Joint Venture Evaluation Plan

Photo courtesy of David McIvor

North American Waterfowl Management Plan
Acknowledgements

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Finally, without funding from the North American Waterfowl and Wetlands Office, it would not have been possible to bring the effort to a successful conclusion.

Prepared for the Lower Mississippi Valley Joint Venture Implementation Board by

Charles R. Loesch, Joint Venture Evaluation Coordinator,
U.S. Fish and Wildlife Service, 900 Clay Street, Vicksburg, MS 38880

Kenneth J. Reinecke, Field Station Leader, National Biological Survey, Mississippi Valley Field Research Station, 900 Clay Street, Vicksburg, MS 39180

Charles K. Baxter, Joint Venture Coordinator,
U.S. Fish and Wildlife Service, 900 Clay Street, Vicksburg, MS 39180

This document should be cited as:

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Introduction

In October 1990, private, state, and federal partners comprising the Lower Mississippi Valley Joint Venture Management Board adopted a plan of action for implementing the North American Waterfowl Management Plan (NAWMP) within the Lower Mississippi Valley (LMV). The LMV Joint Venture Plan was formulated to address problems that traditionally confronted wetland conservation in the region—the clearing of forested wetlands for agriculture, and extensive alterations of wetland hydrology resulting from basin-wide flood control and drainage. The traditional approach to wetland conservation has been to acquire and protect as many wetlands as possible and to slow the loss of remaining areas through regulatory programs and mitigation of federal flood-control projects. The first effort was by itself inadequate, and the second was largely unsuccessful.

By the late 1980s when the LMV Joint Venture Plan was being formulated, changes in economic, social, and regulatory environments had converged to reduce the pressures for wetland conversion, create opportunities for wetland enhancement and restoration, and provide avenues for integrating waterfowl management with traditional farming practices. Consequently, waterfowl researchers were gaining insights into the relationships between waterfowl populations and their wintering habitats that suggested new ways of organizing and evaluating habitat management programs at the regional level. Of special interest were insights into the relationship between hydrologic conditions on the wintering grounds and waterfowl population dynamics, the role of habitat managed by private landowners and the role of moist-soil and agricultural habitats in meeting waterfowl food requirements.

The goals, objectives, and strategies subsequently adopted for the LMV Joint Venture reflect a synthesis of traditional approaches, new opportunities, and an increasing understanding of waterfowl and wetland ecology and management. The LMV Joint Venture Management Board recognizes that as habitat projects are implemented, there must be a deliberate effort to monitor and evaluate the extent to which goals and objectives are accomplished. To that end, this document has been prepared—the LMV Joint Venture Evaluation Plan. It is important to recognize that this document was developed specifically to evaluate the goals and objectives identified in the LMV Joint Venture Plan (Lower Mississippi Valley Joint Venture Management Board 1990). The remaining narrative is organized into two parts. The first is an Evaluation Strategy. It briefly reviews the biological assumptions implicit in the LMV Joint Venture's goals and objectives, identifies specific issues to be addressed, and explains in general terms how data will be collected and used to address those issues. The second section, Evaluation Procedures, provides additional information on selected management studies and research required, and identifies responsibilities of LMV Joint Venture partners for implementation.

Evaluation Strategy

According to the guidelines developed by the Continental Evaluation Team, the primary strategies in a Joint Venture evaluation are to monitor progress in meeting the Joint Venture's goals and objectives, and test the validity of the assumptions that led to establishment of these goals and objectives. For reference, LMV Joint Venture goals and objectives are summarized in Appendix 1. Of the three goals, the partnership goal does not lend itself to quantification or evaluation, and accordingly, it is not addressed by this Evaluation Plan. The biological benefits of Joint Venture implementation hinge on the 'waterfowl' and 'waterfowl' goals (see the Lower Mississippi Valley Joint Venture Plan for a detailed discussion of the goals) and their associated habitat objectives (Appendix 1). Four assumptions implicit in the LMV Joint Venture's goals and objectives will be evaluated:

1. achieving the objectives of the LMV Joint
Venture will reverse the long-term trend of wetland loss with resulting benefits to the general health of wetland and terrestrial ecosystems;

2. achieving the objectives of the LMV Joint Venture will provide sufficient wetlands and associated habitats during winters of normal precipitation to meet waterfowl needs of migratory waterfowl at population levels specified in the NAWMP and Joint Venture Plan;

3. accomplishing the objectives of the LMV Joint Venture will provide benefits to other non-waterfowl migratory birds, particularly neotropical migratory forest birds, shorebirds, and wading birds; and

4. waterfowl management practices can become a viable component of sustainable agriculture within the LMV.

