TO: STUART BROWN AND CPRA COASTAL MASTER PLAN TEAM

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SUBJECT: INCORPORATING COASTAL FORESTS INTO 2023 COASTAL MASTER PLAN DECISION FRAMEWORK AND GENERAL COASTAL MANAGEMENT

DATE: 8/6/2020

Restore the Mississippi River Delta organizations, consisting of the Coalition to Restore Coastal Louisiana, Environmental Defense Fund, Pontchartrain Conservancy, National Audubon Society and National Wildlife Federation, as well as our partners The Nature Conservancy and Restore or Retreat continue to be concerned about the treatment of coastal forests in the Coastal Master Plan analysis and decision framework. This document will outline the major issues with the current treatment of the coastal forests in the Coastal Master Plan, and suggest possible paths forward to remedy the lack of emphasis of coastal forest habitat at the state level in the future.

We previously submitted similar comments during the development of the 2017 Coastal Master Plan through a memo to planning staff and the project development program (attached for reference).

Overview

Coastal forests provide numerous benefits to the citizens of Louisiana, such as important wildlife habitat, water quality improvement, carbon storage and economic opportunities such as fishing, crawfishing, hunting, trapping, timber production and ecotourism. One of the greatest benefits of coastal forests is the ability to provide storm protection to coastal and even inland communities. Coastal forests have been demonstrated as an essential component of the flood protection system and coastal resilience for millions of citizens, and if we lose our coastal forests, the risk of flooding will increase tremendously for numerous communities. In addition, swamp forests are highly resistant to wind damage during hurricanes and storm events, making them a sustainable storm protection feature on the landscape when they are properly connected to riverine processes. This was especially evident in the Pearl River system during Hurricane Katrina, where swamp forests experienced very little damage, despite having the eye of the hurricane pass very near. A similar scenario was documented with Hurricane Gustav in the Atchafalaya River Basin in 2008.

Coastal forest habitat is particularly vulnerable to sea level rise due to the constrained landscape position adjacent to developed upland areas and the general low salinity tolerance of woody species. Unlike saline, brackish, and intermediate marsh, Louisiana's coastal forests lack the potential to migrate upslope under pressure from rising sea levels due to development. This disadvantage adds to recent concerns about the decreasing health of coastal bald cypress-water tupelo swamps, resulting largely from hydrological alterations. Many coastal bald cypress-water tupelo swamps, which make up a large percentage of the total area of coastal forests, are thought to be relic forests, incapable of natural regeneration (Edwards et al. 2019, Shaffer et al. 2016). Regeneration bottlenecks, or issues related to the recruitment of new individuals to the stand in one or more of the stages of the multistage regeneration process, are likely present across large areas of the current bald cypress-water tupelo

forest distribution. Mechanisms reducing natural regeneration success can include the lack of sufficient new sediment to offset subsidence (disconnect from river inputs), compaction, and sea level rise; lack of water drawdown which is needed for seed germination; too short of a period of drawdown which can drown recently germinated seedlings; nutria herbivory on new established seedlings and saplings; and potential light competition of seedlings with herbaceous marsh cover and invasive species such as Chinese Tallow.

The majority of current baldcypress individuals in the interlevee basins were established after logging efforts in the late 1800's to early 1900s. Current stands are dominated by individuals from this cohort (Conner and Toliver 1990, Lopez 2009). Even an episodic saltwater intrusion event can lead to the death of individuals with no mechanism to reestablish after the salinity disturbance event. This threshold response is evident by the large areas of former bald cypress-water tupelo swamp in the Pontchartrain Basin that have converted to herbaceous freshwater marsh under salinity stress related to the construction of canals for oil and gas extraction, and, especially, for navigation, such as the Mississippi River Gulf Outlet Canal (MRGO) (Shaffer et al. 2009). Although the closure of the MRGO in 2009 changed the salinity gradient of the Pontchartrain basin to more favorable conditions for swamp forests, there has not been any significant evidence of potential conversion back to forest in areas where bald cypress-water tupelo swamp transitioned to herbaceous marsh (Henkel et al. 2019). The Caernarvon and Davis Pond diversions into the Breton and Barataria basins respectively have resulted in a proliferation of early successional recruitment of black willow and increased vigor for established bald cypress and water tupelo trees (USGS—study in Barataria Preserve after DP opening), but recruitment of new bald cypress-water tupelo trees is not occurring at this time. This suite of vulnerabilities is alarming due to the fact that coastal forests provide such a large degree of societal value when it comes to storm protection, flood storage, and nutrient processing. Coastal forest habitat and the vast array of ecological benefits provided by all types of coastal forests are in line with all five objectives of the Coastal Master Plan in the following ways:

