to protect and restore coastal wetlands and the concurrent renewal of forest harvesting in cypress-tupelo swamps have brought new attention to Louisiana's coastal wetland forests in recent years. Our understanding of these coastal wetland forests has been limited by inadequate data and the lack of a comprehensive review of existing information. The importance of these forests is now being recognized and the loss and degradation of the ecosystem functions and services provided by Louisiana's coastal wetland forests is significant. Since Louisiana's coastal wetland forests are of tremendous economic, ecological, cultural, and recreational value to Louisiana, the country, and the world, the Louisiana Governor's office commissioned a Science Working Group to examine these forests and make recommendations for their conservation, protection and use. This paper summarizes the report findings and provides recommendations for what

state government, professional foresters, research scientists, landowners, and the public can do to ensure the sustainability of Louisiana's coastal wetland forests well into the future.

INTRODUCTION

Wetland forest regeneration, long-term establishment, and forest sustainability have received little attention in Louisiana. The coastal wetland forests of Louisiana represent 400,000 ha and are of tremendous economic, ecological, cultural, and recreational value to residents of Louisiana, the people of the United States, and the world. Large-scale and localized alterations of key processes affecting coastal wetland forests have caused the complete loss of some and reduced the productivity and vigor of much of the remaining areas. Moreover, loss and degradation of these forests threaten ecosystem functions and services they provide.

In response to the increasing concern over loss of and adverse impacts on coastal wetland forests, the Governor of Louisiana commissioned the formation of the Science Working Group on Coastal Wetland Forest Conservation and Use (hereafter referred to as the Science Working Group or SWG). At the request of the SWG, the Governor also established an Advisory Panel to the SWG representing a diverse cross-section of stakeholders including agencies, forest industry, landowners and non-governmental organizations. The mission of the SWG was to provide information and develop 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:

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 baldcypress 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.

The purpose of this paper is to address the sustainability of Louisiana's Coastal Wetland Forests based on the findings of the Science Working Group, present recommendations developed by the SWG, and to make further recommendations for natural resource managers and the public about how best to manage this important resource.

BACKGROUND

Coastal forested wetlands are freshwater ecosystems typically divided into two general categories in Louisiana: swamps or bottomland hardwood forests. The coastal Chenier forests can be considered a subtype of the latter. Natural forested ecosystems of coastal Louisiana are dominated by the underlying geomorphic processes responsible for their formation. The Mississippi and Atchafalaya rivers have had the largest impact on the development of the Louisiana coast and the deltaic plain formed by these rivers in southeastern Louisiana. In addition their impact on the Chenier plains to the west is of importance. The majority of Louisiana's wetland forests are in the Lower Mississippi River Alluvial Valley (LMV) and the Deltaic Plain. Saucier (1994) indicated that the true geologic boundary of the Deltaic Plain extends to the head of the Atchafalaya River. This selected area includes large areas of coastal wetland forests extending beyond the Louisiana Coastal Zone Boundary, especially in major river bottoms draining to the coast (e.g., Atchafalaya and Pearl River basins) and those with extensive areas of wetland forests (e.g., Lake Maurepas). This region also corresponds well with the general physiographic regions associated with the coastal areas, factors governing forest establishment and continued human impacts. Two USDA Forest Service inventory regions in Louisiana, together comprising 31 parishes, represent this area in a convenient format (Figure 1, upper map). Therefore, the SWG adopted these combined regions as the area of primary interest for assessing coastal wetland forests (Figure 1, lower map).

