

Waterfowl Conservation in the LMVJV

Summary Report to the NAWMP Plan Committee August 2021

I. The LMVJV Landscape

NATURAL RESOURCES AND THREATS

The Lower Mississippi Valley Joint Venture (LMVJV) consists of two Bird Conservation Regions (BCR); the Mississippi Alluvial Valley (“MAV”; BCR 26) and the West Gulf Coastal Plain & Ouachitas (“WGCP”; BCR 25), comprised of portions of eight states (Figure 1). Although adjacent to one another, these two ecological regions differ significantly in social, economic, agronomic, and natural influences. As a result, conservation priorities and approaches are relatively dissimilar.

Figure 1. Forested wetland habitat distribution within the West Gulf Coastal Plains & Ouachitas and Mississippi Alluvial Valley Bird Conservation Regions of the LMVJV.



MAV -- The MAV was historically dominated by bottomland hardwood forest, interspersed by a few significant areas of native prairie (e.g., Grand Prairie of Arkansas) and upland pine (e.g., Crowley’s Ridge). As a result of its expansive flood-prone forests, the MAV is a historical corridor for migration and

winter terminus for ducks (Mallard, Gadwall, Green-winged and Blue-winged Teal, American Wigeon, Northern Shoveler, Northern Pintail), as well as an important breeding area for Wood Ducks. However, most of the original bottomland hardwood forest has been converted to row crop agriculture (Figure 2). Whereas naturally-flooded forest still provides significant feeding, resting, and breeding habitat for ducks, managed shallow emergent wetland (i.e., moist-soil) and flooded grain crops now account for a substantial amount of food energy found in this region.

Conversion to non-habitat (i.e., cotton, non-flooded cropland, development) along with further direct alteration of surface (levees, diversions) and subsurface (pumping) hydrology, as well as indirect shifts in hydrology due to climate-driven changes in precipitation and agriculture are among the most pressing threats to waterfowl habitat within this system. Because of the pervasive influence of agricultural activities within the MAV, land use and conservation opportunities and threats within this region are sensitive to agricultural (and related) policy.

WGCP -- The WGCP is composed of the Ouachita Mountains and West Gulf Coastal Plain ecological regions. Both regions historically were heavily dominated by native upland pine and mixed pine/hardwood forest. These uplands were interspersed with rivers, their floodplains, and smaller streams in the West Gulf Coastal Plain, whereas the Ouachita Mountains were characterized by smaller streams with narrow riparian zones. The contemporary landscape is similar, but with significant portions of upland forested habitat converted to pasture, urban development, and silviculture using off-sight pine, with much of the forested wetland impacted by clearing on the higher elevations and inundation from major reservoirs in the lower elevations. Several river systems in the West Gulf Coastal Plain produce fairly extensive floodplain forests and wetlands (e.g., Arkansas River, Boeuf River, Ouachita River, Red River, Sabine River, Trinity River; Figure 3) that are important to waterfowl as non-breeding (e.g., Mallard, Green-winged Teal) and breeding (e.g., Wood Duck) habitat. The major threats to remaining waterfowl habitat include hydrological alteration (especially reservoir construction and expansion), and conversion of forested wetland to other land uses.

PLANNING GOALS & OBJECTIVES

Habitat goals and objectives for waterfowl in both BCRs are based on the assumptions that food during the non-breeding season is the limiting factor, and that coarse-scale distribution of food resources (i.e., among states within BCRs) is sufficient to meet their needs. Waterfowl population goals are stepped down directly from NAWMP continental goals, using accepted methodologies. Habitat objectives are expressed as Duck Energy Days (DEDs), and are calculated based on a series of assumptions regarding availability and energy density of common foods in naturally flooded, privately managed “in project” (i.e., under formal agreement), privately managed “out of project” (i.e., no formal agreement), and public managed habitats. Human objectives have not been established, but when developed are expected to relate to (1) improving acceptance/delivery of clearly important conservation practices/programs, and (2) enhanced/increased recreational opportunities.

GOVERNANCE & BUDGET

The organizational structure of the LMJV is composed generally of a Management Board, JV Support Office, Working Groups, and Partner Organization Staff. Each of these entities has unique and specific roles and functions, consistent with the priorities of the Joint Venture. However, identifying and filling critical capacity gaps is the responsibility of the entire partnership, such that making decisions on how

and by whom various functions are filled depends upon the strengths and weaknesses in both Partner and Support Office capacity.

Management Board & Governance -- The Lower Mississippi Valley Joint Venture is overseen and directed by a 17-member Management Board representing eight state conservation agencies, four non-profit organizations, and four federal agencies (two USFWS legacy regions have separate representation; Table 1). The Management Board membership includes agencies or organizations, which by virtue of mission or legislative authority, commit to sharing in the responsibility of implementing national and international bird conservation plans within the LMV region. Member organizations are expected to commit/dedicate time, energy and resources to developing a shared-vision of bird conservation for the LMV and coordinating their otherwise independent actions in the cooperative pursuit and refinement of that vision.

