LOWER MISSISIPPI VALLEY JOINT VENTURE

SCIENCE PRIORITIES: 2022-2027

Lower Mississippi Valley
JOINT VENTURE
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LOWER MISSISSIPPI VALLEY JOINT VENTURE
SCIENCE INTEGRATION AND EVALUATION TEAM

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Introduction

Document Purpose. This document identifies and evaluates the most pressing threats and highest priority science needs, both current and future, in the LMVJV that will affect our ability to strategically plan for and implement bird habitat conservation over the next 5 years. The intent of this document is to provide a scientific foundation and guidance for partners on information needs related to biological planning and conservation design in order to improve management actions and delivery of population and habitat objectives across our region. Ultimately, this plan furthers the mission of the LMVJV to: "function as the forum in which the private, state, federal conservation community develops a shared vision of bird conservation for the Lower Mississippi Valley region; cooperates in its implementation; and collaborates in its refinement" (LMVJV 2018).

LVMJV Vision. The LMVJV partnership, formed in 1987, provides support for the implementation of the North American Waterfowl Management Plan, United States Shorebird Plan, North American Landbird Conservation Plan, and North American Waterbird Conservation Plan at a regional level. The goal of each of these plans is ultimately to sustain bird populations through strategic habitat conservation and the partnering of numerous individuals and organizations. The vision of the LMVJV partnership is a landscape supporting healthy native bird populations and other wildlife across the LMVJV (LMVJV 2018). Priority bird species are supported through a mosaic of natural and managed habitats on publicly and privately owned lands. The primary habitat types we consider in biological planning and conservation design include bottomland hardwood, upland hardwood, mixed pine, open pine, moist-soil impoundments, emergent marsh, greentree reservoirs, and flooded agricultural crops, each on publically owned and privately owned land. Each habitat and/or ownership type is distinctively important to supporting the wintering, migration and breeding needs of our priority avian taxa. To make conservation more effective, Bird Conservation Regions (hereafter BCR) were developed to represent ecologically distinct regions with similar bird communities, habitats, and resource management issues.

LMVJV Geography. The LMVJV consists of two BCRs with distinct habitats, priority bird species, and resource issues: the Mississippi Alluvial Valley (dark green) and West Gulf Coastal Plains/Ouachitas (light green).

MISSISSIPPI ALLUVIAL VALLEY. The Mississippi Alluvial Valley BCR (MAV) supports a diverse and ecologically rich forested wetland ecosystem – one of the most productive in North America. The 24 million acre, topographically complex floodplain extends from the confluence of the Mississippi and Ohio Rivers, to the northern Gulf of Mexico, featuring a mosaic of ridges, swales, meander belts and backswamps. Small changes in elevation (<1 foot) in the MAV are associated with large shifts in hydrology, which in turn, strongly affect plant and animal community composition and structure. As with many natural river systems, much of the MAV landscape has been degraded through the development of agricultural practices and hydrologic alterations that have modified the river-floodplain connection. Today, only 20% (~ 7 million acres) of the original bottomland hardwood acreage remains, which includes significant reforestation efforts over the last 20 years.

It is estimated that 60% of all U.S. bird species migrate through or winter in the MAV, and it is an important breeding location for several species. The MAV is the most important wintering location for Mallard (*Anas platyrhyncos*) and Wood Duck (*Aix sponsa*) populations. Accordingly, the MAV was identified as a priority non-breeding region for waterfowl in the 1986 North American Waterfowl Management Plan (NAWMP). The MAV is estimated to support 32% of the global breeding population of Prothonotary Warblers (*Protonotaria citrea;* Panjabi et al. 2021). Approximately 500,000 shorebirds utilize the MAV as a fall migratory stopover site (LMVJV Shorebird Working Group 2019). Waterbirds abound with an estimated 30% of the regional Little Blue Heron (*Egretta caerulea*) population, 73% of the regional Least Tern (*Sternula antillarum*) population, and 57% of the regional and 23% of the global Yellow-crowned Night-heron (*Nyctanassa violacea*) population (Hunter et al. 2006).

WEST GULF COASTAL PLAIN/OUACHITAS. The West Gulf Coastal Plain/Ouachitas BCR (WGCPO) is largely dominated by shortleaf, longleaf, and loblolly pine forests on the uplands, transitioning to mixed pine-hardwood, and then to relatively linear river systems with bottomland hardwood and riparian forest. The 52-million-acre physiographic area encompasses southwestern Arkansas, southeastern Oklahoma, western Louisiana, and eastern Texas. Impacts to bird populations and habitat include urban development, conversion to pasture, conversion to pine plantation, lack of forest stand thinning, a lack of prescribed burning and/or suppression of fire, and construction of reservoirs. A significant number of bird species migrate, winter, or breed in the WGCPO. The WGCPO is estimated to support 29% of the global breeding population of Swainson's Warblers (*Limnothlypis swainsonii*), 25% of Hooded Warblers (*Setophaga citrine*), 24% of Pine Warblers (*S. pinus*), 26% of Kentucky Warblers (*Oporornis formosus*), 34% of Red-cockaded Woodpeckers, (*Picoides borealis*), 19% of White-eyed Vireos (*Vireo griseus*) and 16% of Chuck-will's-widows (*Caprimulgus carolinensis*; Panjabi et al. 2021).

LANDSCAPE-LEVEL SCIENCE NEEDS

BACKGROUND

Landscape-level science needs have far-reaching, habitat-oriented impacts. Accordingly, these science needs are not necessarily bird taxa-specific, but affect habitat carrying capacity for multiple priority bird groups and impact how habitat is conserved on the landscape. Thus, increasing our understanding of the potential magnitude of overarching threats, stressors, and influences on habitat condition will improve the effectiveness of biological planning and conservation design to support a landscape that is capable of sustaining healthy bird populations. We identified several categories of landscape-level science needs that could impact habitat carrying capacity and condition for multiple bird taxa and affect how conservation programs are designed and/or delivered. These include: forest health and structure, hydrology, ecosystem goods and services, climate change, and social science/human dimensions.