To the extent that success in achieving stated objectives can be measured and the validity of the assumptions tested, LMV Joint Venture partners will have a basis for evaluating the effectiveness of their collective actions, modifying efforts where necessary, and ultimately judging the extent to which the NAWMP has been implemented within the LMV. Our strategy will be to address a series of evaluation issues. The issues are identified for reference in Table 1; the general strategy for dealing with each is summarized at right. Procedural details are reserved for the Evaluation Procedures section.

Data Management

The evaluation of a regional conservation plan implemented by multiple partners over an extended period of time poses challenges in the management of data. Specifically, two data management issues have been identified:

1. implementing a system for tabulating, storing, and retrieving project accomplishments and

2. developing a capability for analyzing the spatial interactions of project implementation, habitat changes, and waterfowl population response.

The two corresponding components of the data management strategy will be participation in the International Tracking System (ITS) and development of a Geographic Information System (GIS) database, respectively. The ITS will provide a record of project accomplishments for periodic comparison with LMV Joint Venture objectives, and the GIS will provide a capability for illustrating regional land use and wetland changes, analyzing spatial relationships between public and private waterfowl management projects, and integrating management and research data for effective evaluation.

Waterfowl

Evaluation Issue 6 Develop LMV Joint Venture waterfowl population goals and foraging habitat objectives, and evaluate the success of the LMV Joint Venture in meeting foraging habitat objectives.

Evaluation Issue 7 Test the assumption that foraging habitat is the primary determinant of carrying capacity in the LMV Joint Venture area.

Evaluation Issue 8 Evaluate criteria used to (determine the potential food for energy value for foraging habitats.

Evaluation Issue 9 Determine the effectiveness of using small water control structures to retain inflows and provide waterfowl foraging habitat.

Evaluation Issue 10 Determine if harvested crop land can be managed to provide habitat for waterfowl while maintaining or improving farm profitability and water quality.

Evaluation Issue 11 Determine waterfowl population response to NAWMP and LMV Joint Venture habitat enhancement and restoration.

Non-waterfowl Migratory Birds

Evaluation Issue 12 Evaluate changes in forage fragmentation that result from LMV Joint Venture activities and relate these changes to habitat requirements of neotropical migratory forest birds.

Evaluation Issue 13 Evaluate opportunities to integrate the habitat needs of migratory shorebirds into management and forage habitat management techniques used to provide waterfowl foraging habitat.

Evaluation Issue 14 Evaluate the effects on waterfowl by providing annually flooded foraging habitat by using small water control structures to reduce wetlands.

accomplishments are meeting acreage objectives. Project data submitted by partners and recorded in the ITS will be compared periodically to the numerical objectives in Appendix 1. Progress will be evaluated in the semiannual meetings of the LMV Joint Venture Management Board, and annual progress reports will be published subsequently.

Determining the extent to which achieving Joint Venture habitat objectives satisfy the goal of reversing the long-term trend in wetland waterfowl habitat losses.
term trend of wetland loss will require data from sources other than the ITS. As detailed in Evaluation Procedures, sources of data such as the Status and Trends of the National Wetland Inventory, the Soil Conservation Service (SCS), National Resources Inventory (NRI), or analysis of LMV satellite imagery will be used to determine if wetland restoration exceeds wetland loss.

The strategy for evaluation of the LMV Joint Venture also includes analysis of one of the primary habitat restoration techniques used in the LMV which will be critical for increasing forest patch size—reforestation through direct planting of oak acorns and seedlings to encourage the establishment of heavy-seeded tree species on former agricultural sites. Field research comparing the success of various reforestation techniques will be required. Individual studies are ongoing on several state and federal management areas, and more comprehensive studies are proposed.

Lacking precise knowledge of the relationships between population levels and habitat conditions, the habitat objectives of past national and regional waterfowl management plans have tended to reflect opportunities for land acquisition or habitat enhancement rather than waterfowl population needs. On the wintering grounds, habitat objectives have generally been stated as land acquisition goals without specifying the relationship between acres acquired and desired population levels. The NAWMP and the guidelines of the Continental Evaluation Team call for increased focus on the relationship between waterfowl populations and habitats. Evaluation guidelines also suggest that wintering Joint Ventures emphasize habitat quantity and quality and place secondary emphasis on surveying population levels.