It is the role of the Management Board to set the broad direction and priorities for the partnership’s shared activities. The Board meets twice annually in scheduled business sessions (in-person, with the exception of recent COVID-19 travel/meeting restrictions; Spring & Fall). Priorities for collective action of the LMVJV partnership are enumerated in a 5-year operational plan, **LMVJV Operational Plan 2018-2023 for a Landscape Supporting Healthy Native Bird Populations Across the LMVJV** (“Operational Plan”; https://www.lmvjv.org/s/LMVJV-Operational-Plan-2018_FINAL-10-17-18.pdf). Communication and Outreach priorities are described in our 5-year communications plan, **Lower Mississippi Valley Joint Venture Communications Plan for a Landscape Supporting Healthy Native Bird Populations Across the LMVJV (2020)** (<https://www.lmvjv.org/s/LMVJV-Communications-Plan-2020.pdf>). Board membership, function, and protocols are guided by the Organizational Performance element of **Desired Characteristics for Habitat Joint Venture Partnerships** (“JV Matrix”; Operational Plan, Appendix A), and LMVJV Operational Procedures (Operational Plan, Appendix B).

Table 1. Composition of the Lower Mississippi Valley Joint Venture Management Board, August 2021.

Organization	Position of Current Member
American Bird Conservancy	Vice President for Operations
Arkansas Game and Fish Commission	Assistant Wildlife Division Chief
Ducks Unlimited	Director, Conservation Programs (MS, TN, AR, LA, AL)
Kentucky Department of Fish & Wildlife Resources	Wildlife Division Director
Louisiana Department of Wildlife and Fisheries	Chief, Wildlife Division
Mississippi Department of Wildlife, Fisheries, & Parks	Executive Wildlife Director
Missouri Department of Conservation	Wildlife Management Chief-Ozark Unit
National Wild Turkey Federation	District Biologist (AR, LA, MS)
Oklahoma Department of Wildlife Conservation	Senior Biologist
Tennessee Wildlife Resources Agency	Wildlife Program Manager, Region 1
Texas Parks and Wildlife Department	Statewide Wetlands/Joint Venture Program Coord.
The Nature Conservancy	Director, Lower Mississippi River Program
US Fish and Wildlife Service (Albuquerque)	Chief, Migratory Birds
US Fish and Wildlife Service (Atlanta)	Deputy Regional Director
US Geological Survey	Deputy Dir., SC Climate Adaptation Science Center
USDA Forest Service, Region 8	Forest Supervisor, Kisatchie NF
USDA Natural Resource Conservation Service ¹	State Conservationist, Arkansas

¹ Non-voting

Joint Venture Support Office -- The Support Office's responsibility is to facilitate timely accomplishment of priorities through day-to-day coordination and attention. While the Joint Venture Support Office may from time to time receive funding and staff from other partners, the Office operates as a field station of the U.S. Fish and Wildlife Service, in the service of the LMVJV Management Board. This Joint Venture is staffed by professional positions (Table 2) focused on our unique geographies and functional responsibilities outlined in the JV Matrix.

Table 2. LMVJV Support Office staff, current as of August 2021.

Position Title	Staff Member	Employer
Coordinator	Keith McKnight	USFWS
Office Administrator	Linda McHan	USFWS
Science Coordinator	Anne Mini	American Bird Conservancy
GIS Applications Biologist	Blaine Elliott	USFWS
MAV Partnership Coordinator	Steve Brock	USFWS
WGCP Partnership Coordinator	Bill Bartush	American Bird Conservancy

In addition to these full-time positions, the LMVJV currently contracts communications assistance (newsletters, news releases, web content updates, technical document summaries, etc.) through a private consultant. The Joint Venture Coordinator and associated staff are responsible for facilitating, guiding, and leading the various working groups created by the Board to pursue all facets of Joint Venture implementation.

Technical Working Groups -- Management Board representatives engage their professional and technical staff in the various facets of Joint Venture implementation through the forum of permanent or *ad hoc* Working Groups, Teams, Conservation Delivery Networks, and/or other networks and active partnerships (Table 3).

Table 3. LMVJV working groups, current as of July 2021.