IMPORTANCE OF COASTAL WETLAND FORESTS

The SWG chose to concentrate its efforts on the wetland forest type most heavily affected by changes in the coastal region of the state, cypress-tupelo. Cypress-tupelo dominated wetland forests are a unique and valuable ecosystem in the southeastern United States. These forests are valuable for the functions and services they provide. Wetland functions are the natural physical, chemical, and biological processes that define the wetland ecosystem and can be broadly grouped into biotic, hydrologic, and biogeochemical functions (Brinson 1993, Smith et al. 1995). Examples include surface water storage (hydrologic), maintaining plant and animal communities (biotic), and nutrient cycling (biogeochemical). Functions of each wetland vary, in terms of functional capacity or the degree to which the functions are performed, depending on the health of the wetland and the landscape setting (Mitsch and Gosselink 2000). Wetlands are uniquely suited to mitigate nonpoint source pollution. Their landscape position and biogeochemical properties give wetlands both the opportunity and mechanisms to alter pollutant loadings to aquatic ecosystems (Johnston 1991). Although wetlands have a wide range of denitrification rates (Mitsch et al. 2001), natural forested wetlands generally have a high denitrification capability (Ambus and Lowrance 1991, Groffman et al. 1992. Ullah et al. 2005). Thus nitrogen is removed from runoff before it can reach coastal marine ecosystems where it contributes to coastal eutrophication including in the hypoxic zones (dead zones) that develop each year off the Louisiana and Texas coasts. Phosphorus, another pollutant important to the formation of dead zones, accumulates in wetlands, primarily in the soil compartment (Faulkner and Richardson 1989). Phosphate coming into wetlands with mineral soils and high amorphous iron and aluminum oxides is adsorbed by these oxides and retained in the wetland soil. In wetlands with organic soils and little oxalate-extractable iron and aluminum, phosphate is taken up by plants and converted to the organic form and phosphorus is retained by the buildup of soil organic matter over time (Craft and Richardson 1998).

Another important function of coastal wetland forests is to provide fish and wildlife habitat. Songbirds, wading birds, waterfowl, raptors, reptiles, amphibians, mammals, crawfish, and fish are common permanent or seasonal inhabitants of Louisiana's coastal forests. Few studies have actually quantified these habitat functions and values. It is generally understood that the actual value of any particular tract depends upon the animal species of interest and characteristics of those forests, including location and size of the stand, connectivity to adjacent stands and habitats, landscape composition, hydroperiod, vertical structure, tree sizes and species composition (Merrell 1977, Brody et al. 1989, Mitchell and Lancia 1990, Skelly 1995, Schneider and Frost 1996, Brokaw and Lent 1999, Haila 1999, Bodie and Semlitsch 2000, Barrow et al. in press).

Louisiana's coastal forests are positioned within a major corridor for migrating neotropical North American landbirds. Millions of birds annually migrate across or near the Gulf of Mexico. Virtually all of the terrestrial migrating eastern bird species in the United States and numerous species from the western United States migrate through the coastal forests of Louisiana (Lowery 1974, Barrow et al. in press). These forests are the last, or first, vestiges of land for many species prior to, or after, crossing the Gulf of Mexico. Thus, these sites provide important food and cover resources for such birds. These coastal forests are habitats that allow the birds to feed and accumulate energy for the trans-Gulf flight. Hydrological conditions in coastal forested wetlands are important to many species, because these species rely on the understory and the forest floor for food resources. These resources are often not found in the most frequently flooded forests because of sparse understory development. Thus, increases in flooding as a result of global climate change or hydrologic alterations can degrade less frequently flooded forests, including bottomland hardwood forests, and reduce habitat quality for neotropical bird species. In addition, coastal wetland forests are important for wintering populations of many waterfowl species.

The Atchafalaya Basin represents the single largest tract of wetland forests remaining in the Lower Mississippi River Alluvial Valley, and it is a critical component of songbird conservation efforts spearheaded by the Lower Mississippi River Valley Joint Venture Office. Although scientists are becoming increasingly aware of the impacts of hydrologic alterations on forest species composition, forest structure, and forest productivity, it is still unknown as to what impact hydrologic alterations, past and future will have on long-term avian productivity and community structure.

Louisiana's coastal forests also provide important wading bird habitat (Kushlan 1997, Michot et al. 2003). A number of species, such as white ibis, roseate spoonbills, wood storks, and a variety of herons, egrets, and other wading birds utilize Louisiana's coastal forests (Lowery 1974). Water depth, food types, amount of cover, and concentration of