The waterfowl evaluation strategy for the LMV Joint Venture reflects this line of thought—establish habitat objectives that can be linked to population carrying capacity, test the validity of the assumptions involved, and evaluate the management techniques employed.

The evaluation strategy for waterfowl will focus on mallards, northern pintails, and related species (i.e., other dabbling ducks and wood ducks) that have experienced the greatest habitat losses resulting from destruction of seasonally-flooded forested wetlands and drainage of seasonally-flooded cypressland. These are the species emphasized in the LMV Joint Venture Plan and in sections of the NAWMP concerning the LMV.

From an evaluation perspective, geese receive limited attention in this Plan. Many goose populations (e.g., lesser snow goose and Canada goose subpopulations) are at or near population goals established by the Mississippi Flyway Council, suggesting that, while goose distribution may not be as desired, winter habitat in the LMV is not limiting. However, geese are considered users of wetland habitats in the LMV Joint Venture inasmuch as their use of a given habitat potentially reduces the availability of resources for dabbling ducks. Consequently, geese are addressed in the context that their presence requires the need for more wetland acres in the LMV Joint Venture than those necessary to satisfy the requirements of dabbling ducks.

Diving ducks also receive little attention. Most recent habitat losses in the Joint Venture area have been the seasonally flooded wetlands used by dabbling ducks rather than permanent wetlands used by diving ducks.

While lowered water quality in rivers and lakes may have reduced the carrying capacity of important diving duck migration and wintering habitat, diving ducks wintering in the LMV have benefited substantially from the creation of more than 100,000 acres of aquaculture ponds.

The LMV Joint Venture waterfowl population goal of providing habitat for 8.7 million ducks and 1.4 million geese.
was arrived at as the number of waterfowl expected to use habitats in the Joint Venture area, assuming the NAWMP
fall flight goal is achieved and dabbling ducks and geese are
distributed among major wintering areas as indicated by the
Midwinter Waterfowl Inventories (MWI) of the 1970's and
the late 1980's/early 1990's, respectively. Based on the
assumption that foraging habitat is the primary determinant
of carrying capacity in the LMV, foraging habitat objectives
for dabbling ducks will be based on potential food values of
the primary habitat types. In this manner, a direct linkage is
possible between LMV Joint Venture habitat objectives
and dabbling duck population goals. Data from a series of
research and management studies will then be used to
determine if foraging habitat is available at levels required by
the dabbling duck population goal. The remaining
waterfowl evaluations will use data from ongoing or
planned research to:

1. test the assumption that foraging habitat is the primary
determinant of carrying capacity in the LMV Joint
Venture area.

Non-Waterfowl Migratory Birds
The primary focus of the NAWMP and its Joint Ventures is to restore and enhance waterfowl populations and
habitats. Other species of wildlife, particularly those dependent on wetlands, will benefit to the extent
that their habitat needs are
compatible with management used to
provide habitat for waterfowl (e.g.,
bottomland hardwoods, moist-soil
habitats, cropland). Because goals and
objectives were not established for
wetlands wildlife other than waterfowl, the evaluation strategy for
these species will be to determine
qualitative (i.e., positive, neutral, or
negative) rather than quantitative
effects of LMV Joint Venture
programs. The species groups
selected for evaluation will be
neotropical migratory forest birds,
especially area-sensitive species,
uading birds, and migratory
shorebirds. Evaluations will consider:

1. effects on neotropical
migratory bird species of concern (Hunter et al. 1993)
of changes in forest fragmentation and reforestation
resulting from LMV Joint Venture programs
2. effects on selected shorebird species of management
strategies used to provide foraging habitat for
waterfowl, and
3. effects of seasonal water management on wading bird
populations.
Evaluation Procedures

DATA MANAGEMENT

Evaluation Issue 1
Implement a system for tabulating, storing, and retrieving project accomplishments.

BACKGROUND:
Data collection, storage, and retrieval is essential for evaluation of the LMV Joint Venture. Consequently, standardized procedures are needed for obtaining, storing, and summarizing wetland and associated habitat protection, enhancement, and restoration data resulting from the actions of Joint Venture partners.

PROCEDURES:
The International Tracking System (ITS) is an automated database developed by the U.S. Fish and Wildlife Service (USFWS) to track habitat protection, restoration, and enhancement accomplishments of the NAWMP. The LMV Joint Venture Management Board subsequently adopted the ITS for cataloging wetland habitat accomplishments. All habitat accomplishments by federal, state, and private partners will be recorded on a standardized accomplishment report and forwarded to the LMV Joint Venture Office for entry into the ITS. Individuals in the field must record and report accomplishments clearly and completely to ensure the accuracy, success, and usefulness of the ITS.