Forest Health and Structure. Habitat carrying capacity for landbirds, waterfowl, wading birds, and shorebirds [i.e., American Woodcock (*Scolopax minor*)] is reduced through loss of functional forest habitat. Size, structure, and composition affect the suitability of forest habitat for avian species. Management of bottomland hardwood forest stands, both public and private, is important to maintain or improve the structure and integrity of the ecosystem. Our ability to manage for healthy bottomland hardwood forest conditions is directly related to a clear understanding of the relationships between vegetative species composition, tree regeneration, canopy gap size, tree survival and other ecological factors. In the WGCPO, the open pine ecosystem is a fire-driven system in which the lack of fire has altered forest structure and condition.

Hydrology. Modifications to hydrologic regimes have cascading effects that limit habitat carrying capacity for all priority bird groups throughout the LMVJV. In the MAV, timing, depth, and duration of flooding have been altered with the construction of levees and ditches for flood control and to improve conditions for agriculture. Natural flooding was the formative force in creating variation in topography and unique microhabitats (e.g., meanders, backswamps, and depressions) that defined historic vegetative species composition. Additionally, the connection between river and floodplain provided sediment deposition, which increased productivity and sustained the forested wetland ecosystem. Now, the extent of flooding is greatly reduced and water generally is held on the landscape for a shorter period of time thus reducing fall, winter, and spring habitat for waterfowl, shorebirds, and wading birds, and reducing aquifer recharge. In the WGCPO, the creation of reservoirs and demand for water impact stream flows. Additionally, the creation of reservoirs permanently inundates existing bottomland forest habitat. Human population growth and increasing agricultural demands amplify the effects of altered hydrology. The Mississippi embayment system, which encompasses 202,000 km^2 and six aquifers across eight states— Alabama, Arkansas, Illinois, Kentucky, Louisiana, Mississippi, Missouri, and Tennessee— has one of the highest cumulative groundwater depletions (182.0 km3; 2008 data) of any region in the United States (Konikow 2013).

Ecosystem Goods and Services. Ecosystem goods and services represent the benefits humans derive, directly or indirectly, from ecosystem functions. Individual ecosystem services include pollination and carbon sequestration as a means of climate regulation (Costanza et al. 1997). In the LMVJV, one natural nexus with ecosystem goods and services is carbon flux and carbon sequestration as related to forests and agricultural habitat. How these habitats are managed with regards to carbon markets has implications for condition and quality of habitat to multiple bird guilds.

Climate Change. The impacts of climate change on bird conservation efforts in the region is an existing and burgeoning issue. According to the U.S. Global Change Research Program, the Southeast region is

most vulnerable to, and will be most affected by: increasing temperatures associated with an increase in frequency, intensity and duration of extreme heat events, as well as decreased water availability (Carter et al. 2014). Climate change impacts such as these have the potential to affect the quality and condition of habitat provided for waterfowl, waterbirds, shorebirds or landbirds.

Social Science/Human Dimensions. Human Dimensions research uses a variety of tools and methodologies (e.g., surveys, focus groups) to better understand human perceptions and behaviors, what influences behaviors, and help determine contributors and barriers to conservation success (Dayer et al. 2019). Both the newest North American Waterfowl Management Plan and Partners in Flight Landbird Plan highlight the need for social science in conservation planning. Improving our understanding of human motivations to participate in conservation efforts will ultimately improve our capacity to deliver habitat conservation for priority bird species.

PRIORITIES

FOREST HEALTH AND STRUCTURE

Assessment of forest condition at the landscape scale, including public lands and WRE lands

Rationale:

Given the importance of bottomland hardwood forest health and structure to birds and to the partnership, long-term monitoring and baseline information of forest health needs to be developed on both public and private land. Where possible, this should be linked to hydrologic condition and management/treatment history. Better remote sensing data, which could assist with a more accurate broad-scale assessment, would be desirable.

Objectives:

- To improve understanding of forest condition as related to management and management history
- To provide a landscape-scale assessment of bottomland hardwood forest health and structure

Expected Outcomes:

- Research project focused on the assessment of forest condition that can be linked to Desired Forest Conditions for Wildlife, management objectives, and/or bird response and demographics

HYDROLOGY

Impact of ground water depletion to natural systems and on agricultural habitats

Rationale:

The current depletion of aquifers (Mississippi River Valley alluvial and Sparta) likely conflicts with management activities now and into the future. Alteration of hydrologic cycles has impacted the duration and frequency of flooding and thus the recharge of wetlands and the aquifer in the associated watershed. We need to understand the impact to these natural systems. However, water provision is also essential to agriculture, such as rice, and rice production provides important habitat for waterfowl in the LMVJV. The impact of water depletion on rice agriculture has implications for waterfowl carrying capacity, land use changes and conservation programs. We thus need to understand the impact to both natural systems and agricultural habitats.

Objectives:

- To provide information that will assist with modeling of future habitat conditions

- To improve understanding of the impacts of hydrologic changes in the LMVJV geography

Expected Outcomes:

- Scenario modeling of changes in water availability into the future, coupled with potential impact on natural systems and agricultural production, to help determine how carrying capacity for waterfowl, shorebirds, and waterbirds may change through time

Impact of hydrologic processes (e.g., subsurface water availability, overbank flooding, duration of flooding) on forest health and subsequent impacts to avian guilds

Rationale:

A better understanding of hydrologic processes would provide baseline information for biological planning and conservation design activities. The current depletion of aquifers (Mississippi River Valley Alluvial and Sparta) likely will conflict with management activities now and into the future. Alteration of hydrologic cycles has impacted the duration and frequency of flooding and thus the recharge of wetlands and the aquifer in the associated watershed. Without this fundamental understanding of recharge dynamics and flow in the system, strategic conservation efforts may be limited in effectiveness. We need to begin long-term monitoring efforts.

