Forested Wetlands in the Mississippi Alluvial Valley (MAV)

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GCPO
Gulf Coastal Plains & Ozarks Landscape Conservation Cooperative
SUMMARY
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The Mississippi River alluvial floodplain formerly held one of the largest expanses of bottomland hardwood forest in North America. It is also one of the most impeded systems on the continent, with altered hydrology from a vast network of protection levees and most naturally occurring bottomland forests long ago converted to agriculture across the majority of the Mississippi Alluvial Valley (MAV). In the MAV, forested wetland systems include alluvial bottomland hardwoods, cypress-tupelo forests, lower flatwoods and riparian forests associated with the Mississippi River. These systems support several species of conservation concern that the GCPO LCC Integrated Science Agenda (ISA) designates as representative of a healthy forested wetland, including the Louisiana black bear, Rafinesque’s big-eared bat, swallow-tailed kite, red-headed woodpecker, and Swainson’s, Kentucky, and hooded warblers.

Desired ecological states for MAV forested wetlands are generally described in the ISA as “local landscapes that are extensively forested with large contiguous patches of forest with a naturally diverse canopy containing a floristic diversity within the midstory and understory; a total amount of 3.7 million acres with 35-50% of all stands meeting the targeted structural conditions at a given point in time.” These endpoints are based largely on the Lower Mississippi Valley Joint Venture’s desired forest conditions report, “Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley.” Initial assessments of condition and configuration were performed separately, then configuration and condition characteristics were combined to better summarize forested wetland amount as it relates to desired conditions for priority wildlife species.

Figure 1. GCPO forested wetland composite. This product represents where 2 or more data layers indicated forested wetland.

Summary of Findings for Landscape Endpoints

AMOUNT

Delineating forested wetlands in the GCPO geography

Ecological function of forested wetland systems is presumed to be positively related to the amount and configuration of all forest habitat in a landscape, such that interspersion of upland forest systems in forested wetland will better support priority species and ecological integrity of the system. This assessment used areas of agreement across multiple data layers as a basis for identifying forested wetlands in the GCPO geography. Using this composite approach, an estimated 4.6 million acres of forested wetlands exist in the MAV subgeography, and 12.9 million acres exist in the entire GCPO region -- in any condition. This composite forested wetland layer was used as a baseline forested wetland layer in which each target landscape endpoint was assessed.
CONFIGURATION

Local landscapes (≥10,000 ac) extensively forested (70-100% forested)

The hypothesis is that forested wetland patches situated in a large forest block would promote wildlife populations better than isolated forested wetlands in an inhospitable landscape matrix. The team found over 3.5 million acres (14%) of the MAV consists of extensively forested land with ≥70% forest cover when assessed across a ~10,000 ac local landscape. The MAV exhibits the least extensively forested subgeography. Areas of extensive forest cover include forested wetlands of the Atchafalaya Basin, within and surrounding White and Cache River National Wildlife Refuges in Arkansas, Delta National Forest in Mississippi, and others.

Large contiguous patches of forest
• 13 patches > 100,000 ac
• 36 patches > 20,000 ac
• 52 patches > 10,000 ac

The Assessment team estimated the MAV to have 11 existing patches of “contiguous” (i.e., within 250 m) forest cover >100,000 acres in size, with the largest single patch found in the Atchafalaya Basin. Of the 4.6 million acres of forest land estimated to occur in >100,000 acre patches, 998,214 acres (22%) is currently protected conservation land under state, federal or non-profit jurisdiction. The team estimated 31 forest patches 20,000 to 100,000 acres in size with ~21% protected, and an additional 35 patches from 10,000 to 20,000 acres, of which ~16% are protected. Cumulatively, there are 77 patches of forest land >10,000 acres totaling ~6.32 million acres.
**CONDITION**

**Overstory canopy cover: 60-70% (forested wetland)**

Optimal canopy cover promotes biological and structural diversity within bottomland forest, providing a layered vertical structure where gaps are present. Forested wetlands with 60-70% tree canopy cover were sparse throughout the GCPO region (Figure 4). An estimated 265,298 forested wetland acres in the MAV were within this range, representing less than 6% of the total MAV forested wetland acreage, and concentrated primarily in the lower MAV. Of this total, 13% (34,935 acres) are currently under permanent state, federal or other protection. Approximately 74% of MAV forested wetlands (3.4 million acres) exhibited canopy cover >70%, of which ~28% (974,722 acres) are protected. These protected areas represent possible opportunities for forest management to meet desired conservation targets.