OPERATIONAL RESPONSIBILITIES:
It is the responsibility of the LMV Joint Venture partner conducting the habitat protection, restoration, or enhancement activity to complete accomplishment reports and forward them to the LMV Joint Venture Office at least annually. The Joint Venture Coordinator will be responsible for maintaining the database and providing summary reports to Joint Venture partners.

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Establish a data management system that will accommodate spatial analysis of habitat changes, program interrelationships, and wildlife population response at a regional scale.

BACKGROUND
Explicit in the goals and objectives of the LMV Joint Venture is a desire to effect landscape level changes in waterfowl habitat. To determine if this has been accomplished requires landscape level analysis of the quantity, quality, and spatial relationship of habitats affected by Joint Venture activities. In the past, logistics for performing landscape level analyses of habitat change and associated population responses were prohibitive using conventional methodology. However, the advent of GIS and related computer hardware have greatly expanded opportunities to conduct analyses of regional scope. The evaluation issue is to develop a GIS database for the LMV Joint Venture area to facilitate spatial analysis of habitat change, responses by waterfowl and other wildlife, and program interrelationships.

Geographic information systems are computer based spatial and related data management and analysis systems. The utility of GIS for evaluation of LMV Joint Venture programs lies in the ability of associated software to assemble layers of information in desired combinations to allow visual and quantitative analysis of spatial relationships relevant to Joint Venture accomplishments. The development of a GIS is a continual process of accumulating georeferenced information of biological and administrative importance in a digital format. An added attraction of GIS is the ability to share the information with a wide variety of users such as the North American Waterfowl and Wetlands Office, regional managers, researchers, and other cooperators.

PROCEDURES
Several data layers will be developed through cooperative efforts among Joint Venture partners to form the base maps for the GIS. Information will be most detailed for the LMV as a result of several research projects described in later evaluation issues. The basic data layers include:

- Georeferenced thematic mapper TMA satellite imagery data with 30 x 30 m pixel size purchased cooperatively by the USFWS, The Nature Conservancy of Louisiana, the University of Arkansas Center for Advanced Spatial Technology, and the US Army Corps of Engineers Vicksburg District (COE).
- Boundary files of USFWS National Wildlife Refuges (NWR), State Wildlife Management Areas (WMA), National Forests, and COE lands developed in cooperation with The Nature Conservancy of Louisiana.
- Digital line graph data derived from US Geological Service quadrangle maps depicting roads and trails, hydrography, railroads, and power and transmission lines.

Specific wetland protection, restoration, and enhancement accomplishments as they relate to FmHA tracts, the Wetland Reserve Program, and private land programs will be digitized and related to databases developed by the LMV Joint Venture Office.

This database will serve as a repository for spatial data relevant to the LMV Joint Venture and will augment the data collected through the ITS (see Evaluation Issue #1), which has limited geographic coordinate information. Data sources for development of the relational database will include Private Lands programs, Public Lands Questionnaires, the ITS, USFWS programs, Forest Service programs, Department of Agriculture programs, and their state counterparts. Examples of information from these programs to be incorporated in the GIS database include:

- Habitat Protection acquisition of authorized wetland mitigation projects.
additions to Federal NWR system
additions to State WMAs
acquisition or donation of conservation easements or
title by or to private conservation organizations
FmHA transfers of fee title or conservation easements
and additions to the Federal NWR system and State
WMAs

**Habitat Restoration**
on National Forests
on Federal NWRs
on State WMAs
on FmHA properties
on Department of Defense facilities
Department of Agriculture Wetland Reserve Program
private lands under management agreement with a
LMV Joint Venture partner
COE mitigation projects

**Habitat Enhancement**
on National Forests
on Federal NWRs
on Department of Defense facilities
on State Wildlife Management Areas
on private lands under management agreement with a
LMV Joint Venture partner

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A 486-66 mhz microcomputer with a large screen high
resolution monitor, color scanner, color and laser printers,
CD drive, and mass data storage and processing devices will
comprise the hardware for initial development of the GIS.
Microimages, Inc. Map and Image Processing software will
be the primary software used to create, manage, and analyze
related data files. Ultimately, a workstation will replace the
486 computer for GIS development and management.