Furthermore, management of bottomland hardwood forest towards desirable stand characteristics is an important conservation issue; however, altered hydrology may have a greater influence on species composition, tree regeneration, and nutrient dynamics than management regime. Improved understanding regarding the influence of hydrology on ecosystem function may enhance effectiveness of strategic reforestation efforts. Specifically, metrics that should be quantified are the effects of hydrology on establishment, growth, and long term sustainability of bottomland hardwood species following reforestation. Furthering our understanding of how regenerating areas and seedlings respond to water stress (prolonged flooding and/or drought conditions) is of particular importance.

Our Science Team previously recommended investing (FY2022 science support funding) in the infrastructure necessary to monitor surface and subsurface water, paired with assessment of forest metrics. This information will help to improve how managers plan reforestation efforts, how existing bottomland hardwood forest is managed, and provide a foundation for modeling predicted forest system function relative to current and future hydrologic conditions. Given the significant investment to improve hydrology and restore forest health in greentree reservoir (GTR) systems in Arkansas, JV partners should aid in monitoring the long-term health and vigor of these systems to inform future modifications as needed. Data collected from these efforts will aid in long-term management and health of forested wetlands in the LMVJV.

Objectives:

- To improve understanding of the relationship between hydrology, forest health, and ecological processes
- To inform best management practices for GTR management

Expected Outcomes:

- Research that addresses the impacts of hydrology on species composition, tree regeneration, and nutrient dynamics
- Baseline hydrological data associated with, and potentially informing, bottomland hardwood demographic and health metrics
- Established long-term hydrological dataset(s) and monitoring locations across the LMVJV region

Hydrologic changes and the impacts on public lands habitat provision

Rationale:

Although understanding the implication of hydrologic changes at a larger scale (above) and to forested land is important, smaller site-scale impacts and impacts to other habitats are important as well. Specifically examining the effects of the hydrologic changes on public land in terms of habitat quality (the condition of habitat) and quantity (the amount of habitat) is important. This would apply to both forested wetlands and other wetlands such as permanent and semi-permanent marsh.

Objectives:

- To improve understanding of the relationship between hydrology and habitat condition
- To provide recommendations for better managing public lands, given hydrologic challenges and changes

Expected Outcomes:

- Research that specifically address the impacts of hydrology on habitat management efforts on public lands

ECOSYSTEM GOODS AND SERVICES

Synthesis of carbon flux, carbon sequestration and carbon markets with application to Joint Venture planning

Rationale:

To better position our Joint Venture in addressing ecosystem goods and services in planning, we need a comprehensive understanding of the current state of knowledge. This entails compiling existing research and assessing gaps in understanding of carbon flux within important habitat types in the region. We also need to better understand the common/anticipated practices that may not be complementary to conservation efforts and planning.

Objectives:

- To improve understanding of how ecosystem goods and services can be used in conservation planning in the region
- To improve understanding of knowledge gaps of ecosystem goods and services in the LMVJV geography

Expected Outcomes:

- A synthesis paper on the state of carbon knowledge in the LMVJV geography, including applications from other geographies
- Recommendations for how carbon flux, carbon sequestration and carbon markets could be used advantageously in Joint Venture planning

Carbon flux and the effect of management on carbon sequestration

Rationale:

The amount of carbon taken up by a forest varies based on soil and tree quality, topography, disturbance frequency, and geographic location, and as such is not uniform across all bottomland hardwood forests. Due to a lack of contemporary data to aid in quantification of carbon sequestration in bottomland hardwood forest systems, research to study carbon and water cycles within various bottomland hardwood forest systems within the LMVJV would be beneficial. In particular, research

targeted on WRE sites varying in location, age, composition, and management would be ideal. This will allow us to understand and quantify the effects of management regimes on carbon sequestration rates, and could be paired with research within GTRs in Arkansas that are undergoing restoration.

Objectives:

- To improve understanding of effects of forest condition and management on carbon sequestration
- To aid with future large-scale quantification utilizing more rapid remote sensing techniques

Expected Outcomes:

- Research project that examines carbon and water cycles on a suite of bottomland hardwood forest sites with recommendations for how the Joint Venture partnership can utilize this information in planning and management

Development of a rapid assessment for forest and agricultural habitat (e.g., rice), and changes in carbon flux with regards to land use

Rationale:

Based on carbon flux research (above), existing literature, and available or developed spatial data layers, the development of a remote sensing technique that provides a rapid assessment of carbon flux and/or carbon flux potential would be valuable for land use planning. Land-use change occurring in the Mississippi Alluvial Valley includes forest conversion, forest restoration, many types of commodity crops, grazing, development, and land abandonment. For planning, it is essential to understand how land types (forest and agricultural land) and land use impact carbon flux at a regional scale.

Objectives:

- To develop a remote sensing data layer to aid in the assessment of ecological goods and services metrics at a regional scale

Expected Outcomes:

- A remote sensing data layer that can be used by partners within the LMVJV geography to aid decision making based on ecological goods and services at a regional scale

CLIMATE CHANGE

Climate impacts (e.g., increased rainfall amounts, periods of drought) on habitat conditions to aid scenario planning

Rationale:

The impacts of climate change on bird conservation efforts in the region is an ongoing issue. The LMVJV needs a more sophisticated understanding of climate impacts on important habitats and systems to improve our planning and augment delivery capacity. Specific examples include the predicted future impacts to forest health and the agricultural community, clearly understanding what partners are already doing with respect to climate change research/planning, and ongoing efforts with non-traditional partners.