1. **Flood Protection** - ***Reduce economic losses from storm-based flooding***: Coastal forests of all types provide a much greater potential level of risk reduction against hurricane winds and thus storm surge than any other coastal habitat type due to significantly higher surface roughness (Raupach and Thom 1981). Higher surface roughness is more effective at converting the kinetic energy of the main flow direction into turbulent energy which can result in decreased wind speeds and storm surge heights. Forests established adjacent to structural flood reduction features such as storm protection levees can provide one line of defense in a multiple line of defense strategy against erosive action along these structures thus reinforcing flood protection for adjacent communities (USACE 2006). Coastal forests have been demonstrated to be an essential component of the flood protection system for the more than 2 million Louisiana coastal citizens, and if we lose our coastal forests, the risk of flooding will increase tremendously for numerous communities. One example that may not be fully captured in the current Master Plan is how the loss of the Maurepas Swamp could increase risk for the Greater Baton Rouge area. For example, the Maurepas land bridge is identified as a critical landscape feature in the LACPR report by the Corps. In the same vein, forests generally have higher evapotranspiration flux compared to herbaceous wetlands (Zhang et al. 2018). Higher rates of water exported to the atmosphere make coastal forest more effective at storing flood waters than other habitats.

2. **Natural Processes – *Promote a sustainable ecosystem by harnessing the processes of the natural system***: Coastal forests are an important component of the Mississippi River floodplain. Overbank flows and crevasses that penetrated the natural levee historically built and

maintained coastal forest ecosystems. Alteration of hydrology by canal construction and elimination of river connectivity have left these forests, particularly bald cypress-water tupelo swamps, extremely vulnerable to sea level rise. Restoration of the natural hydrology with upper basin diversions (e.g. Ama and Union diversions) will not only improve the health of these swamps, but it will allow for natural nutrient reduction of river water before it enters coastal estuaries, reducing the probability of harmful algal blooms from high nutrient river water. Present efforts to reconnect the Atchafalaya River to thousands of acres of isolated back swamp habitat further highlights these critical floodplain processes (Baustian et al. 2019). Herbaceous marshes subject to high nutrient loads may be more vulnerable to erosion, reducing the ability of the marsh system as a storm buffer (Deegan et al. 2012). Ecosystem services provided by nutrient deprived coastal swamps and black willow dominated forests would likely increase with the addition of high nutrient water (Effler et al. 2006). Increased fresh water and nutrients to coastal forests will reduce the probability of high salinity mortality events and increase productivity of coastal forests and reduce the potential for hypoxic conditions in isolated swamp habitats. In addition, bald cypress specifically has the added beneficial characteristic of being a long-lived species that can persist as an adult under flooded conditions. This attribute makes this species particularly resilient to increases in water levels if salinity remains low (Allen et al. 2019, McAlhaney et al. 2020). Lastly, through energy partitioning and evapotranspiration flux, all forests modulate the microclimate of a local area (Li et al. 2015). This is an important benefit to consider in the face of increased heat threats stemming from increasing summer temperatures.

3. **Coastal Habitats** – ***Provide habitats suitable to support an array of commercial and recreational activities coast wide***: Coastal forests are one of the many habitat types in coastal Louisiana that support a diversity of species. Louisiana's Wildlife Action Plan identifies 61, 37, and 41 species of conservation concern that depend on bottomland hardwood, bald cypress-water tupelo swamp, and batture forests respectively, including the Prothonotary Warbler, Swallow-tailed Kite, Bald Eagle, and alligator snapping turtle (Holcomb et al 2015). Coastal forests are critical to over 82 species of Nearctic-Neotropical migratory birds as they provide important stop over habitat for birds migrating through the Mississippi flyway. Many other species of both cultural importance and economic importance live in coastal forests. These include the red swamp crawfish, the American alligator, white-tailed deer, American bullfrog, and various important species of pollinators. In addition, the proximity of coastal forests to developed areas provide important opportunities for Louisiana residents to easily connect with many of these species in their backyard.

4. **Cultural Heritage** – ***Sustain Louisiana's unique heritage and culture***: Bald cypress is the state tree of Louisiana, and coastal forests, particularly swamps, are iconic representations of Louisiana. Coastal forests have long provided unique cultural and economic opportunities such as fishing, crawfishing, hunting, trapping, timber production, and ecotourism.

5. **Working Coast** – ***Support regionally and nationally important businesses and industries:*** Preservation of coastal forests helps to protect coastal infrastructure that enables industry to function in coastal Louisiana. Coastal forests also provide abundant ecotourism opportunities and thus support a number of local businesses. Further, the ecosystem services provided by coastal forests such as pollution reduction and carbon sequestration are important to the sustainability of Louisiana's coastal industries including fishery production in the face of climate change. These ecosystem services may also provide future economic opportunities for Louisiana businesses in the form of nutrient and carbon credits.