Category	Working Group
Technical	Science Team
	Waterfowl Working Group
	MAV Landbird Working Group
	WGCP Landbird Working Group
	Shorebird Working Group
	Waterbird Working Group
	Forest Resources Conservation Working Group
	Human Dimensions Working Group
Delivery	Arkansas MAV Conservation Delivery Network
	Arkansas-Louisiana WGCP Conservation Delivery Network
	Louisiana-Mississippi Conservation Delivery Network
	Northeast Texas Conservation Delivery Network
	Tri-State Conservation Partnership
Administrative	Private Landowner Conservation Champion Selection Team
	Communications Plan Working Group
	Operational Plan Working Group

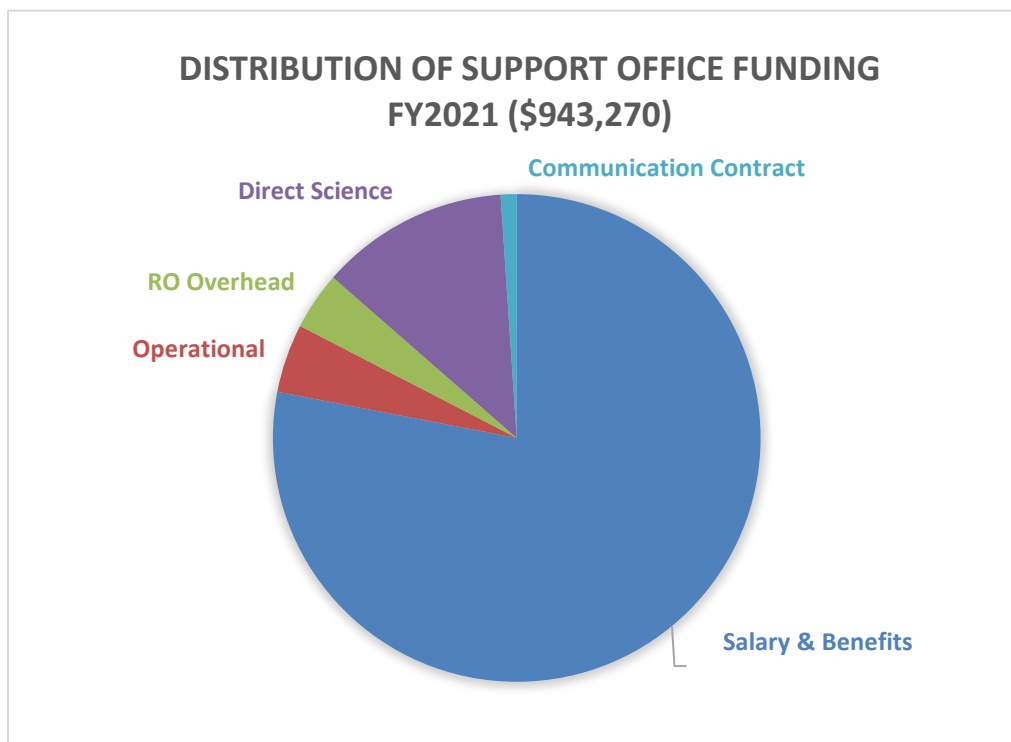
Importantly, many of these working groups and teams generally are open to individuals from any organization (i.e., not only Management Board organizations) with the understanding that their interests and expertise are consistent with LMJV needs and priorities (see Table 4).

Table 4. Non-Management Board organizations participating in LMJV working groups.

Arkansas Cooperative Fish & Wildlife Research Unit
Arkansas Forestry Commission
Arkansas Natural Heritage Commission
Arkansas Natural Resources Commission
Audubon
Black Bear Conservation Coalition
Caddo Lake Institute
Central Hardwoods Joint Venture
Colorado State University, Center for Environmental Management of Military Lands
Delta Wildlife
Delta Wind Birds
East Gulf Coastal Plain Joint Venture
Forest Resource Consultants, Inc.
Gulf Coast Joint Venture
Hancock Forest Management
International Paper
Louisiana Cooperative Fish & Wildlife Research Unit
Louisiana Department of Agriculture and Forestry
Louisiana State University
Louisiana Tech University
Manomet
Mississippi Forestry Commission
Mississippi State University
Patuxent Wildlife Research Center
Quail Forever
Stephen F. Austin State University
Texas A&M Forest Service
The Conservation Fund
U.S. Department of Defense - Ft. Polk
University of Arkansas, Monticello
Wildlife Mississippi

Budget -- The LMJV receives approximately 5.9% of USFWS 1234 funds annually to support staff and other Support Office expenses. In FY2021 this amount was \$842,000. In addition to these funds, the LMJV annually receives and administers \$100,000-200,000 in funds from partner organizations (contributed funds, cooperative agreement, intra-agency agreement) and grants to support the work of the Joint Venture.

It is important to note that our support office staff work directly with partners and funders to facilitate the flow of tens of millions of dollars annually directly to partners in support of the LMJV mission (e.g., Wetlands Reserve Enhancement Program, Regional Conservation Partnership Program, NFWF). These dollars are used to fund on-the-ground project work, increased capacity, communication and outreach, and other actions in support of LMJV priorities.



II. Approaches to Setting Step-Down Objectives

Populations and Habitat: Approach, Rationale, Assumptions, etc.