Objectives:

- To improve understanding of climate change effects in the LMVJV geography

Expected Outcomes:

- Synthesis paper of climate change impacts
- Vulnerability assessment of habitats and species

Impact of renewable energy (e.g., solar, onshore wind) on birds and bird habitat conservation

Rationale:

The impacts of renewable energy on bird conservation efforts in the region is an emerging issue. To be in a better position to speak to the impacts and potentially aid in planning, the LMVJV should be more informed regarding the nexus of renewable energy and priority habitats. Thus, a literature review and/or vulnerability assessment examining the potential for negative impacts may be beneficial.

Objectives:

- To improve understanding of potential impact of renewable energy activities to LMVJV habitats and birds
- To improve the Joint Venture's ability to engage with other organizations, such as EPA, to better understand the impacts of renewable energy in our geography

Expected Outcomes:

- Synthesis of potential impact of renewable energy to LMVJV habitats and birds

SOCIAL SCIENCE AND HUMAN DIMENSIONS

Test critical assumption about linking local conservation work to supporters

Rationale:

The North American Waterfowl Management Plan (NAWMP) has challenged partners to better connect people to nature and thereby increase support for conservation. Specifically, Goal 3 of the 2018 NAWMP is: "Growing numbers of waterfowl hunters, other conservationists and citizens who enjoy and actively support waterfowl and wetlands conservation" with a recommendation to "build support for waterfowl conservation by connecting people with nature through waterfowl and their habitat." A core, untested assumption is that making our conservation work more relevant to people will increase support. In other words, at a local scale, do local investments in connecting people with nature increase 'support' for conservation? Some assert that the conservation community needs to invest in supporters, even in waterfowl poorer areas, to access greater support for our mission, with the assumption that people connect through conservation investments in their back yard. If that is true, then we need to understand what level of local investment is required to trigger support for action in key areas.

Objectives:

- To test assumptions made in NAWMP planning
- To better understand the relationships between people, waterfowl and habitat conservation

Expected Outcomes:

- A research project in key focal areas of investment that quantifies local citizen perceptions of conservation actions in the area, and how those perceptions relate to their active support of the work

Impacts of involving volunteers in science projects to long-term conservation and hunting

Rationale:

Another avenue of connecting people with nature, per NAWMP Goal 3, is to directly immerse people in waterfowl conservation through a hands-on experience. A regional example is the Five Oaks waterfowl banding program in which volunteers have direct contact with waterfowl and see science in action. A longitudinal (long-term) survey of volunteers may help provide insight as to whether this direct interaction has long-lasting benefits, along with a cost-benefit analysis. Information learned could help develop objectives for similar or other citizen-science projects.

Objectives:

- To address the NAWMP goal of connecting people to nature
- To better understand the relationships between people, waterfowl and habitat conservation

Expected Outcomes:

- Research project that surveys volunteer efforts over time, possibly including a cost-benefit analysis
- Recommendations for how to improve or develop other citizen-science project related to waterfowl

Assessment of landowner motivations and hurdles to enrolling in conservation programs and adopting conservation practices

Rationale:

Our work with the Arkansas-Louisiana Open Pine RCPP has three primary goals: 1) maximize applicant pool diversity, 2) increase wildlife-friendly conservation practices used during program, and 3) increase conservation practice persistence after program. To address all three goals requires both qualitative and quantitative social science approaches. The qualitative approach involves interviews with enrolled landowners to better understand their perspectives on conservation of open pine habitat and why they enrolled in the program, and will be carried out through RCPP-related funding. However, an additional quantitative approach using a formal survey design is desirable to reach a greater number and diversity of landowners for greater statistical rigor and broader extrapolation. The Science Team concluded that along with the ongoing social outcomes monitoring we should invest (FY2022 science support funding) in the quantitative research as well.

Objectives:

- To understand landowner barriers to enrolling in conservation programs, motivations for enrolling, and landowner satisfaction with the program

Expected Outcomes:

- Quantitative survey and analysis that addresses landowner perceptions of the ecological and economic benefits of the program, conservation ethic, and willingness to conduct management behaviors after the program ends
- Quantitative survey and analysis that addresses barriers to enrollment in the AR-LA Open Pine Conservation RCPP program

Assess best way to reach target landowners for additional conservation programs

Rationale:

In general, the LMVJV partnership should strive to better understand how to engage with target landowners for conservation programs to improve program delivery and program enrollment (including numbers and diversity of landowners). The AR-LA Open Pine RCPP is a great launching point to learn about connecting with landowners. However, there are a multitude of other programs that could benefit from similar evaluation. Additionally, we recommend that new conservation programs consider an assessment of how to best engage landowners, given the program's priorities and objectives.

Objectives:

- To understand landowner barriers to and motivations for enrolling in conservation programs

Expected Outcomes:

- Quantitative surveys and analyses that addresses landowner perceptions of the ecological and economic benefits of various program, conservation ethic, and willingness to conduct management behaviors after the program ends

AVIAN-FOCUSED SCIENCE NEEDS

BACKGROUND

The LMVJV is responsible for conservation planning under the North American Waterfowl Management Plan, Partners in Flight Landbird Plan, North American Waterbird Plan and U.S. Shorebird Conservation Plan. Each plan is stepped down to regional population and/or habitat objectives at the appropriate scale - either Bird Conservation Region or Joint Venture region. For waterfowl, a MAV step down objective plan was completed in 2015 (LMVJV 2015) and will be updated in 2023. A LMVJV shorebird plan was completed in 2019 (LMVJV Shorebird Working Group 2019). For landbirds, a MAV plan was completed in 2021 (Twedt and Mini 2021); the WGCPO Forest Wetland plan was completed in 2017 (WGCPO Landbird Working Group 2017); and an Open Pine Plan (LMVJV WGCPO Landbird Working Group 2011) was finished in 2011, with a revision in the works. The LMVJV has not specifically developed a waterbird plan but uses the Southeast Waterbird Plan completed in 2006 (Hunter et al. 2006). Priorities below will help refine biological planning, conservation design, and monitoring and evaluation needs as well as address uncertainties identified in existing plans.