**Midstory Cover 25-40%**

Limited presence of forest midstory provides added vertical structure and may increase biological diversity in MAV forested wetland systems. However, management for midstory cover may come at the expense of species preferring closed canopy systems, such as the prothonotary warbler. Using midstory density measures as a proxy for midstory cover, the data suggest a greater acreage of forested wetlands may exhibit desired midstory cover when compared to overstory canopy cover. Of the nearly 1.3 million acres of forested wetlands in the MAV with midstory density 92-169 trees/acre, 26% (328,727 acres) are currently under permanent state, federal, or other protection; whereas 29% (521,346 acres) of the 1.8 million acres of forested wetlands with >169 midstory trees/acre are protected and may present opportunities for midstory management.

**Understory cover 25-40%**

The understory endpoint was derived from recommendations to promote floristic and structural diversity associated with complex vertical forest structure within forested wetland stands. This structure will determine presence or absence of many wildlife species. However, accessing spatially-explicit data on vertical structure below the primary forest canopy with remote sensing technologies is challenging. Using the USFS forest carbon stocks information as a proxy for understory cover, the data show forest understory carbon stocks are similar across the MAV (typically <1-2 Mg/ha) and distinctly depauperate compared to the East and West Gulf Coastal Plains subgeographies within the GCPO region. (no Figure shown)
Basal Area 60-70 ft²/ac (forested wetland)

Basal area can be thought of as the “footprint occupied by trees” in a given area, and it is one of the primary forest inventory metrics used in southeastern forests. Basal area can be a predictor of habitat use in some LCC priority species, including black bear (denning sites) and prothonotary warbler (breeding habitat). With an overall average basal area of 78 ft²/ac in the GCPO, the Assessment team estimated 387,507 acres (8%) of forested wetlands in the MAV meet the landscape endpoint target of 60-70 ft²/ac (see Figure 5). Nearly 2.5 million acres (54%) of forested wetlands in the MAV are estimated to exhibit >70 ft²/ac basal area. This indicates there is also ample potential for management on protected and non-protected lands to better achieve target basal areas.

Tree stocking: 60-70%

Metrics like tree stocking and basal area are commonly used to determine density of trees in a forest. A 60-70% stocking rate would represent a bottomland stand with approximately 65-75 ft²/ac basal area and about 150-175 trees per acre for trees. The analysis suggests substantially greater forested wetland acreage in the MAV exhibits the target 60-70% tree stocking rate (727,030 acres, or 16%) as compared to the target 60-70 ft²/ac basal area (387,507 acres or 8%). It is unclear whether this difference results from a data anomaly or a disjunct relationship between the two measures. This analysis yielded estimates of 475,677 acres of MAV forested wetlands that exhibited tree stocking measures >70%, whereas 3,436,133 acres exhibited stocking rates <60%, suggesting stocking across most MAV forested wetlands is below the target range, which is contrary to that observed in the assessment of basal area.
Large (>26” dbh) snags: 0.2/ac of forested wetlands

Standing dead trees, or snags, are an important habitat element in any forested system and provide diurnal or seasonal shelter for many species, including waterfowl and bats. Female Louisiana black bears in the MAV have been shown to use tree dens exclusively in non-commercial forests. Assessment of this endpoint included all large snags with 0.2/ac density or greater, with snag densities of all sizes also evaluated for comparison. Density estimates across all snag sizes ranged from 0-36 snags/acre, with a mean of 3.66 snags/acre on MAV forested wetlands. Density of snags >26” in diameter ranged from 0-3.78 snags/acre on MAV forested wetlands, with a mean of 0.08 snags/ac. Thus, as much as 91% of forested wetland acres in the MAV have large snag densities below the target range (<0.2 large snags/acre).

Diverse tree species composition

Black bear, waterfowl, foliage-roosting bats, and insectivorous birds may all benefit from a variety of forage and other resources offered by a diverse tree species composition. Historical accounts of old-growth and/or undisturbed bottomland forest in the MAV suggest a range of 15-22 tree species on select sites in Arkansas and Louisiana. Using species richness (i.e., number of tree species) as a proxy for species composition yielded a range of 0 - 43 species per 15.44 acres in the MAV, with a mean species richness of 18.21. MAV forested wetlands exhibited lower mean tree species richness than forested wetlands in all other GCPO subgeographies except the Gulf Coast (Figure 7); however, a diverse tree species composition (>15 species) in forested wetlands is more prevalent than not throughout the MAV.
Occurrence of cane and overstory vines

Hundreds of thousands of acres of fire-dependent canebrakes (i.e., cane-dominated vegetative communities) were once integral to early Americans across the southern landscape. Land use changes in the 18th and 19th centuries resulting from disease impacts following European exploration and later European settlement reduced canebrakes to the status of critically endangered. Native vine species occurrences are less well-documented, but have been shown to be an important (see discussion below) and species rich community in MAV forested wetlands. However, encroachment of invasive vine species is widespread and may threaten the integrity of native vine habitats within the forested wetland system. To our knowledge, efforts have not been put in place to adequately quantify presence of cane and vines on a landscape scale.