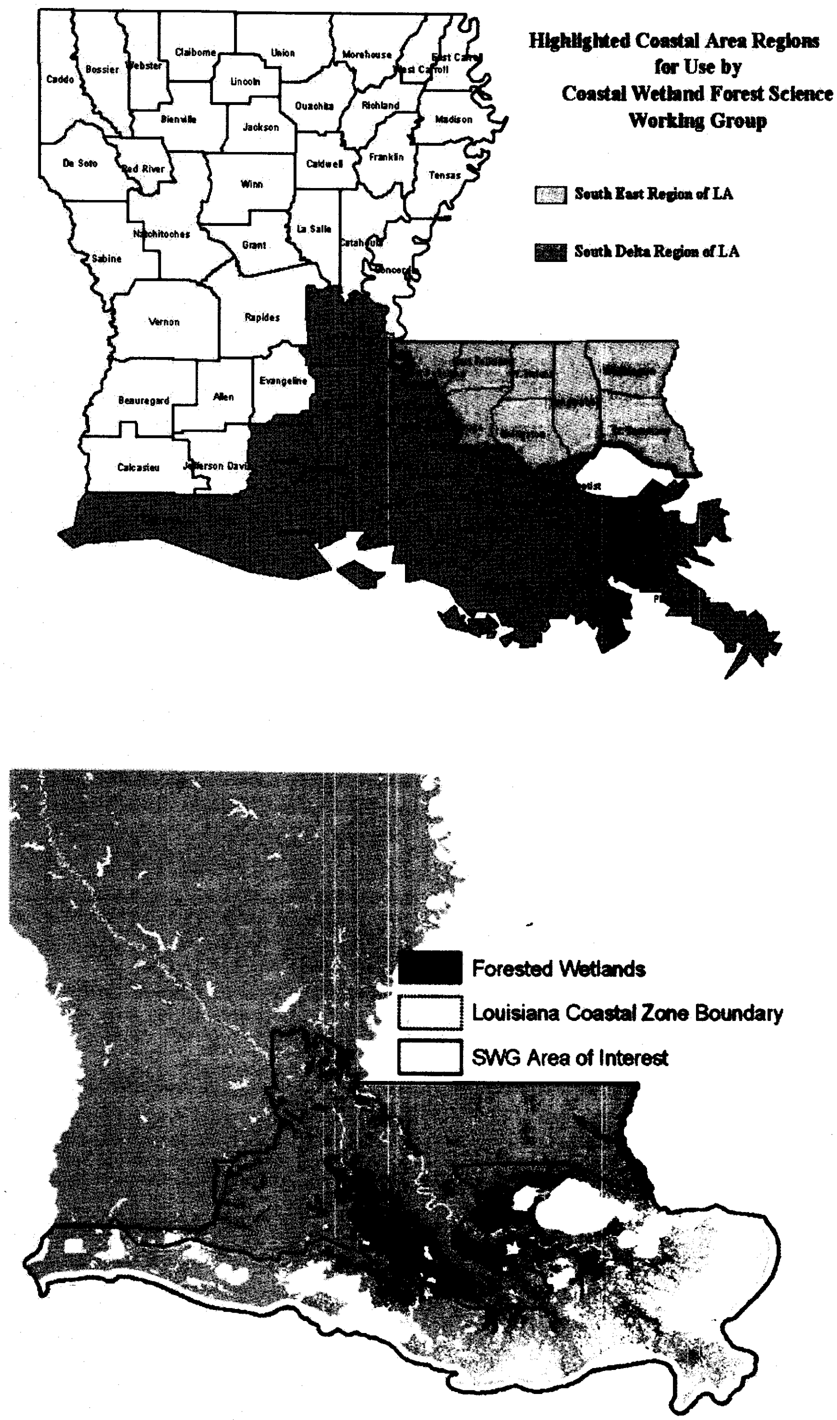

Figure 1 - Louisiana Coastal Wetland Forest Area established by the Governor's Science Working Group on Coastal Wetland Forest Conservation and Use; USDA Forest Service forest inventory regions composing the SWG Coastal Wetland Forest Area (upper); forested wetlands within the SWG Coastal Wetland Forest Area compared to Louisiana Coastal Zone Boundary (lower)

food resources are a few of the factors determining foraging habitat quality for these birds (Kushlan 2000). Since water depths that exceed the leg lengths of a specific wading bird species relegate those habitats as unsuitable, increasing floodwater depth has serious consequences. Annual seasonal drying of the swamp can concentrate food resources in drying pools and increase the quality of foraging habitat. In addition, this drawdown stimulates vegetative productivity which then increases productivity of invertebrates and vertebrate food resources.