Past effort (2015 and prior)

The primary assumption in the LMJV's approach to waterfowl conservation is that food energy during the non-breeding season is the limiting factor. For our 2015 effort, we used the 1970s distribution of waterfowl populations (M. Koneff, unpublished data) to derive objectives. We assumed a 110-day wintering period to translate population objectives into Duck Energy Day objectives, adjusted for a 15% winter mortality and a proportion of ducks wintering in Mexico ([Reinecke and Loesch 1996](#); [LMJV 2007](#)). We included geese in our model as 'competitors' ([Edwards et al. 2012](#)).

We used a bioenergetic model to complete the [2015 stepdown objectives](#) and develop habitat objectives, calculating energy supply on the landscape for 3 habitat categories – areas subjected to natural flooding, private managed land, and public managed land.

- For natural flood, we calculated the extent, habitat type, and frequency of flooding.
- For managed private land, we calculated extent, habitat type, status and disturbance.
- For managed public land, we calculated extent, habitat type, performance, and disturbance.

Extent – For naturally flooded and managed private land, the acres of each category were calculated through remote sensing overlaid with water on the landscape. For public lands, we maintain a geospatial database ([Water Management Unit database](#)) into which partners enter detailed information; acres of habitat are automatically generated from the database.

Habitat type-- We assigned Duck Energy Day values to seven major habitat types: moist-soil, rice (harvested/unharvested), soybean (harvested/unharvested), corn (harvested/unharvested), milo (harvested/unharvested), millet (unharvested), and forested wetlands (percent red oak component) based on expert recommendations (Reinecke and Kaminski, unpublished data). For naturally flooded and managed private land, we used a crop data layer to assign habitat type inundated by water. For public land, we used the Water Management Unit database to determine habitat type.

Frequency of flooding -- We assumed that habitat needed to be flooded for at least one day to be accessible to and used by waterfowl. We used satellite imagery scenes from winter periods to assess water on the landscape, and Monte Carlo simulation to determine flooding scenario most likely to occur 80% of the time in each watershed.

Status (private managed) – Geospatial information on land managed through a conservation program (e.g., WRP/E, Partners for Fish and Wildlife, etc.) was obtained directly from partners and the Protected Areas Database. We additionally calculated, based on a square water algorithm, whether land was likely managed outside of a conservation management program (e.g., duck club not enrolled in WRP/E).

Performance (public land) – We used remoted sensing to assess, on average, how often full pool capacity was reached for each agency (state or federal) within a state.

Disturbance -- We assumed that hunting-related disturbance affects the availability of energy to waterfowl

Current effort

For population objectives, we arrived at a decision to use the 80th percentile of waterfowl populations from the dual objectives of the 2012 NAWMP and 2014 guidance document. Specifically, the Gulf Coast JV and LMVJV agreed that the long-term average objective should be viewed as an alarming level that, if not consistently exceeded by habitat conditions, would trigger increased, concerted actions to accelerate conservation efforts. The 80th percentile is viewed as the objective we strive to achieve every year, while recognizing the need to preserve landscape conditions capable of periodically providing habitat above this level. [see https://www.lmvjv.org/s/GC-LMV_Joint_report_pop_obj_2018.pdf]

Based on partner recommendations since 2015, we have moved forward with updating our modeling effort, which will begin in earnest in 2022. Updates will include the following:

- Switch modeling platforms to the TrueMet platform (versus an Excel spreadsheet).
- Model both waterfowl migration chronology and habitat availability over the course of time (no longer using a static time period)
- We have updated our DED values based on current literature and other research
- We have developed a more sophisticated flood modeling approach that looks at flood inundation over a longer time frame versus a single snapshot of a winter water scene (prior approach)

- Use eBird data and STEM models to develop migration chronology
- We have revised our geospatial database (Water Management Unit database) to reflect the habitat within public lands impoundments more accurately

Populations and Habitat: Issues and Challenges

In the course of our modeling update, we will have several uncertainties to address. Each of the following presents its own challenges.

- Uncertainty in our characterization of natural flooding
- Provision of unharvested crops on private land
- Sanctuary availability and the role of sanctuary on private land and public land
- Reassessment of the amount of goose competition for duck resources
- Waterfowl distribution in relation to energy on the landscape and habitat complexes

Our partnership allocates NAWMP goals based on the current distribution of habitat provision from state agencies, federal agencies and private land within each state. For example, a federal agency currently providing 50% of the energy on the landscape within the state is assigned 50% of the NAWMP goal for that state. These state-level objectives then can be allocated to individual WMA and/or NWR objectives. State and federal partners were encouraged to work together to do so, providing JV Office assistance where desired. A series of meetings were convened to discuss useful approaches to allocating objectives at this finer scale. Based on the *Strategic Action Plan for Waterfowl in the Southeast Region*, the USFWS Southeast Region set NWR-specific DED goals for the entire region. The Joint Venture will continue to coordinate with the Southeast Region Waterfowl Biologist, Heath Hagy, and NWRs on their objective setting process, monitoring, and other action items from the Strategic Action Plan.