PRIORITIES

GENERAL PLANNING AND EVALUATION

Reassessment of bird plan priorities at set intervals

All relevant LMVJV plans should be reassessed at 5-10 year intervals, with progress towards population/habitat goals assessed every five years.

Monitoring the effects of conservation practices, including bird response and habitat metrics

All projects that entail habitat work should include a monitoring component for the appropriate bird guild and habitat metrics, where practical.

WATERFOWL

Investigate cross-seasonal effects of winter conditions and mallard age ratios

Rationale:

Heitmeyer and Fredrickson (1981) described the association between winter precipitation patterns in the MAV and mallard age ratios in the harvest the next year (data from 1961 to 1979). It would be informative to repeat a similar analysis with ~40 years of new data, given that climate patterns have changed (e.g., some exceptionally dry winters and exceptionally wet winters). This study would explore the relationships between winter precipitation patterns and age ratios to see if they hold as suggested

by Heitmeyer and Fredrickson (1981). In addition, during this time period, the MS Flyway has had stable hunting regulations - 6 ducks, 60 days, 4 mallards (and for the most part only 2 female mallards).

Objectives:

- To elucidate cross-seasonal effects on mallards in the LMVJV geography with contemporary data

Expected Outcomes:

- A research project that repeats similar methodology to Heitmeyer and Fredrickson (1981)

Rice agriculture in the MAV – roles of agricultural habitat in meeting waterfowl foraging needs

Rationale:

Rice agriculture is promoted as a very important habitat for waterfowl in the LMVJV geography, with funding and programs established for facilitating availability of this habitat during winter. The LMVJV may benefit from a better understanding of the current role that rice agriculture plays within the region for providing waterfowl habitat. For example, with tillage practices shifting over time, our quantification of available energy likely needs to be updated.

Objectives:

- To assess the available food energy of current rice agriculture to wintering waterfowl

Expected Outcomes:

- A research project similar to Central Valley Joint Venture report from Matthews et al. (2018)
- Recommendations for if/how changing tillage practices would enhance waterfowl habitat

Review waterfowl energy values and determine if there are habitat values that are missing

Rationale:

One of the most important components of the LMVJV waterfowl bioenergetic model is Duck Energy Day values used to calculate available energy. Although some values likely still are relevant, much of the DED information is outdated. Further, there are additional habitats (not currently treated in the model) that should be considered (such as fall-tilled rice, persistent emergent wetland, subaquatic vegetation).

Objectives:

- To improve current waterfowl model and planning efforts to more accurately reflect DED provision on the landscape

Expected Outcomes:

- Recommendations for new energy values (DED) to be used in planning

Abundance of white geese and white-fronted geese and impact on rice for ducks

Rationale:

Abundance and distribution of white geese (Snow and Ross') and greater white-fronted geese have changed over time in the MAV, particularly since the waterfowl bioenergetics model was first assembled. Understanding the provision of rice to waterfowl habitat is important for the bioenergetic model. However, evidence suggests that geese have a strong preference for rice and may significantly deplete resources (more so than previously estimated) before ducks have access.

Objectives:

- To improve current waterfowl model and planning efforts to more accurately reflect DED provision

Expected Outcomes:

- Recommendations for adjustments to waterfowl modeling and planning based on contemporary goose competition for rice and other crops

Quantify the importance of bottomland hardwood habitat for waterfowl beyond energetic value

Rationale:

Bottomland hardwood forest is an important habitat for many taxa. However, for waterfowl planning, we have focused solely on the energetic value (DED) of bottomland hardwood forest, which is relatively low. Quantifying the additional benefits of bottomland hardwood forest to waterfowl is important. As an example, we need improved time-energy budget information for waterfowl (e.g., Mallards, Wood Ducks) in bottomland hardwood forest, possibly trough accelerometers, for a more complete understanding of their use of this system. Additionally, studies on invertebrate availability in bottomland hardwood forest have reported relatively high variability. Better quantifying the value of invertebrates in these habitats in spring, along with associated waterfowl gains in protein, would provide partners with the necessary data to establish explicit habitat objectives.

Objectives:

- To improve current waterfowl planning efforts to elucidate the role that bottomland hardwood habitat plays in the mid-winter/spring needs of waterfowl

Expected Outcomes:

- A research project(s) that intensively studies waterfowl use and resource availability of bottomland hardwood habitat during the non-breeding season in the LMVJV, with particular attention on invertebrate resources

Waterfowl sanctuary: optimal design and position within the landscape

Rationale:

Within JV conservation planning efforts, designated sanctuary has largely been viewed and explored relative to its role in providing waterfowl with more efficient access to high quality foraging habitats, thereby enabling attainment of greater body condition and reduced vulnerability to mortality agents. With establishment of human-related objectives in the 2012 NAWMP, JVs have an additional opportunity to consider the direct and indirect impacts of designated sanctuary on resource users and conservation supporters. Studies are needed to: 1) demonstrate effects of sanctuary on hunter harvest, 2) demonstrate effects of sanctuary on survival, 3) demonstrate effects of sanctuary on movements and migration chronology, 4) quantify sanctuary on the landscape.

Objectives:

- To improve understanding of the role of sanctuary to important waterfowl life requisites and to user metrics in the LMVJV

Expected Outcomes:

- Recommendations for how to formally incorporate sanctuary into waterfowl planning efforts in the LMVJV

Spatial and temporal distribution of energy

Rationale:

A central tenant of Joint Venture planning is that waterfowl are energy limited during the mid-winter season. Quantification of the spatial and temporal distribution of energy (DEDs) on the landscape would elucidate energy 'hotspots' and provide a first critical step to understanding waterfowl distribution, both spatially and temporally. This information will, in turn, help address issues such as staggered flooding and other management practices at the larger regional scale.