Ecosystem services are the benefits that humans and society derive from the functions of an ecosystem. Costanza et al. (1997) estimated the value of ecosystem services worldwide. They estimated the ecosystem value of swamps and floodplains to be (\$19,580 ha^{-1} yr^{-1}), second only to coastal estuaries (\$22,832 ha^{-1} yr^{-1}). Services from wetland forest ecosystems include timber production, commercial fish, fur, and alligator harvests, recreation, flood storage, water quality maintenance and carbon storage (Messina and Conner 1998). There are no data specific to Louisiana's coastal wetland forests.

Based on recent stumpage volume and prices, the value of the cypress-tupelo timber in the area delineated by the Science Working Group is \$3.3 billion (Paul Frey, Louisiana State Forester, personal communication). The total value of freshwater fisheries and wildlife commodities in Louisiana in 2002 was \$278,053,689. While this value is not exclusive to the area of coastal forested wetlands, many of these resources rely on the benefits provided by this ecosystem. Wildlife-associated recreation expenditures totaled \$1.2 billion in Louisiana in 2001 (U.S. Department of Interior, Fish and Wildlife Service, 2001). During 2003 wildlife-associated recreation had a total economic effect of \$7.1 billion in Louisiana (Southwick Associates, 2005). These wildlife related values are not exclusive to the area of coastal forested wetlands; however, many of these resources rely on the benefits provided by the coastal forest ecosystem. One growth industry in the state, and especially southern Louisiana, is ecotourism, including swamp tours. Although it is beyond the scope of this effort to develop accurate estimates specifically for these wetlands, we can derive a rough estimate. From Costanza et al's (1997) value of \$19,580 ha^{-1} $yr^{-1}$for swamps and floodplains and the estimated 342,243 ha of cypress-tupelo forests reported by the USDA Forest Service, we can estimate a total value of \$6.7 billion per year

COASTAL FOREST LOSS

The Final Report to the Governor of Louisiana on Coastal Wetland Forest Conservation and Use by the SWG provided a consolidated source of information on coastal forests in the state. The report concentrated on two of the dominant species within the coastal forest area, baldcypress and water tupelo, and the stands and conditions to which they were exposed. Unlike the situation for coastal marshes, little consistent information is available on the change in area of these forests over time. Reports and estimates of area over time have been complicated by changes in categorization by different individuals or groups. Norgress (1947) and Post (1969) estimated that swamplands in Louisiana between 1848 and 1872 covered about 0.9 to 1.1 million ha, while Mattoon (1915) estimated the area of permanent swamp to be 3.6 million ha. The Louisiana Department of Conservation estimated that the 1934 area of cypress and denuded cypress was 0.67 million ha. As late as 1978, MacDonald et al. (1979) estimated wooded swamps to occupy 0.66 million ha in the Mississippi River floodplain. However, the 1991 estimate of oak-gum-cypress was 1.76 million ha (Rosson 1995). Knowledge gaps have developed from problems with classification, accessibility, and lack of active forest management. Studies of coastal land loss have largely omitted forest lands (e.g. May and Britsch 1984) and those that have (eg. Barras et al. 1994) omitted estimates of forest land loss due to harvesting and natural conversion.