It is important to note that we set two types of habitat objectives – a maintenance goal and an aspirational goal. The maintenance goal emphasizes the imperative of maintaining current habitat. States below their NAWMP goal took on an aspirational goal to highlight the needed land management and/or acquisition to make up the DED difference. However, we consistently received feedback from partners that even maintaining high quality waterfowl habitat was difficult without adequate staff, equipment and funding.

For waterfowl, we do not currently have spatial priorities (at finer resolution than state, such as county or watershed). Without spatial priorities, we cannot evaluate the distribution of waterfowl habitat provision (as suggested by PC guidance).

People: Approach, Rationale, Assumptions, etc.

Initial efforts to address human dimensions/people objectives of NAWMP were begun by a subset of the Waterfowl Working Group in November 2019. This group discussed the most potentially fruitful approaches for the LMVJV.

- 1) Private Lands Conservation -- The most straightforward issue in this context is determining how to maintain and increase waterfowl-friendly habitats and remove barriers to enrollment in conservation programs. An important example is fall tillage of rice fields, and programs to incentivize no-till practices. The Arkansas Waterfowl Rice Incentive Program (WRICE) through the Arkansas Game and Fish Commission (AGFC) provides an important opportunity to learn

about this aspect of private land conservation. This is one of the most important types of working land that can translate to waterfowl habitat. AGFC will continue work on increasing persistence of conservation practices after program termination. The LMVJV community will work in cooperation with AGFC to refine, and potentially duplicate this approach outside of Arkansas.

A general synthesis of what is known about salient components (e.g., hurdles, motivations, effective communication) of private lands conservation in the Southeast could be a helpful tool for the LMVJV. Specifically, a review of all tillage practices, rice production, and economic drivers within the LMVJV could help inform our understanding and application of programs focused on tillage. Identifying cultural and/or economic motivations and impediments to enrolling in conservation programs or in different tillage practices likely would be helpful.

- 2) Environmental Goods and Services – It is not clear how best to incorporate this into our planning. There are two potential avenues to explore as relate to Ecological Good and Services (EGS): 1) Non-market value: other services that waterfowl habitat provides; and 2) economic impact assessments: revenue from waterfowl hunting, recreation, etc. Partners also identified a need to establish common terminology when discussing EGS. For resolution of these issues, the LMVJV’s best course of action will be to follow Ducks Unlimited’s lead through a working group tasked with better understand how EGS (water, carbon, nutrient retention, flood abatement, etc.) can be utilized within our geography to enhance conservation of key habitats.
- 3) Management Symposium – Bringing the issues and key people together to arrive at better mutual understanding of the challenges and common approaches to solving them is seen as an important Human Dimensions action for the LMVJV. Hence, the time is right for a symposium on state of waterfowl knowledge and management in the LMVJV. This is envisioned as a manager-oriented meeting with presentations as well as field excursion(s). Besides traditional waterfowl management, it would be beneficial to expose managers to social science/people objectives, the shifting constituency of conservation, and principles of conflict resolution and collaboration.

People: Issues and Challenges

- Lack of social scientists and social science expertise/support (at all levels)
- Ability to find a meaningful nexus between stated NAWMP people objectives (hunter numbers, conservation funding support) and habitat work occurring on the ground
- We are interested in using the Regional Planning Tool (Krinsky) to explore its potential usefulness with our partners. However, the tool is not available at this time.

How has thinking evolved/been influenced by Update(s)?

- Our revised population and habitat objectives will reflect the newest updated population estimates from Fleming et al. 2019
- We are attempting to address human dimensions questions/objectives, to the degree that we are able to access appropriate expertise, and it remains a high priority in our Operational Plan
- We will be convening a Human Dimensions Working Group that will help identify Human Dimension needs for various bird taxa, including waterfowl, and related projects

Please share any examples of integration attempts (between any of the three objectives)

- None yet

How has your JV approached adaptive management?

- The LMVJV has a long history of approaching adaptive management through Strategic Habitat Conservation. One of our best examples is through our landbird and forested wetland conservation efforts wherein we set population and habitat objectives, developed decision support tools and management guidelines that impacted conservation delivery, and then evaluated the effectiveness of forestry and management. We revised and adjusted our goals based on evaluation and new information. This full cycle of Strategic Habitat Conservation took over a decade to complete, but was accomplished successfully.
- In our 2015 waterfowl habitat stepdown document, we outlined potential management strategies (acquisition, restoration, and enhancement) to address aspirational goals and associated energy gains or losses. For example, based on the average acres of a crop type on private land, we calculated the DED trade-off of converting the equivalent acres of harvested soybeans to moist-soil wetland. These scenarios were intended to provoke thought regarding a portfolio of various management actions and subsequent tradeoffs.
- We are revisiting and revising our biological objectives for waterfowl and determining how best to measure available habitat with updated information in an adaptive framework. We will be incorporating new waterfowl population objectives (Fleming et al. 2019) and setting revised habitat objectives accordingly. Based on partner feedback, we completely revised our Water Management Unit database to include various levels of moist-soil management intensity, the ability to put more than one habitat type in an impoundment, and a shorebird habitat option. We use an average of public lands data across years to better reflect the variability in habitat provision. We have done an extensive literature review of current research to improve seed and invertebrate yield estimates of bottomland hardwood forest, cropland, and moist-soil.