Decision Drivers

As in the 2012 Master Plan, the 2017 Master Plan relied on the acres of land built/maintained as the main decision driver for deciding upon restoration projects using the planning tool. Land area is an extremely important metric and we support the state's emphasis upon land area and risk reduction in determining the value of projects to the state. These two factors are priorities for the state and provide a simplified and easy to understand basis for the decision framework. However, the use of only land area in guiding project selection may lead to inadvertent prioritization of certain coastal habitats over others.

Today's existing coastal forest habitat can be maintained through reduction in salinity stress via freshwater diversions, possibly expanded through facilitated upslope migration in response to sea level rise, or restored through habitat transitions from freshwater herbaceous marsh or newly built bare land in the outfall influences areas of sediment diversions. Because each one of these scenarios will likely result in slightly different communities with different levels of ecological function, we think separate consideration of each process is important. First, consideration of upslope migration of coastal forest habitat is not fully evaluated in the Master Plan. Future sea level rise scenarios will likely push the favorable conditions for bald cypress-water tupelo swamp and BLH forest up gradient into areas with higher population density. Not only is this not explicitly considered in the current Master Plan, the area available for migration and the likelihood of this occurring given the specific environmental conditions of each species has not been evaluated.

Second, the majority of land creation projects proposed in the 2017 Coastal Master Plan are either sediment diversions or marsh creation projects located in areas where salinity regimes are too high for coastal forest species to survive. Although sediment diversions will likely increase areal coverage of black willow on newly forming deltas as has been observed in the foot print of current diversions (Wax Lake and Caernarvon), the time scale for delta formation and successional processes that lead to acceptable physical conditions for bald cypress-water tupelo swamp will likely be outside the 50 year time span considered by the CPRA, if at all. Although black willow forests provide abundant ecosystem services, black willow and bald cypress-water tupelo forest are not equivalent in terms of ecosystem function. The natural establishment of bald cypress in currently forming deltas at presently operating diversions has yet to be observed. This may be due to the fact that the long time horizon of successional processes from pioneer to climax species has not fully progressed or other modern day regeneration bottlenecks exist such as high nutria herbivory observed in coastal areas (Conner 1988) or lack of a seed source. However, reforestation efforts through artificial regeneration of bald cypress have been successful in the footprint of the Caernarvon diversion (Hillmann et al. 2020). Either way, it should not be assumed that sediment diversions will be able to replace current bald cypress-water tupelo swamp forest through natural regeneration in the time scale of interest under the suite of projects considered in the current Master Plan.

The other side of the max land metric is preventing current land from converting to open water. Projects such as freshwater diversions into upper basin areas (e.g. Ama and Union diversions) will likely slow down the conversion of largely bald cypress-water tupelo swamp forests into marsh or open water habitats by preventing salinity intrusion but will likely not result in significant gains in bald cypress-water tupelo swamp habitat from conversion of herbaceous marsh back into forest. This is due to hydrological requirements for seed germination and seedling establishment, light competition with herbaceous plants and invasive species (e.g. Chinese tallow), nutria herbivory, and potentially a lack of seed source in freshwater herbaceous marsh. Evidence of this is apparent in areas within the Pontchartrain Basin

previously occupied by bald cypress-water tupelo swamp converted to freshwater herbaceous marsh due to the influence of saltwater intrusion attributed to hydrological alterations associated with the MRGO combined with drought conditions in 1998-2000 (Shaffer et al. 2009). These areas, specifically swamp forest along the Maurepas land bridge and along the periphery of Lake Pontchartrain, have shown little to no evidence of recruitment in the 11 years since the closure of the MRGO (Henkel 2019). However, reforestation through artificial regeneration has been successful (Hillmann et al. 2020). Preservation of current bald cypress-water tupelo swamp and the potential for upslope migration of both bald cypress-water tupelo swamp and BLH forest is not accounted for in the max land metric while increases in land area via sediment diversion and marsh creation will not result in bald cypress-water tupelo swamp area gains within the time horizon of interest.

Decision Criteria

While we agree that we do not want to drive project decisions based on habitat types, we are concerned that under this scenario, coastal forests, specifically bald cypress-water tupelo swamp and BLH forest, will not receive adequate consideration. Coastal forests provide significant land area and risk reduction, but, at the same time, they are especially vulnerable to decline due to low salinity tolerance. Therefore, we consider it appropriate to develop a decision criterion to capture this information and incorporate it into the decision-making framework. Decision criteria are utilized in the decision framework to capture how well the projects selected, individually and as a component of an alternative, achieve the objectives of the Master Plan. As described above, coastal forests play a key role in ensuring that we achieve the objectives of the Master Plan and thus merit a decision criterion.