According to Mattoon (1915), the area of greatest commercial production for baldcypress was concentrated in the area south of Baton Rouge. Detailed area, volume, and logging data do not exist for many areas (Norgress 1947, Mancil 1972), although scattered data does exist. Mattoon (1915), Norgress (1936, 1947), and Mancil (1972) described the history of baldcypress logging in Louisiana. Early settlers depended on these forest for a ready supply of timber for building and other uses, the heaviest extraction began in the 1890's and better methods of extraction led to increased use from the deeper or more remote areas of the swamps. During the 1890's, the pullboat, and later the overhead-cableway skidder, increased the range of extraction of baldcypress from the swamps. Therefore, the amount of timber that could be brought out of the forest increased dramatically. Based on data from several sources, the volume of baldcypress cut increased near the beginning of the 1890's and remained very high until the 1930's (Louisiana Department of Conservation 1943, Steer 1948, Louisiana Forestry Commission 1957, Louisiana Forestry Commission Progress Reports 1956-76, Mistretta and Bylin 1987). Conversion of lands to agriculture was a common practice, leading Norgress (1947) to suggest these forests were being converted to their "true function". Reduced volumes continued to be harvested until the mid 1950's when the last "cypress" sawmill was closed. Thereafter, harvests continued at low levels until the mid 1980's when helicopter logging provided easier access to the increasing volume of sawtimber-sized material. From 1986 until 2003 an estimated 3.4 million m^3 of baldcypress was harvested (Paul Frey, State Forester, Louisiana Department of Agriculture and Forestry, personal communication). In the last few years, harvesting activity has received renewed attention as increasing baldcypress sawtimber demand, increasing stumpage prices, and an increased demand for cypress mulch for the landscape industry have taken hold. The renewed interest and value of baldcypress has led to a new cypress mill that will be opening soon north of Amite Louisiana. The mill will use baldcypress exclusively.

CAUSES OF COASTAL FOREST LOSS

The dominant species in Louisiana's coastal wetland forests, baldcypress and water tupelo, are adapted to deep and prolonged flooding during the growing season, which gives them a competitive advantage over the less flood-tolerant species. If the hydroperiod is reduced enough to allow the less flood-tolerant species to become established, then those species will take over the site (Conner and Day 1976). It is much more likely that increased inundation (both depth and duration) and soil saturation associated with subsidence and sea-level rise will occur in coastal Louisiana. The structure and function of Louisiana's coastal forests will be significantly affected by increased inundation. Despite these adaptations, flooding is a stress that significantly lowers aboveground net primary productivity (NPP) of southeastern floodplain forests, and this impact is magnified in areas undergoing rapid hydrologic transformation (Megonigal et al. 1997). In addition, baldcypress seeds require a bare, moist seedbed and will not germinate under water (Matton 1915, DuBarry 1963). The increased flooding depths and durations in south Louisiana's coastal wetland forests may be a factor in the poor baldcypress regeneration.

A number of factors have led to the massive loss of coastal wetlands in Louisiana. The construction and maintenance of flood-protection levees has isolated south Louisiana from Mississippi River sediments, nutrients, and freshwater, which are critical to the long-term survival of coastal wetland forests (Kesel 1989, Boesch et al. 1994, Day et al. 2000). The Barataria, Lake Verret, and Lake Pontchartrain basins, located in south central and southeastern Louisiana, contain extensive freshwater wetland forests. All of these watersheds were once overflow basins of the Mississippi or Atchafalaya rivers. The construction of the flood protection levees along these rivers during the 1920-1940's, eliminated or substantially reduced the annual flushing with freshwater and deposition of nutrients and mineral sediments in these areas. Rainfall or backwater flooding are therefore now the main sources of freshwater. Riverine input and sediment deposition once served to prevent saltwater intrusion and sea-level rise by offsetting land subsidence.

The Barataria and Verret basins have experienced significant increases in the total number of days flooded per year. In Barataria Basin, the swamps have always been flooded to some extent, but many are now flooded almost year round (Conner and Day 1988, 1991). Since the 1950's, floodwater levels in the swamps of the Pontchartrain Basin have doubled (Thomson et al. 2002). For many years, people living and working in low-lying coastal areas have seen the impacts of sea-level rise on land loss and coastal forest loss. The increasing water levels resulting from eustatic sea-level rise and subsidence in many areas contribute to the degradation of coastal wetland forest areas. Subsidence rates for large areas of the Deltaic Plain have been estimated to range from 30 to 40 cm per century, while relative (eustatic + subsidence) sea-level rise in the Deltaic Plain is predicted to range from 50 to 100 cm over the next 100 years (Twilley et al. 2001). These rates substantially underestimate subsidence, according to more recent estimates from NOAA (Shinkle and Dokka, 2004). They indicate that subsidence is far greater than previously thought and exceeds 5 to 17 mm per year (50 to 107 cm per century). In coastal wetland forests with sufficient sediment input and organic accumulation from high primary productivity, their surface elevation is maintained despite sea-level rise (Baumann et al. 1984, DeLaune et al. 2004). In wetland forest areas not receiving sufficient inputs, water level and salinity increases lead to death of some of these forests, degradation of others, and prevention of regeneration and establishment of future forests.