Flow patterns mimicking natural hydrology

Forested wetlands are natural reservoirs that mitigate downstream flooding effects, capture backwater flooding, and facilitate lateral exchange of water, sediments, and nutrients. Maintaining a natural flow regime -- magnitude, frequency, duration, and timing -- not only enhances the biotic integrity of the forest bottomland system, but also influences downstream water quality. Using the floodplain inundation frequency datasets developed by the GCPO LCC to estimate floodplain availability, lateral connectedness, and permanent inundation in the MAV showed mean annual flow in areas adjacent to MAV forested wetlands was double or greater than that of the other GCPO geographies. The influence from the Mississippi River and its major tributaries dominates flow estimates in this region. MAV forested wetlands also contain the greatest total amount of intermittently (>10% inundation) flooded areas.
TEMPORAL CONSIDERATIONS

Appropriate distribution of successional stages (with <10% of local landscape in early successional stage at any given time - except reforestation tracts)

To maintain soft mast and thickets of escape cover, forested wetland management should be approached temporally, with forest regeneration in mind. Findings imputed from USFS plot-level field data show stand ages ranged from 0 – 105 years on GCPO forested wetlands, with the MAV skewed toward younger age-class forests. The Assessment team estimated that 70% of MAV forested wetland stands are <52 years old, with 19% in an “early successional” stage (<22 years old) and 29% in mid-to-late successional stages (52-105 years). Hot spots for older age class forested wetland systems were found on publicly owned and managed lands in the GCPO region.

AMOUNT

3.7 million acres forested wetlands

The goals of the ecological assessment of forested wetlands were to determine where in the MAV and other GCPO subgeographies forested wetland systems exist in or nearly in the desired ecological state outlined in the GCPO LCC Integrated Science Agenda (ISA), and how much acreage exists in the desired state relative to defined acreage targets. The Assessment team developed a scoring system allowed for calculation of a condition index value based on the decision tree outlined in Figure 10. An index value of 25 represents forested wetlands that are estimated to be in the desired ecological state, as determined by the suite of measurable condition endpoints. The combined data show ~4.6 million acres of forested wetland in any condition in the MAV subgeography of the
GCPO LCC. This suggests forested wetlands make up over 50% of the estimated 9.2 million acres of forest in the MAV. However, only minute portions of the landscape exhibit all the quantifiable features of the desired ecological state for forested wetlands. The analysis yielded estimates of about 27% of forested wetlands meeting both configuration endpoints (size of patch and landscape context) and at least one condition endpoint, and 7% meet at least two condition endpoints in the MAV. Moreover, 445,206 acres (36%) of forested wetlands with condition index values ≥21 are located on permanently protected federal, state, or non-profit lands, again demonstrating their importance to forested wetland conservation.

**Insights, Opportunities, and Future Directions**

★ The results of this assessment show that though forested wetland area in the MAV is greater than the target 3.7 million acres, the proportion of forested wetlands actually reflecting the desired ecological state for the system is much more limited throughout. However, the results also suggest there is ample opportunity to manage existing forested wetlands in addition to restoring potential forested wetlands on the MAV landscape to better reach desired targets.

★ GCPO LCC landscape endpoints must be refined and revised to include species such as black bear and Rafinesque’s big-eared bat. In many cases relationships among species and habitat are only generally understood, such that knowledge of a preferred range of habitat conditions is speculative. The ISA was intentionally built for continued refinement and revision.

★ In some cases, it will be difficult to define a range of threshold values that are important to key species because the system has been extremely altered. (“Flow pattern mimicking natural hydrology” will be challenging to measure, as determinations of natural hydrology are hampered by the extensive network of protection levees in the MAV.)

★ In addition to limitations regarding definition of ISA landscape endpoints, there are also situations where the geospatial data available to address an endpoint is limited in scope, resolution, or temporal scale. In this Assessment, insufficient data or data reliability prevented the application of the following endpoint parameters in determining the overall condition index:
  - Understory Cover
  - Diverse tree species composition
  - Occurrence of cane and overstory vines
  - Flow patterns mimicking natural hydrology