Developing the Decision Criteria

The 2017 Louisiana Coastal Master Plan improved upon the 2012 plan by the inclusion of 9 bottomland hardwood (BLH) and swamp forest species in modeling of future vegetation distribution (Table 1). However, coastal forests were only mentioned explicitly a couple of times in the document and were not included in the decision-making framework. Due to specific project selections and the ecology of specific tree species, the max land metric does not accurately reflect changes in coastal forest habitat distribution but indirectly favors herbaceous marsh habitat.

Scientific Name	Common Name	Modeled CMP Habitat
Salix nigra Marshall	black willow	Swamp forest
Taxodium distichum (L.) Rich.	Bald cypress	Swamp forest
Nyssa aquatic L.	water tupelo	Swamp forest
Quercus lyrata Walter	overcup oak	Bottomland Hardwood forest
Quercus laurifolia Michx.	laurel oak	Bottomland Hardwood forest
Quercus texana Buckley	Nuttall oak	Bottomland Hardwood forest
Ulmus americana L.	American elm	Bottomland Hardwood forest
Quercus nigra L.	water oak	Bottomland Hardwood forest
Quercus virginiana Mill.	live oak	Bottomland Hardwood forest

Important distinctions between species in the swamp forest habitat class should be made to clarify the effects of potential projects. Black willow is a pioneer species that can establish quickly on emerging delta lands such as those being built by sediment diversions. Bald cypress-water tupelo swamp is a late climax species composition that presumably establishes later in the delta cycle as black willow stands

age (Gosselink 1997), however this has yet to be realized in any of the growing deltas of current river diversions such as Wax Lake and Caernarvon. Coastal forest made up entirely of early successional black willow stands and coastal forest composed of mature bald cypress-water tupelo swamp are not equivalent in function. For instance, black willow forests are classified as a batture forest in the Louisiana Wildlife Action plan and thus support different wildlife species than that of bald cypress-water tupelo swamp and BLH forest. All types are important to the sustainability and culture of coastal Louisiana, but bald cypress-water tupelo swamp and BLH forests are the most extensive type of coastal forest by area in the state of Louisiana. In addition, adult black willow trees do not perform as well as bald cypress individuals under flooded conditions (McAlhaney et al. 2020) and are thus not as resilient in deep water. The difference between the different types of swamp forests is important in reference to the conservation of coastal forest ecosystems as a whole within the scope of the Master Plan.

The decision criterion for coastal forests should be based on information produced from the updated version of LaVegMod 2.0 for the specific species found in coastal forests. In the 2017 plan, the distribution of 3 swamp and 6 BLH species were modeled for different project scenarios in coastal Louisiana. We propose a formulation that looks at coastal forest suitability for swamp and bottomland hardwood species. The formulation would use the acreage generated by this analysis separating swamp and bottomland hardwood forest into their own groupings and compare forest acreage of these groups in the future without action to the acreage resulting from a management action. The inherent difference between black willow and bald cypress-water tupelo should be kept in mind even if the species are lumped together in the modeling exercise. This would provide information about how well a project, or group of projects, along with a programmatic annual planting program, maintains/increases specific types of coastal forest habitat.

Using the Decision Criteria

In the 2017 Coastal Master Plan, the planning tool selected projects on land area and developed project alternatives referred to as max land for each environmental scenario. We suggest performing this process to develop a max coastal forest alternative for each scenario. This process would generate an acreage value that represents the maximum total land area of coastal forest maintained given the set of projects and environmental scenarios. If the max land threshold and max coastal forest threshold values match, the max land alternative is likely already maximizing coastal forest area. However, if the max land threshold and max coastal forest do not match, other options exist that would still allow coastal forest habitat to receive the deserved consideration.

1. Sensitivity Testing in Land Area: In the 2017 Coastal Master Plan, a sensitivity analysis on brown shrimp was performed. We think a sensitivity analysis for coastal forests would be an important addition to the 2023 Coastal Master Plan. With sensitivity testing, CPRA could evaluate projects, land area, and coastal forest area by comparing the maximum land alternative to that of a maximum land and coastal forest alternative. This analysis would provide valuable information for further deliberations regarding specific project recommendations.
2. Sensitivity Modeling for Risk Reduction: Because coastal forests have such a larger impact on risk reduction than other habitat types, we propose sensitivity testing to quantify the risk reduction benefit of forested land versus marshes or open water. This could include direct risk reduction benefits to communities inside and outside the levee system, as well as benefits to the levee system itself (risk of failure, overtopping, maintenance costs, etc.)

3. Comparison of alternatives during deliberations: Even if coastal forest land area cannot be completely incorporated into the planning tool, deliberation of project considerations could greatly benefit from the availability of data generated from a max coastal forest area analysis.