III. Achieving Objectives - Conservation Actions

What has the JV done in relation to, and in the context of, achieving NAWMP objectives?

GOAL 1: *Abundant and resilient waterfowl population to support hunting and other uses without imperiling habitat.*

- The LMVJV partnership addresses the needs of non-breeding waterfowl. As such, our ultimate goal is to ensure that birds return to the breeding grounds in sufficient body condition to reproduce successfully. Thus, our primary emphasis is on addressing Goal 2 and ensuring that we have sufficient waterfowl habitat to meet waterfowl energy needs.

GOAL 2: *Wetlands and related habitats sufficient to sustain waterfowl populations at desired levels, while providing places to recreate and ecological services that benefit society.*

- The LMVJV partnership strives to provide high quality, non-breeding habitat for waterfowl. Partners consistently apply for and receive North American Wetlands Conservation Act grants to increase and improve the wetland management infrastructure necessary for effective management, and protect important wetland habitats. Our partners are actively working with agricultural producers to provide shallow water habitats in fall and winter. Finally, LMVJV partners continue to harness tens of millions of dollars annually to restore and manage bottomland hardwood habitat through Farm Bill Programs (e.g., WRE) and other sources.

GOAL 3: *Growing numbers of waterfowl hunters, other conservationists and citizens who enjoy and actively support waterfowl and wetlands conservation.*

- The LMVJV partnership has discussed addressing human dimensions in our geography. Hunter number has not been identified as a priority issue through our partnership. Instead, our focus is on private landowners and how we can best address barriers to their application of effective conservation practices.

Has effort shifted over time?

- Our partnership's mission to provide high quality habitat for non-breeding waterfowl has remained steady through time. LMVJV staff continue to provide support in terms of biological planning and conservation design, as well as delivery coordination and communication. LMVJV partners have always strived to deliver wetland habitat to meet NAWMP objectives.

AREAS OF NEED/ATTENTION

The LMVJV accepts responsibility for achieving national and international bird conservation objectives across five major bird guilds, and two Bird Conservation Regions, in the face of an increasingly complex set of environmental, economic, and social issues. As a result, we are challenged to adequately understand and address several important drivers of landscape change, as a partnership, due to lack of capacity for coordination and information synthesis. These drivers have a profound, but poorly understood, impact on bird habitat quantity and quality, and on the partners' ability to carry out appropriate conservation measures. The four areas of need are Avian Science, Climate Science, Hydrological Science, and Social Science.

Avian Science -- The foundation of our partnership is bird habitat conservation. The LMVJV Mission speaks to developing, implementing, and refining a shared vision of bird conservation. Priority actions in pursuit of this mission dovetail well with numerous other important conservation goals (e.g., climate adaptation, water conservation, social benefits, etc.). However, to understand, quantify, and effectively deliver on these areas of true nexus, our Bird Science must be solid, complete, and current. Ensuring that the LMVJV's foundational science for bird conservation is optimally developed and kept current (relevant) requires effective science coordination across each sub-discipline of waterfowl, songbird, shorebird, waterbird, and bobwhite ecology and management, and across two Bird Conservation Regions, with an understanding and sensitivity to their nexus with the other disciplines, and ample time to do the job well.

As with all aspects of science important to LMVJV priorities and objectives, the majority of work is accomplished through partnership, by partners. However, a key ingredient in that recipe for the LMVJV over the past three decades has been provision of dedicated JV Support Office Staff capacity to plan, organize, communicate, coordinate, and facilitate action by our partner staff in developing products (decision support tools, conservation plans, communications tools, etc.) appropriate to support the effective delivery of action in pursuit of the mission. Placing responsibility on a single individual (Science Coordinator) to remain current in the science, networking with other scientists, initiating and completing contemporary plans/tools/objectives, and publishing these results across all bird guilds and taxa in an efficient and effective manner is unrealistic. Splitting the primary Avian Science coordination responsibilities among two JV Support Office Science Staff is necessary, if timely and effective progress is to be made and maintained over time.

Climate Science -- Climate, soil, and disturbance are the ultimate drivers of ecological community composition and function. Hence, changes in climate impose significant impacts on habitat.