Objectives:

- To inform waterfowl planning and management
- To identify possible spatial/temporal priorities for specific management actions

Expected Outcomes:

- Maps depicting the spatial and temporal distribution of food energy in the LMVJV, aiding in identifying those areas that have either high or low food energy
- Address questions of staggered/coordinated flooding and other management actions a landscape scale

Drivers of waterfowl distribution on the landscape

Rationale:

MAV habitat objectives currently are established based on energy needs, without consideration of how and where ducks are distributed spatially and temporally. However, distribution is an important component of the original NAWMP. The distribution of ducks relative to energy on the landscape should identify priority areas for providing waterfowl habitat. Additionally, understanding the distribution of waterfowl, habitat, and energy will facilitate and inform discussions regarding our ability to accomplish human dimension objectives as outlined in the most recent iteration of the NAWMP.

Objectives:

- To inform waterfowl planning and management
- To identify fine-scaled spatial/temporal priorities for specific management actions for waterfowl

Expected Outcomes:

- Maps depicting the spatial and temporal distribution of waterfowl relative to food energy, allowing comparison of expected distribution of waterfowl as derived from NAWMP objectives.

The value and availability of wetland complexes for waterfowl

Rationale:

A significant proportion of the MAV Wetland complexes for waterfowl include a variety of natural wetland types (bottomland hardwood forest, emergent marsh, etc.) located in close proximity and adjacent to other important flooded foraging habitat, such as flooded agriculture. Most waterfowl tend to remain within a limited radius of a central roost site (some studies indicate ~20km for mallards). It is logical to assume that providing a complex of appropriate habitats within that radius is ideal for

management. However, we have a limited understanding of the optimal proportion and juxtaposition of habitats within wetland complexes to waterfowl in the LMVJV.

Objectives:

- To improve current knowledge of how waterfowl use habitat complexes
- To identify spatial priorities for waterfowl habitat complexes

Expected Outcomes:

- Quantification of acceptable ranges of waterfowl habitat complex parameters (composition, proportion, size, juxtaposition, etc.)
- Maps depicting the location of suitable habitat complexes for waterfowl in the LMVJV geography
- Maps depicting spatial priorities for provision of deficient habitat components within near-suitable complexes

Benefits of emergent marsh to waterfowl and other wetland bird species

Rationale:

The LMVJV Science Team and LMVJV Waterbird Working Group have emphasized that semi-permanent emergent marsh, composed of persistent emergent species such as cattails, giant cutgrass, arrowhead, etc. interspersed with shallow open water and aquatic bed vegetation, is an important habitat component for a variety of birds and other wildlife. The Joint Venture has invested funds in the development of an emergent wetland geospatial data layer to be used in planning for waterbirds and waterfowl. However, we lack important information on the full energetic value of this wetland type in our geography, especially with respect to the value of submersed aquatic vegetation (SAV) and invertebrates to a host of waterfowl species. In addition, a high Operational Priority for our Joint Venture is the integration of priorities among bird guilds. Investigating in more detail the components of semi-permanent emergent marsh benefits would help inform how priorities can be integrated between waterfowl and marsh birds. By examining well-managed emergent wetland sites with demonstrated King Rail and other priority marsh bird breeding and non-breeding use, we can better understand the benefits to multiple species and promote optimal management of this habitat type.

Objectives:

- Document plant species and cover composition within semi-permanent emergent marsh to be used in conjunction with spatial data to estimate energetic carrying capacity for waterfowl.
- Document marsh bird, wading bird, and waterfowl use of emergent marshes for comparison with other wetland types (which may include summarizing existing survey data)
- Validate accuracy of the LMVJV emergent marsh spatial data layer
- Estimate energy density of emergent marshes for waterfowl (intensive sampling)

Expected Outcomes:

- Provide a region-wide index of the availability and distribution of emergent wetland habitats and compositional measures of their suitability to wetland associated birds that can be used in conservation planning and design by the LMVJV

Refine habitat objectives to reflect the contribution of all habitats and better estimate the provision of Duck Energy Days (DEDS) on private lands

Rationale:
Availability and annual reliability of viable foraging habitats on private land (i.e., unharvested crops, moist-soil, and ratoon rice) are a substantial source of uncertainty in DED estimates. A better estimate of private land contribution was identified as a priority information need by the LMVJV Waterfowl Working Group. Gaining a better understanding of this parameter and incorporating revised data into biological modeling could significantly improve our estimate of the DED balance (i.e., deficit vs. surplus) throughout the LMVJV. Inclusion of better private land estimates in the analysis will improve the reliability of intensively managed private land habitats and the foraging energy they provide.

Objectives:

- To improve current waterfowl model and planning efforts to more accurately reflect DED provision on private lands

Expected outcomes:

- Adjustments to the Waterfowl Bioenergetic Model based on delineation and collection of improved spatial information regarding habitats provided on private land
- Further refining of habitat assessment for the LMVJV

Establish habitat objectives over biologically-relevant winter periods in the MAV, accounting for migration chronology and flooding schedules

Rationale:
Current planning efforts use duck energy needs over a 110-day period; however, food availability due to flooding may vary over those 110 days. Additionally, energy demand differs temporally due to the migration chronology of waterfowl species and the availability of water on the landscape. Refining these habitat objectives will provide a more accurate depiction of the temporal distribution of energy demands.

Objectives:

- To improve current waterfowl model and planning efforts to more accurately reflect DED provision

Expected outcomes:

- Early, mid, and late winter habitat objectives (or something similar) will be used in future iterations of the waterfowl bioenergetic model to further inform and refine, spatially and temporally, habitat objectives for the LMVJV.