One significant issue regarding this methodology is related to the fact that the upper-basin freshwater diversions will likely not result in expansion of coastal forest, specifically bald cypress-water tupelo swamp, back into areas recently converted from forest to herbaceous marsh. In addition, sediment diversions will likely not result in significant gains of bald cypress-water tupelo swamp area within the 50-year timeline of interest. These diversion projects must be paired with reforestation efforts through artificial regeneration to result in significant gains in bald cypress-water tupelo swamp area in addition to the preservation of current coastal forest habitat distribution. CPRA should fully embrace land protection strategies (in fee or conservation servitudes) for high priority tracts as well as a programmatic annual planting program that invests money into restoration plantings. Such an integrated approach will achieve the full potential of projects in the Coastal Master Plan to both build and sustain land and reduce risk to communities.

Additional Recommendations for Coastal Forests

The state of Louisiana invested significant resources in determining the value of coastal forests in the aftermath of Hurricane's Katrina and Rita in the form of the Coastal Wetland Forest Conservation and Use Science Working Group which published an in depth report on the state of Louisiana's coastal forest in 2006. Within this document 14 specific recommendations for sustainable management of coastal forests were detailed. Although many of these recommendations have been partially adopted, large action gaps remain. One specific action,

"Enhance wetland forest ecosystem functions and values as part of all hydrological management decisions, including management of point- and nonpoint-source inputs, floodways, and creation of diversion, levee and highway construction, and coastal management,"

emphasizes the need to include coastal forest analysis in the decision-making framework of the Coastal Master Plan which will guide funding for many of the specific project types including within the science working group's recommendation. Although inclusion of coastal forests in the Coastal Master Planning tool in a mechanistic way would be the preferred option, we acknowledge the potential political and analytical difficulties in rationalizing inclusion of this habitat type in the planning tool mechanistically while excluding other habitats. Thus, we propose additional options to increase the State's emphasis on coastal forest habitat that lie outside of the main planning tool framework. These alternatives could also be in addition to including coastal forests more mechanistically in the planning tool framework, particularly when it comes to the question of large-scale reforestation that have previously been excluded in the Master Plan.

As the first alternative, we propose a programmatic approach to coastal forests similarly to the treatment of barrier islands through the Barrier Island Re-nourishment Program (BIRP). We do this with caution as we do not want to provide routes of unfounded deviation beyond the planning tool. However, we believe the importance of coastal forests to the state provides significant reasoning to increase the emphasis of coastal forests in the Master Plan. Thus, we envision a programmatic approach with quantitative ties to the modeling and planning tool that allow for a scientific approach for coastal forest project determination that reduces vulnerability of the process to political pressures while providing coastal forest habitats the deserved attention by state coastal managers. Although the

specifics of the connections between a programmatic approach and the planning tool need further refinement, they may take the form of certain qualifying criteria as outlined and guided by the planning tool and suggested above.

A second alternative to mechanistic inclusion of coastal forests in the Coastal Master Plan planning tool, would be the creation of independent programs outside of the Coastal Master Plan that address the need of projects that preserve and restore coastal forest habitat. Programs such as the previously mentioned Coastal Forest Conservation Initiative (CFCI) exist currently and have been very successful when funding is available. Consideration should be given to integrating funding for such land protection efforts focused on hydrologic restoration and reforestation. First, the spatial scale of the CFCI could be increased to include land predicted to be suitable habitat for coastal forests in the future under various sea level rise scenarios to address the squeeze of coastal forests up gradient into developed areas. It could also include land predicted to be suitable for reforestation under various restoration projects such as some diversions. In addition, small scale hydrologic restoration could be implemented on easement tracts to enhance the health and resiliency of the coastal forest in that location. Additional program alternatives could center on taking advantage of previously implemented hydrologic restorations efforts such as the closure of the MRGO by implementing a reforestation effort in the form of planting. This could also include small scale hydrologic restoration projects identified in the 2017 Coastal Master Plan as beyond the scope of the planning tool due to scale and other larger projects such as large scale reforestation efforts that are paired with master plan projects such as fresh water and sediment diversions that will help accelerate coastal forest restoration.

Many scientific gaps exist in understanding the specific mechanisms shaping coastal forest ecosystems. Regardless of the course of action to increase representation of coastal forests in coastal management at the state level, funding should be directed towards better filling scientific gaps in coastal forest ecosystems. This can be accomplished through establishment of scientific working groups or advisory panels and by the allocation of funding toward ongoing calls for proposals that address scientific needs. Specific scientific questions regarding the potential for long term restoration success, suitable areas of potential upslope migration, the status of natural regeneration in bald cypress-water tupelo swamps, and the science dictating species specific distribution modeling require further study. Scientific priorities could be guided by an advisory panel which could then be used to define research proposal topics and the allocation of grant money to academic professionals with the goal of resolving these questions. Better science is imperative to improve future planning and management of Louisiana's coastal forest ecosystems regardless of the method of approach to increase emphasis of these systems in coastal management at the state level.