As if the large-scale processes were not serious enough, degradation has been increased by management practices and development that have also altered and degraded coastal ecosystems. Logging and the building of canals and railroads altered the hydrology of many coastal areas (Mancil 1969, 1980). The effects of oil and gas, flood control, navigation, road construction, and agricultural activities have altered the original overland water flow patterns of the swamp. Large areas of swamp forest are now constantly flooded due to impoundment by spoil banks and other obstructions to flow (Conner et al. 1981). Canal construction has also increased saltwater intrusion and contributed to coastal wetland loss. An example is the Mississippi River Gulf Outlet that resulted in saltwater intrusion and huge coastal forest losses in areas like Lake Maurepas and Lake Ponchartrain.

THE FUTURE OF OUR COASTAL WETLAND FORESTS

The continued existence of coastal cypress-tupelo forest depends on replacement of trees following disturbance, especially the replacement following logging or other disturbances such as tropical storms and hurricanes. A number of studies (DeBell and Naylor 1972, Hook 1984, Kozlowski 1997) have shown that baldcypress and water tupelo swamps must have dry periods for the seed to germinate and establish. Coppice reproduction of baldcypress is possible, but current data indicates, that in many cases, the majority of sprouts die within several years and thus do not contribute as a reliable means of regeneration (Kennedy 1982, Conner et al. 1986, Conner 1988, Conner and Toliver 1990, Ewel 1996, Keim et al. 2005). If water levels continue to rise, death of trees and failure of regeneration and establishment within coastal forest areas will eventually lead to replacement by scrub-shrub stands, marsh, or open water.

Even with current restoration efforts, the area of swamps in Louisiana's Deltaic Plain is projected to decrease by 93,845 hectares by the year 2050. This represents 27% of the existing wetland forest in the Deltaic Plain and, in other areas, three of the nine basins will lose from 30% to 55% of their remaining swamps. Adding sediments and nutrients to these degraded coastal wetland forests is an essential component of sustaining the coastal wetland forest ecosystem (Day et al. 1999, 2000, 2003, Woods, 2004).

Continued water level rise will subject coastal forests to more prolonged and deeper flood events. Even though many of the forest species growing in these areas are adapted to prolonged inundation, extended flooding during the growing season can cause mortality and loss of productivity of these tree species (Mitsch & Ewel 1979, Conner & Brody 1989, Conner & Day 1992, Megonigal et al. 1997, Pezeshki et al. 1990, Young et al. 1995). Many of the trees in these areas are showing evidence of severe stress (Hoeppner 2002, Shaffer et al. 2003, Conner et al. 1993). Even baldcypress and water tupelo, two of the dominant species In Louisiana's coastal forests, can slowly die when exposed to prolonged, deep water flooding of longer than normal duration. Impoundments have been shown to have detrimental effects on adult trees through reduced growth, crown dieback, increased susceptibility to insects and pathogens, decreased root mass and increased tree mortality (Conner et al. 1981, King 1995, Keeland et al. 1997). The hydrologic changes produced by impoundment are rapid in comparison to those caused by subsidence and sea-level rise, and effects on forest productivity and turnover rates may differ between natural sites and artificial impoundments. With increased subsidence and sea-level rise, saltwater intrusion into coastal wetland forests reduces productivity and can kill baldcypress and water tupelo (Allen 1992, Krauss et al. 2000, Pezeshki et al. 1990). Baldcypress appears to tolerate salinity up to 8 ppt, but productivity and survival decline with salinity above 4 ppt (Pezeshki et al. 1990, Conner and Askew 1992, Conner 1994, Pezeshki et al. 1995, Allen et al. 1996, Conner and Ozalp 2002). Also of critical importance is the fact that these permanently flooded forests fail to regenerate and become established when trees are removed either by logging or natural disturbance. Together, these impacts are so substantial that loss of coastal wetland forests is nearly assured in some areas of coastal Louisiana without active measures to ameliorate problems.