Importantly, confidence in the predicted trajectory of important climatological changes within a given geography is essential if conservation actions are to be tailored to fit and/or dampen that trajectory. Within the LMVJV geography, the choice of which model(s) is applied can have a significant effect on not only the severity of forecasted impacts, but even the direction of the trajectory of some variables. For this reason, informing and/or adjusting LMVJV bird population and habitat objectives using climate change predictions has been, and continues to be, problematic.

However, the current political and funding environment increasingly places a premium on the ability to express goals, objectives, and expected outcomes in terms of climate-related benefits and accommodations. The LMVJV's standing in this regard (political support, financial support, etc.) will be improved in direct proportion to our ability to demonstrate a nexus with and communicate our priorities and actions in connection to climate change. Using recent, accepted, published work, the LMVJV can begin by cataloguing plausible climate-positive equivalents (e.g., sequestration rates, connectivity, etc.) for our most prevalent priority actions (reforestation, wetland restoration, forest management). Beyond this, if the partnership's decision support tools are to be informed by climate science, partner consensus on the most plausible climate change models (or suite of models) and parameters will be necessary. Outputs from these predictive models can then be used to inform the relevant features of our habitat models.

As with all others aspects of science important to LMVJV priorities and objectives, the majority of work will be accomplished through partnership, by partners. Close association of the Migratory Bird and Science Applications Programs in USFWS, Interior Regions 2 & 4 likely can facilitate the LMVJV's access to significant technical capacity regarding climate change and related model application. Some cursory "equivalents" are easily obtained from the literature (e.g., carbon sequestration rates for afforestation in the MAV). However, a more thorough (and dynamic) synthesis of existing literature, practices, etc. will require focused attention and investment of time. Pursuing questions of climate change, its nexus with LMVJV priorities, and specifically applying these to our habitat objectives, priorities, and models in a timely and effective manner will require at least some degree of additional dedicated science coordination capacity.

Hydrological Science -- Terrestrial conservation issues connected to water are significant and numerous within our geography. While not exclusive to lowlands, the most pervasive and easily-understandable water issues relate to impacts upon bottomland hardwood habitat – both in the MAV and WGCP. From reservoir development to prolonged flooding to drying of once-wet surface and subsurface layers, the LMVJV's collective understanding of the ecological and sociological drivers, consequences, and possible solutions to changed/changing hydrological patterns will greatly impact our ability to conserve these systems for birds. Making useful progress in this arena will require a comprehensive synthesis of what is already known, coupled with a short list of priority actions necessary to fill in critical knowledge gaps, then working to fill the gaps. This synthesis, identification, and closing of gaps applies equally to the science and policy of water (surface and subsurface).

As with all others aspects of science important to LMVJV priorities and objectives, the majority of work will be accomplished through partnership, by partners. However, doing this in an effective and efficient manner will require additional science/information coordination capacity, no different from the way we address bird biology and delivery questions. Preliminary effort (2016 SEAFWA) was initiated to begin scoping issues relevant to floodplain hydrological challenges. Whereas investigations into these issues have continued throughout the LMVJV geography and beyond by scientists (USGS, LSU, etc., etc.), no

concerted effort has been applied to a useful synthesis and focused effort(s) by the LMVJV. Pursuing an actionable, broad-scale understanding of floodplain hydrology (science, and informing policy) as a partnership will require additional dedicated science and information coordination capacity.

Social Science -- Human behavior/attitude factors strongly influence conservation success. Understanding the primary drivers of decision-making surrounding important conservation actions is the first step to increasing our reach and effectiveness. We must work as partners to identify the most important (assumed) limiting factors in understanding and applying solutions to attitudinal/behavioral hurdles to achieving LMVJV objectives. Following this, we must then secure appropriate resources for addressing the questions, then practically apply this new/refined understanding to delivery.

As with all others aspects of science important to LMVJV priorities and objectives, the majority of work will be accomplished through partnership, by partners. However, doing this in an effective and efficient manner will require some level of additional science coordination capacity. A preliminary effort was begun (Nov 2019) with respect to scoping priority human dimensions issues that impact achieving our waterfowl objectives. Revision of the LMVJV waterfowl energetics model and objectives in 2022 will utilize application of social science. In a similar way, partners have begun applying basic social science theory, principles, and approaches to better understanding landowner adoption of important practices within Open Pine ecosystems in Arkansas and Louisiana (Morehouse Family Forest Initiative), with expanded effort planned outside the 8 MFFI counties/parishes in 2022 through RCPP. The 2018 Organizational Plan priority of piloting an effort to use existing public land-use information (monitoring data) to synthesize, analyze, and understand numerical response of humans to management actions on appropriate state Wildlife Management Areas has not yet begun. Pursuing social science questions in a timely and effective manner will require at least some additional dedicated science coordination capacity.