Evaluate the hydrological performance (e.g., quantity and quality) of water management units on public and private lands

Rationale:
Hydrologic performance (i.e., the ability to provide flooded habitat for waterfowl consistently) on public lands was last assessed in 2001-2002. The LMVJV Waterfowl Working Group agreed on an average performance of achieving habitat objectives in 4 of 5 years (80%). However, hydrological performance

needs to be reassessed for more current years. Additionally, similar performance on private lands needs to be better assessed.

Objectives:

- To improve current waterfowl model and planning efforts to more accurately reflect DED provision

Expected Outcomes:

- Adjustments made to the waterfowl bioenergetic model based on better information regarding public and private land performance

LANDBIRDS

Develop and deploy protocols for monitoring breeding landbird populations

Rationale:

Tracking population trends of priority species is an inherent part of our landbird plans. To do this effectively, it is recommended that LMVJV partners consider, in detail, what is needed for more effective long-term monitoring of landbirds (e.g., additional BBS routes, point counts at certain intervals) to detect meaningful trends in population abundance and/or other appropriate metrics.

Objectives:

- To develop and deploy long-standing temporal and spatial data sets for landbirds

Expected Outcomes:

- A landbird-specific monitoring strategy document with established protocols and best practices for population monitoring
- Active deployment of strategy

Bird community response to forest habitat treatments

Rationale:

Given the amount of forest habitat conservation that continues to occur in the LMVJV region, it is important to document the bird community response to forest habitat treatments. Much of this intrinsically involves testing important assumptions of habitat work based on Desired Forest Conditions for Wildlife recommendations and open pine thinning/burning. Whereas methods should be tailored to the specific project, habitat type, treatments, etc., the partnership would benefit from standardized approaches that can be adapted as needed.

Objectives:

- To establish a framework for assumption testing and model validation

Expected Outcomes:

- A standardized, documented and approved approach to monitoring bird response to habitat treatments

Louisiana Waterthrush decision support model validation

Rationale:

With the completed Louisiana Waterthrush Habitat Model, the next step is validation of the habitat-based and species distribution models.

Objectives:

- To set up framework for model validation and appropriate methodology to test
- To validate current LOWA model and improve as needed

Expected Outcomes:

- Remote sensing validation of habitat variables included in decision support model
- Validation through on-site data collection – habitat data and point counts for LOWA detection

Continued engagement in the Southern Grassland Bird Cooperative

Rationale:

It is advantageous for the LMVJV partners to continue engaging in Southern Grassland Bird Cooperative with Central Hardwoods Joint Venture, Oaks and Prairies Joint Venture and East Gulf Coastal Plain Joint Venture. This effort is developing predictive models using data collected in the four-JV geography to determine the habitat factors driving patterns of distribution and abundance of grassland birds and affecting demographic rates associated with population growth or decline.
https://southerngrasslandbirds.org/

Objectives:

- To improve understanding of priority LMVJV grassland/open pine priority species such as Henslow's Sparrow and Northern Bobwhite
- To develop predictive models to elucidate limiting factors and improve habitat delivery

Expected Outcomes:

- Multi-state research effort that will focus on demographic parameters and help identify limiting factors across the range of these priority species

Investigate climate change nexus with landbirds

Rationale:

The impact of climate change on bird conservation efforts in the region is a burgeoning issue, and understanding the impacts to landbirds is particularly important. The most plausible first step is to ensure the LMVJV's decision support tools are informed by climate science, using outputs from predictive climate models to inform the relevant features of our habitat models.

Objectives:

- To identify and apply relevant climate change impacts that may affect landbirds

Expected Outcomes:

- Landbird decision support model(s) enhanced using relevant climate science predictive model output

Revision of Open Pine model for West Gulf Coastal Plains/Ouachitas

Rationale:

Revision of the Open Pine Decision Support Model is identified as Highest Operational Priority in our Operational Plan. The last model was completed in 2011, with habitat information used dating back well over 10 years. Researchers at Mississippi State University (MSU) currently are working on a revision of the model and data layers. After completion of the MSU project, LMVJV staff will convene partners to review and refine data layers and model outputs.

Objectives:

- To update 2011 Open Pine Plan decision support model with more current information and contemporary models

Expected Outcomes:

- A revised Open Pine Decision Support Model that is vetted with partners and updated based on work currently being undertaken at MSU

WATERBIRDS

Wader colonies – assess need for coordinated inventory of wading bird colonies

Rationale:

Past information may be insufficient to assess the current location of wading bird colonies and the number of birds utilizing those colonies. In the past, waterbird surveys have not been well coordinated among states and the resultant data have not been maintained in a centralized database. The Mississippi Flyway Nongame Technical Team is working on entering state-level data into a central database. The LMVJV partners and staff should remain engaged in this process. Unmanned Aerial Vehicles (UAVs) may offer a useful tool for assessing colony composition and size.

Objectives:

- To obtain estimates of wading bird population sizes and distribution across the geography

Expected outcomes:

- The feasibility of surveying and monitoring wading birds in the MAV and WGCPO will be discussed with regional waterbird experts. If a coordinated inventory appears reasonable and feasible and other datasets are inaccurate, the LMVJV will form a working group dedicated to this task.

Documentation of limiting factors for long-legged waders and secretive marshbirds

Rationale:

There have been few studies of wading birds and secretive marshbirds in the LMVJV geography, thus not much is known about habitat associations and limiting factors. Gathering experts to document assumptions and limiting factors needing further investigation is critical.