Regeneration is a critical process of specific concern in maintaining coastal wetland forest resources. Successful natural regeneration of this resource in the 1920s and 1930's was caused by fortuitous conditions existing at that time. Baldcypress seeds cannot germinate in standing water, and seedlings must grow tall enough during short drawdown periods for their crowns to extend above the water surface to survive flooding during the growing season. Baldcypress seedlings can withstand complete inundation for up to 45 days, but long-term flooding above the foliage results in high mortality. Baldcypress is exacting in its needs, but regenerates well in swamps where there is ample sunlight and the seedbed is moist but not flooded during the period of seed germination and seedling establishment. Currently, there is a lack of regeneration in coastal cypress-tupelo forests that is a direct result of factors identified in this paper and their interactions with regeneration processes.

Since regeneration is a critical key to coastal forest protection and conservation, the SWG developed a set of regeneration condition classes for the dominant wetland forest type, Louisiana's coastal cypress-tupelo forests. Basically, Condition Class I includes seasonally flooded forests with a pulsing of fresh water and sufficient flood free period that natural regeneration can establish a new forest stand. Condition Class II has standing water for such a long period each year that natural regeneration is unlikely to succeed, but water levels of 120 cm or less make artificial regeneration feasible. Finally, Condition Class III includes either forests that are flooded deeper than 120 cm on a permanent basis or those sites affected by salinity levels that make even artificial regeneration improbable or impractical. Development of methods of analyzing sites for these attributes will allow recommendations regarding regeneration where possible. Those forests in Condition Class III must have a restored hydrological regime before they can be regenerated in a practical way. Therefore, these forest stands should not be harvested under the current set of conditions.

WHAT CAN BE DONE TO CONSERVE AND PROTECT LOUISIANA'S COASTAL WETLAND FORESTS?

What the State Can Do

The SWG on Coastal Wetland Forest Conservation and Use made recommendations to the Governor's Office regarding actions that the state could take to conserve and protect these forests. For details on the recommendations by the SWG, see the report at www.coastalwetlandforestswg.lsu.edu. In general terms, the SWG recommended the following:

- Place priority on conserving, restoring, and managing these coastal wetland forests.
- Recognize the set of condition classes that the SWG outlined relative to regeneration ability of specific sites.
- Place priority on maintaining the hydrological regime of the most productive sites and avoid loss of the more sensitive sites, including placement of a delay in harvesting those not likely to regenerate until conditions are changed.
- Help to ensure proper management and regeneration through recommendations on 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 of coastal forests.
- Ensure that all agencies and organizations share and coordinate information, develop practices to prevent coastal 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.

What Professional Foresters Can Do

It is the inherent responsibility of all professional foresters to ensure forest sustainability and strive to meet the landowner's objectives. Professional foresters can do much to conserve and protect Louisiana's coastal wetland forests and act in the long-term best interest of landowners, including the following:

- Recommend harvesting of healthy forest areas only when the forest stand can readily be regenerated, leading to long-term establishment of stands that will maintain sustainable productivity into the next generation of forests.
- Create written forest management plans that are explicit about how management will be sustainable and how regeneration and long-term wetland forest establishment will be guaranteed.
- Indicate what necessary and feasible alterations to site hydrological regime may help ensure future productivity.
- Explore alternative revenues or management options for sites not likely to regenerate and become established.
- Work with scientists to develop more reliable regeneration for a range of difficult site conditions.
- Look to see how the Sustainable Forestry Initiative can help protect and conserve these forests for the landowners and future generations.