IV. Additional Insights

Recommended “Best Practices” that might transfer to other JVs

- Thoroughly vet population and habitat objectives within the partnership
- Consistency (or at least complementarity) in setting population objectives across Joint Ventures that share common partners is ideal
- Continue sharing of information, modeling approaches, and constructive feedback through shared forums such as the Unified Science Team and the NAWMP Science Support Team.

Areas your JV is struggling with, perhaps where more guidance/technical support would be of value

- More social science capacity in the Joint Venture community is needed to support NAWMP social science expectations.
- We are very interested in using the Regional Planning Tool to explore its potential usefulness with respect to social inputs. However, the tool is not available.

V. Progress in Relation to Previous PC Recommendations

Following is a summary of critique/recommendations extracted from the 15 March 2017 Plan Committee letter to the LMVJV Management Board. Each bulleted subject will be addressed in turn.

1. Light coverage of adaptive management adjustments
2. Assessment of spring waterfowl migration habitat requirements
3. Assess climate change impacts on waterfowl distributions

4. More information about the state of the JV partnership
5. Integration of “all bird” priorities at the CDN scale
6. Address annual variation in habitat in the planning process

Adaptive Management Adjustments -- Adaptive adjustments in LMVJV waterfowl habitat conservation have and continue to come primarily in the form of (a) improved understanding of food energy provision by various management/habitat categories, (b) increased ability to remotely estimate food energy available in naturally-flooded habitats, (c) a refined method of tracking public managed habitat, and (d) from updated continental population objectives stepped down to our BCRs.

Spring Waterfowl Migration Habitat Requirements -- No progress has been made in assessing spring migration habitat. However, our new modeling approach may allow for some estimation of this.

Assess Climate Change Impacts on Waterfowl Distributions -- Several studies utilizing empirical data [e.g., Thurber et al 2020, Meehan et al 2021] and climate models [e.g., Notaro et al 2016, Lange et al 2018, O’Neal et al 2018] to understand/predict waterfowl distribution relative to climate change have been recently published. Predicted increases in average winter temperature and decreased snow accumulation at latitudes north of the LMVJV suggest northward distributional shifts, and empirical data are consistent with such a northward shift. This pattern, on it’s own, results in lower non-breeding duck population numbers within the LMVJV region. At the same time, predicted negative impacts of sea level rise on Gulf Coastal Plain shallow wetland habitats may suggest a northward shift in non-breeding duck distribution from the Gulf Coast into the LMVJV. A clearer understanding of net effects of climate change, as well as increased confidence in model predictions, will be necessary before making changes to regional population and habitat objectives. Several attempts to obtain research funding through partner academic institutions for exploring LMVJV-specific climate impacts on waterfowl distribution have so far been unsuccessful.

State of the LMVJV Partnership -- The example stated in the 2017 PC letter refers to the LMVJV’s need to manage Conservation Delivery Networks (CDNs) to ensure that overall JV objectives are achieved, with a suggestion to monitor individual CDN contributions. Our CDNs continue to be active, dynamic networks of local/regional partners strategically pursuing multiple bird (and related natural resource) conservation objectives within their sub geographies. Each CDN is staffed by one of the LMVJV’s Partnership Coordinators, prioritizes actions using significant input from the LMVJV’s bird planning priorities, and provides reports and updates to the LMVJV Management Board twice annually.

Integrating “all bird” Priorities at the CDN Scale -- Integration of spatial priorities among multiple bird guilds will be possible only as such priorities are developed for guilds other than forest breeding songbirds. It is anticipated that spatial priorities (at a finer scale than State/BCR) for waterfowl habitat conservation will be a product of the upcoming (2022) revision process. Further, spatial priorities for secretive marsh bird habitat is anticipated be a product of that (ongoing) planning effort.

The LMVJV has and continues to facilitate integration of wetland-dependent bird habitat conservation through provision of information and delivery of shallow wetland habitat management workshops (2015, 2021/22). The most recent online workshop (Aug/Sep 2021) explicitly addressed multi-guild management opportunities and tradeoffs at the area/site scale.

Addressing Annual Variation in Habitat in the Planning Process -- Annual variation in habitat conditions is addressed within the LMVJV’s waterfowl habitat objective-setting process in at least three ways. First, our assessment of naturally flooded and private lands habitat – a significant portion of assumed

available food energy – is derived using DED values reached or exceeded in 4 of 5 years (80% of winters), estimated using Monte Carlo simulation. This approach is used in acknowledgement that habitat conditions are temporally variable within the LMVJV. Second, our assessment of public lands habitat (energy) provision is based upon a three-year average, so as to account for annual variability driven mainly by weather (but also by capacity). Finally, we are developing habitat goals with the continental 80th percentile population objectives driving our operational objective, and habitat provision below that which is required to support the Long-term Average population objective as a “critical red flag” that, if not consistently exceeded would trigger concerted actions to accelerate conservation efforts.