Objectives:

- To identify limiting factors and threats facing long-legged waders and secretive marshbirds

Expected Outcomes:

- A synthesis of limiting factors and threats with recommended actions to address

Marshbird foraging in emergent wetlands

Rationale:

Managers and researchers have noted that many wetland areas assumed to provide quality marshbird habitat support no detectable King Rails, and often few other marshbirds. Habitat conditions appear suitable, but marshbirds apparently are not responding to the conditions or management. It is postulated that habitat quality is dictated by factors beyond assumed positive habitat metrics (e.g., good interspersion of habitat, <10% woody wetland). Investigation of available forage and associated habitat features in marshbird-occupied wetlands may offer important insights into this challenge.

Objectives:

- To assess feasibility of a diet/foraging study focused on marshbirds

Expected Outcomes:

- Recommendation and outline for a research project that would address the forage limitation hypothesis

Gather and assess waterbird population information to compare with existing breeding population estimates and adjust as appropriate

Rationale:

Baseline population information used in LMVJV planning probably does not accurately reflect regional population sizes. Historical and current information likely exists through partners with respect to the number of long-legged wader rookeries and regional population estimates of secretive marshbirds. Likely sources of information are natural heritage data and literature review. We should also explore the use of BBS and/or eBird STEM models to assist in bolstering population information (trends, size, abundance, etc.)

Objectives:

- To improve underlying data used in developing objectives and models for long-legged waders and secretive marshbirds

Expected Outcomes:

- Recommendations for best data in formulating population estimates and/or metrics

Consider non-breeding (migration) population objectives or alternative metrics for high priority secretive marshbirds

Rationale:

Population goals for secretive marshbirds are expressed as number of breeding pairs, emphasizing the breeding season. However, the MAV and WGCPO may be equally or more important during the non-breeding season. Thus, the Waterbird Working Group is encouraged to consider the best means to setting non-breeding population (and/or habitat) objectives. With sparse data available, we may also need to consider alternative metrics to traditional population objectives.

Objectives:

- To ensure that waterbird planning efforts reflect the importance of the non-breeding season to secretive Marshbirds, as appropriate

Expected Outcomes:

- A set of metrics or population objectives that will be used in waterbird planning and used to assess progress towards meeting goals

Develop GIS data layers that depict potential waterbird habitat for breeding and migration

Rationale:

GIS data layers are needed to generate species-habitat models for waterbirds in the MAV and WGCPO. The Joint Venture has developed an emergent wetland data layer. However, more work is needed to translate the raw habitat information into Marshbird habitat suitability based on size, juxtaposition with other landcover types (e.g. open water, forest), etc.

Objectives:

- To develop data layers and outputs useful in waterbird planning

Expected Outcomes:

- Synthesized GIS output that accurately depicts waterbird habitat

Develop species-habitat model for king rail (*Rallus elegans*)

Rationale:

Addressing planning needs for King Rail has been identified as a high priority species by our Waterbird Working Group, and addressing conservation planning and design for waterbirds remains our highest Operational Priority. Having a dedicated individual to synthesize habitat requirements, management needs, and knowledge gaps better positions our Joint Venture to identify variables to be included in a modeling framework. Based on the synthesis of information, we could begin the development of a framework (variables, data layers, etc.) for a species-habitat model (e.g., Bayesian Belief Network framework) in both the breeding and non-breeding season to identify key areas for management action/attention. However, much uncertainty remains with regards to population trends and estimates, so any additional time would be devoted to the development of a larger-scale monitoring protocol to inform conservation planning efforts.

Objectives:

- To develop a suitable species-habitat model for King Rail to inform management and planning efforts in the LMVJV geography
- To develop a model that can be improved as more information is captured for King Rail and other secretive marshbirds

Expected Outcomes:

- Literature review and synthesis of King Rail habitat requirements, management needs, and uncertainties related to species-habitat model development
- Development of a conceptual model and framework for a King Rail species-habitat model (both breeding and non-breeding), using principles of decision theory, such as probability of uncertainty of management actions and tradeoffs, and solicitation of expert opinion where data is lacking

Develop species-habitat model for little blue heron (*Egretta caerulea*)

Rationale:

The Little Blue Heron is the highest priority colonial wading bird identified for the LMVJV in the 2006 Southeast Waterbird Plan. Additional coordination with Gulf Coast and East Gulf Coastal Plain Joint Ventures will improve the LMVJV's understanding of habitat needs and population status of the Little Blue Heron across its annual cycle. Similar to King Rail, the LMVJV partnership should develop a species-habitat model that will improve our ability to manage for this species, and other wading birds, across the geography.

Objectives:

- To develop a suitable species-habitat model for Little Blue Heron to inform management and planning efforts in the LMVJV geography

Expected Outcomes:

- Literature review and synthesis of little blue heron habitat requirements, management needs, and uncertainties related to species-habitat model development
- Development of a conceptual model and framework for a little blue heron species-habitat model

SHOREBIRDS

Continue evaluation of shorebird habitat provided on public and private lands

Rationale:

Per our 2019 LMVJV Shorebird Plan, late summer and early fall water availability is assumed most limiting to shorebird species during migration. The condition and availability of shorebird habitat on public lands is relatively unknown. An assessment of management capabilities for shorebirds would highlight limitations in management or identify areas in which further support is needed to provide high quality shorebird habitat. The LMVJV currently has a Shorebird Module in its Wetland Management Unit database and should undertake a formal assessment of where and how much shorebird habitat is provided on public lands. Additionally, information on drivers of variability in shorebird habitat (infrastructure, financial expenditures, weather, etc.) would be useful. Much is unknown about shallow water habitat on private land, and past remote sensing capabilities have not been available to assess this. However, there have been satellite imagery and remote sensing advances recently that should be explored for their ability to determine shallow water habitat with acceptable accuracy.

Objectives:

- To improve current shorebird model and planning efforts to more accurately reflect habitat provision

Expected Outcomes:

- A database of available shorebird habitat on public land by state and partner with indication of condition and availability. This will be used to evaluate management and calculate habitat carrying capacity.
- Explore options for private land assessment given new imagery and technology advances

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