What Research Scientists Can Do

Research in Louisiana's coastal forest has not kept pace with past problems, much less those that are now upon us. Part of the reason is that we have not always appreciated their importance to our coast and have not understood the many functions and services they provide. We are only now beginning to see the worth of coastal wetland forests and will continue to increase our understanding of their values and importance through new and expanding research. Detailed numbers of coastal wetland forest acreage and the condition of these forests are still not available. Some coastal forests are rapidly disappearing, and many others are degrading. We know that some cannot regenerate and become established, if harvested. Research scientists can assist in ensuring the future of these forests in a number of ways, by:

- Continuing to reveal and interpret the data that exists.
- Establishing new research related to the effects of hydrologic regime and soils on the growth and productivity of these forests, both young and old.
- Establishing research to provide better information on seedling and coppice regeneration and stand establishment under a variety of site conditions and harvesting regimes; This research may also help establish new methods of regeneration for difficult sites.
- Discerning new methods of evaluating and mapping condition classes and forest health both on the ground and by remote sensing techniques.
- Evaluating what the public knows and how much they are interested in conserving and protecting these forests.
- Conducting additional research in coastal forests to understand the important links to other functions and services that are crucial to wildlife, fisheries, clean water, and coastal processes.
- Investigate conservation alternatives acceptable to forest landowners, including set-asides, easements, and sale of timber rights.

What Coastal Forest Landowners Can Do

Perhaps the most important and crucial key to protecting, conserving, and continuing to use Louisiana's coastal wetland forests lies with the landowners and their families. They have a great personal connection to these lands, and they hold the public's many values of these lands in their hands. Coastal forest landowners can do much to see that these lands are protected and conserved through the following actions:

- Recognize the serious nature of the problem.
- Work to ensure that proper forest management techniques are used on lands that can be regenerated on a sustainable basis and that regeneration occurs; Application of BMPs (Best Management Practices) assists in reducing non-point source sediment to waterways but has little to do with proper stand management and regeneration at this time.
- Demand to know the correct state of their lands and the condition they are in relative to regeneration, if harvested.
- On hydrologically degraded lands, work with the state and others to further efforts to restore them, so as to regain productivity.
- Be willing, when necessary, to temporarily forgo timber harvesting on those portions of their land that will not regenerate and become established under current conditions.
- Insist that professional foresters provide a written management plan that details how the lands will be regenerated after harvest and how a new forest of equal or better productivity will be established; Get a second independent opinion when lands are frequently flooded for long periods, especially during

the growing season; Stump sprouting is not a reliable means of regeneration for baldcypress or tupelo.
- Provide research scientists with information on how the flood frequency, flood depth, and forest conditions have changed over time and allow them access to land for research on this problem.
- Look for alternative income sources (instead of timber harvests in coastal forests). Often, other sources of income can be steadier and offer a way to keep the trees, while enjoying an income and the other benefits forests provide.
- Consider placing your lands in a "forest reserve" system or some other category of compensation, if developed by the State.
- Consider donating your land to a conservation organization that will provide protection and allow you to reap tax benefits.
- Contact your local Cooperative Extension Service county/Parish agent for educational materials and programs.

What Everyone Can Do
- Recognize the serious nature of the problem with Louisiana's coastal wetland forests.
- Contact federal and state senators and representatives, as well as local officials about helping to save existing and restore degraded coastal wetland forests in Louisiana.
- Recognize that we can continue to conserve and protect these resources only for those coastal forests that are sustainable.
- Voice your support for efforts to conserve and protect these forests in surveys of opinion and to the news media, friends, and those at work.

SUMMARY AND CONCLUSIONS

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. Over the last hundred years, Louisiana has lost a considerable amount of coastal forest and the current condition of many remaining forests is not good. Sustainability has been compromised in large part by man-made alterations to the landscape and the natural processes that result. Once flood pulsing from leveed rivers was stopped, sediments and nutrients were excluded from associated coastal wetland forests and the conditions necessary for sustaining forests were disrupted. In some areas, land subsidence and altered hydrological regime have caused permanent or near permanent flooding that prevents forest regeneration and establishment. To ensure the sustainability of Louisiana's coastal wetland forest it is time to take action. The Governor's Science Working Group has made recommendations to ensure the sustainability of Louisiana's coastal wetland forests. An Advisory Panel to the Science Working Group was also established by the Governor's office. This panel is composed of a diverse group consisting of federal agency, state agency, non-governmental organizations, and landowners. The Advisory Panel will also provide input to the Governor's office relative to the Science Working Group's recommendations. There are many things that various groups and the general public can do to help ensure the sustainability of these forests. It is the hope of the authors and many others that everyone will get involved in the protection and conservation of this valuable forest ecosystem.

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