Conclusion

In summary, many options are available to turn the tide in conserving coastal forests for future generations of Louisiana. Proposed options included mechanistic inclusion of coastal forest area in the planning tool, programmatic inclusion of coastal forest with quantitative ties to the planning tool, land protection strategies similar to the former Coastal Forest Conservation Initiative (CFCI), establishment of a programmatic annual planting program, initiatives outside of the Coastal Master Plan that address the many stressors facing coastal forest systems, and allocation of money toward increased scientific research effort to answer remaining questions that are critical to effective management of coastal systems regardless of the approach. We hope that these options provide flexibility for state coastal managers while emphasizing the serious need of increased emphasis on the critically important coastal forest ecosystems of the state of Louisiana.

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SUBJECT: **INCORPORATING COASTAL FORESTS INTO 2017 COASTAL MASTER PLAN DECISION FRAMEWORK**

DATE: **APRIL 21, 2015**

Louisiana's 2012 Coastal Master Plan identified limitations to the analysis (page 110) which would need to be addressed in future versions of the master plan. One limitation acknowledged was that by using land area as the key decision driver for restoration projects, though it kept the master plan focused on a central priority, some benefits of projects could not be accurately accounted for. The master plan states

> *"This is particularly true with respect to coastal forest projects, which do not build land per se, but do work to restore or sustain an essential habitat. This is an area of future analysis that the state needs to expand."*

The 2012 Coastal Master Plan models were able to capture the effects of environmental conditions and management actions on the future of our coastal forests. These results have demonstrated that many of our coastal forests are not sustainable, even with implementation of the master plan. The 2017 Coastal Master Plan models are being designed to provide an even greater level of detail on the future of our coastal forests, including the fate of 11 swamp and bottomland hardwood species, based on salinity, water level, and flood duration variables, while accounting for available seed source and germination conditions.

This information is invaluable to understanding how we can develop and design management actions to sustain these coastal forests. The information was available in 2012 and will be available in 2017. The question is how this information is to be incorporated into the decision-making framework.

Master Plan Objectives

Coastal forests provide important coastal protection and biodiversity benefits. Their importance to all five objectives of the master plan, referenced below, plus their vulnerability to continued decline, warrant special consideration within the decision-making framework.

- Reduce economic losses from storm surge flooding: Coastal forests provide a much greater level of risk reduction than any other habitat type, and coastal forest species are resistant to wind damage, making them a sustainable storm protection feature when properly managed, including through riverine processes. Coastal forests have been demonstrated as an essential component of the flood protection system for millions of

coastal citizens, and if we lose our coastal forests, the risk of flooding will increase tremendously for numerous communities. One example that may not be fully captured in the master plan is how the loss of the Maurepas Swamp could increase risk for the Greater Baton Rouge area, e.g. the Maurepas land bridge is identified as a critical landscape feature in the LACPR report by the Corps.

- Use of natural processes: Coastal forests are an important component of the Mississippi River floodplain, and overbank flow was, historically, a common occurrence. In addition, crevasses that penetrated the natural levee periodically supplied discrete sections of the overbank floodplain with massive influxes of heavier sediment, which played a role in the longevity of coastal forests and with the development of forest habitat diversity. Canals have altered the hydrology and allowed salt water intrusion. Re-establishing these natural hydrologic processes should be an important feature of the plan.
- Provide a wide array of coastal habitats: Coastal forests are one of many habitat types that are important to sustain across the coast. Louisiana's Wildlife Action Plan identifies 17 species of conservation concern that depend on baldcypress/bottomland forests, including iconic species like Prothonotary Warbler, Swallow-tailed Kite, and Bald Eagle. Coastal forests are critical to over 82 species of Nearctic-Neotropical migratory birds (basically all of the migratory land birds of eastern North America).
- Conserve our unique heritage and culture: Coastal forests have long provided unique cultural and economic opportunities such as fishing, crawfishing, hunting, trapping, timber production and ecotourism.
- Support business and industry: Preserving coastal forests not only protects the industries that depend on them, but also supports business and industries that are located behind them.

Decision Drivers

The analysis and decision support tool used to select projects in the 2102 Coastal Master Plan relied on the acres of land built and/or maintained as the decision driver to choose restoration projects. We support the State's commitment to focus the decision drivers on land area and risk reduction. These two factors are priorities for the state and its citizens and provide a simplified and easy to understand basis for the decision framework. We also understand that, by using land area as the decision driver, we do not want to prioritize one habitat type over another when driving our decisions.

Decision Criteria

While we agree that we do not want to drive our decision based on habitat types, we are concerned that under this scenario, coastal forests may not receive adequate consideration. Coastal forests provide significant land area and risk reduction, but, at the same time, they are especially vulnerable to decline. Therefore, we consider it appropriate to develop a decision criterion to capture this information and incorporate it into the decision-making framework. Decision criteria are utilized in the decision framework to capture how well the projects selected, individually and as an alternative, achieve the objectives of the master plan. As

described above, coastal forests play a key role in ensuring that we achieve the objectives of the master plan and thus merit a decision criterion.

Developing the Decision Criteria
The proposed decision criteria would utilize information from the vegetation model, LaVeg, on specific species found in coastal forests. The formulation would quantify the acres of a specific species, a habitat designation (such as bottomland hardwoods which includes multiple species), or all forest species (collectively, coastal forests) and compare the acres in the future without action to the acres resulting from a management action. This would provide information about how well a project, or group of projects, supports coastal forests.

Using the Decision Criteria
The Planning Tool initially selects projects on the decision driver (land area) and develops alternative(s) referred to as Max Land for each environmental scenario. At that point, the decision criteria are used to refine the Max Land alternative.

The first step is to use the Planning Tool to develop an alternative focused on a suite of projects that maximize coastal forests. This "Max Coastal Forest" alternative would provide a threshold value for what is the maximum support possible considering the projects under evaluation and objective function being utilized.

Does the Max Land threshold value for coastal forests match the "Max Coastal Forest" threshold value? If so, great! That means that this constraint has no effect on the projects selected, and maximizing land also maximizes coastal forests. More than likely, however, the answer will be no, and the constraint is binding.

There would be two options on how to incorporate the special value of coastal forests at this point:

1. Sensitivity Testing: The Planning Tool could evaluate how well the Max Land alternative performs on the Coastal Forest decision criterion (X) and then utilize the constraint on the objective function to incrementally increase (X+10%, X+15%) the support for coastal forests. This analysis would demonstrate and provide transparency on tradeoffs between land area and forested area. The master plan team could review what projects varied between the alternatives evaluated. This information could be utilized by the master plan team and the Framework Development Team to understand tradeoffs and make decisions.
2. Comparison of Alternatives: The decision criteria could also be used as an output that is evaluated during the decision-making process. For each alternative produced to capture Max Land and other decision criteria constraints, the master plan team and Framework Development Team could review how these other options affect the support for coastal forests decision criterion. This comparison would be used to inform decisions.

We strongly encourage you to incorporate a decision criterion for coastal forests into the 2017 Coastal Master Plan. We are happy to work with you to make that happen.

2017 Coastal Master Plan Project Development Program

COASTAL FORESTS RESTORATION PROJECTS

August 21, 2014

The Mississippi River Delta Restoration Coalition, consisting of the Coalition to Restore Coastal Louisiana, Environmental Defense Fund, Lake Pontchartrain Basin Foundation, National Audubon Society and National Wildlife Federation, and our partners, Louisiana Wildlife Federation, Restore or Retreat and The Nature Conservancy, are submitting the following project recommendations to be considered in the 2017 Coastal Master Plan to help sustain and restore Louisiana's coastal forests.

Coastal forests provide numerous benefits to the citizens of Louisiana, such as important wildlife habitat, water quality improvement, carbon storage and economic opportunities such as fishing, crawfishing, hunting, trapping, timber production and ecotourism. One of the greatest benefits of coastal forests is the ability to provide storm protection to coastal communities. Coastal forests have been demonstrated as an essential component of the flood protection system for millions of coastal citizens, and if we lose our coastal forests, the risk of flooding will increase tremendously for numerous communities. In addition, swamps forests are highly resistant to wind damage during hurricanes and storm events, making them a sustainable storm protection feature on the landscape when they are properly connected to riverine processes. This was especially evident in the Pearl River system during Hurricane Katrina, where swamp forests experienced very little damage, despite having the eye of the hurricane pass very near.

Modeling efforts have demonstrated that many areas of our coastal forests are not sustainable, even with implementation of the 2012 Coastal Master Plan. For example, the Maurepas Swamp, which is predicted to be converted to marsh or open water in both Future Without Action and Future with the Master Plan scenarios, protects communities as far north as Baton Rouge. Losing these forests could increase the flood risk for hundreds of thousands of citizens. The 2012 Coastal Master Plan analysis also predicted large-scale land loss could occur in the next 20 years, leaving little time to act. Since the 2012 Coastal Master Plan evaluated all previously proposed projects, it indicates that we haven't fully conceptualized and considered the types of projects needed to sustain the coastal forests. We have proposed some potential projects that we would like evaluated in the 2017 analysis to understand if these projects can help sustain the swamps.

The analysis and decision support tool used to select projects in the 2102 Coastal Master Plan relied on the acres of land built and/or maintained as the decision driver to choose restoration projects. Using the decision driver of land acreage built or maintained did not allow for the exclusion or prioritization of projects based on the type of land built or maintained, or the specifics of the land, like habitat quality or its ability to provide risk reduction to communities and infrastructure. As described on page 108 of the 2012 Coastal Master Plan:

Using land building as one of our two decision drivers kept us focused on a central priority of the master plan. However, this approach also introduced a few limitations into our analysis. Using land building to evaluate projects meant that we could not accurately account for the benefits of all project types. This was particularly true with respect to coastal forest projects, which do not build land per se, but do work to restore or sustain an essential habitat. This is an area of future analysis that the state needs to expand. Demonstration projects can provide on the ground results that will help us understand the complexities of restoring or sustaining these important forest habitats.

The 2017 Coastal Master Plan should ensure that the multiple benefits of coastal forests, especially the risk reduction benefits, are captured in the analysis and decision-making framework. As CPRA begins its evaluation of projects for the 2017 Coastal Master Plan, we offer the following recommendations:

- **Quantify Risk Reduction Value of Restoration**: The 2017 analysis should include modeling to quantify the risk reduction value of restoration projects and habitat types, as well as capture the synergies between and among restoration and protection projects, and the resulting data should be incorporated into the decision framework for project selection and sequencing.

- **Update and Implement the Recommendations of the Coastal Wetland Forest Conservation and Use Science Working Group:** In response to continuing loss and adverse impacts to Louisiana's coastal wetland forests, the State of Louisiana initiated the formation of the Coastal Wetland Forest Conservation and Use Science Working Group. A report of findings and recommendations was produced in 2005 titled, "Conservation, Protection and Utilization of Louisiana's Coastal Wetland Forests." These recommendations are still relevant today and should be implemented.

- **Invest in Sustaining Existing Coastal Forests:** Annual dedicated funding to forest sustainability could start to address the critical needs of our forests, which could range from protecting extant, sustainable tracts, to restoration of natural hydrology, to tree planting that helps to artificially regenerate a swamp area. With proper mapping of our coastal forests, we can better understand the factors affecting their health and sustainability, and develop projects to address the issues of decline, such as ponding or elevation loss. Anywhere in the coastal zone where we can protect or restore these coastal forests adds to our protective landscape. We recommend that CPRA develop and include for funding in the 2017 Coastal Master Plan a programmatic coastal forest sustainability program or expand the purpose of the Coastal Forest Conservation Initiative to provide annual funding to forest sustainability over 50 years focused on cypress-tupelo forests, bottomland hardwoods and chenier/ridge forests.

- **Encourage the Development of New Coastal Forests:** With implementation of the master plan, habitats will shift towards the Gulf of Mexico, leaving fresher habitats near the outfall of existing and future diversions. These new fresher habitats provide an opportunity to encourage the establishment of new coastal forest areas that will provide a new layer of protection for communities and levees along the river. Through their on-the-ground habitat restoration program, the Coalition to Restore Coastal Louisiana (CRCL), with assistance from the Lake Pontchartrain Basin Foundation (LPBF), has demonstrated that cypress trees can be successfully planted in a diversion outfall area. Trees previously planted in the Caernarvon outfall area by CRCL and LPBF not only provide new habitat in the short-term, they also provide much-needed long-term protection for the levees and communities in the Braithwaite area, an area that has been devastated by recent hurricanes, as they continue to grow into healthy cypress forests.

- **Spillways to Deliver Sediment and Freshwater:** Coastal forests, specifically those along the Mississippi River, were created when the river would overflow its natural levees. Unlike a diversion, which is designed to mimic a crevasse, spillway structures are designed to mimic the overbank flow during a flood peak and deliver freshwater, sediment and nutrients to a large area. Since these vast areas of coastal forests have been disconnected from the river through the Mississippi River and Tributaries Program, the forests no longer receive sediments that allow them to maintain elevation in the face of subsidence and rising seas. Spillway structures, where not constrained by communities and infrastructure, can provide immense benefits to these coastal forests.

- **Freshwater Conservation Management:** The Pearl River is an important freshwater resource to the Pontchartrain Basin, and also acts as a hydrologic barrier to saltwater entering Lake Pontchartrain which helps maintain coastal forests in the upper portion of the basin. Although individual management decisions on the Pearl River may vary in scale, from weir removal to dam construction, the collective effect of the individual water control measures could be evaluated by the 2017 Coastal Master Plan (i.e., reduce/increase freshwater flow by 10%, 20%, etc.) to understand how future management decisions will affect our overall success.