**OPERATIONAL RESPONSIBILITIES**
The GIS of the LMV Joint Venture area will be developed
and maintained by the Evaluation Coordinator. The
Evaluation Coordinator will have primary responsibility for
collecting information for base map data layers and
obtaining data for inclusion in the relational database. LMV
Joint Venture partners will be called upon to assist in data
collection (e., maps, questionnaires) for developing various
data layers. State Team Leaders will be asked to aid in
collecting needed information relative to their state. Results
will be available to LMV Joint Venture partners upon
request.
WETLANDS AND ASSOCIATED HABITATS

Evaluation Issue 3
Determine the extent to which project accomplishments are meeting LMV Joint Venture objectives.

BACKGROUND.
The LMV Joint Venture Management Board identified acreage objectives for various waterfowl foraging habitats (Appendix 1). The acreage objectives were based on perceived necessity and necessity to satisfy the "wetland" goal of the LMV Joint Venture. Before the "wetland" goal was met, it was assumed that the amount of foraging habitat would be adequate to support the waterfowl population goal of the Joint Venture. The evaluation issue will consist of making direct numerical comparisons between cumulative project acres and their respective LMV Joint Venture objectives (Table 2).

![American Green-Winged Teal](image)

TABLE 2.

<table>
<thead>
<tr>
<th>OBJECTIVE</th>
<th>ITS ACCOMPLISHMENT</th>
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<td>Protection of Existing Naturally Vegetated Wetlands</td>
<td>Permanent conservation easement on private land held by a LMV Joint Venture Partner</td>
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<td>190,000 acres of conservation easements on private lands</td>
<td>Acquisition by a State and/or Federal LMV Joint Venture partner</td>
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<td>355,000 acres acquired in State and Federal management systems</td>
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<td>Wetland Restoration and Enhancement</td>
<td>Restoration and enhancement on State WMAa and Federal NWRb</td>
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<td>324,000 acres on properties owned or proposed for acquisition by State and Federal wildlife agencies</td>
<td>Restoration and enhancement on fee title Federal Public and Federal Public Land System lands with conservation easements</td>
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<td>74,000 acres of wetland transferred in fee title or conservation easements by Federal to State and Federal wildlife agencies</td>
<td>Restoration of wetlands in private ownership involving the Wetland Reserve Program or private lands programs in agreements held with LMV Joint Venture partners</td>
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<td>571,000 acres of marginal agricultural land restored to wetlands on private lands</td>
<td>Any management of winter water on private lands under agreement with a LMV Joint Venture partner</td>
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<td>582,000 acres of winter water management on privately owned farmed wetlands and prior converted wetlands remaining in agricultural production</td>
<td>Any change in operations that results in increasing the amount of winter water on the landscape</td>
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<td>Water Management Projects</td>
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<td>Operation of U.S. Army Corps of Engineers flood control/drainage structures to manage wetland hydrology on 100,000 to 300,000 acres of public and private lands</td>
<td>Any acquisition of authorized mitigation lands by the Corps of Engineers</td>
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<td>73,000 acres of authorized mitigation</td>
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1. Lower Mississippi Valley.
2. Wildlife Management Area.
4. Farmers Home Administration.
PROCEDURES:
The ITS will be used to document accomplishments reported by LMV Joint Venture partners and compute acreage summaries for various geographic areas (e.g., Joint Venture, stated over the array of conservation strategies identified in the LMV Joint Venture Plan (e.g., Fm-A lands, private lands, wetland protection). Results will be produced in tabular and graphical form to allow interpretation of temporal changes in acres of wetlands and associated habitats, and to make direct comparison of cumulative acres relative to the target Joint Venture objectives (Table 2). Results will be published annually in an LMV Joint Venture Accomplishment Report by the LMV Joint Venture Management Board.

OPERATIONAL RESPONSIBILITIES:
The LMV Joint Venture Assistant Coordinator is responsible for using the ITS to synthesize accomplishment data in tabular and/or graphical formats, and make direct comparisons of cumulative accomplishments to Joint Venture objectives. Additionally, the LMV Joint Venture Office is responsible for periodically compiling data into a draft Accomplishment Report for approval by the LMV Joint Venture Management Board.

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Evaluation Issue 4

Assess trends in the conversion and restoration of forested wetlands in the Lower Mississippi Valley to determine if achieving Joint Venture objectives will satisfy the goal of reversing the long-term trend of wetland loss.

BACKGROUND

A key assumption of the LMV Joint Venture Plan is that if Joint Venture objectives are met (Appendix) the long-term trend of wetland loss will be reversed. Evaluating changes in the quantity of wetlands will not only require data on habitat gains (Evaluation Issue #3) but also on habitat change and loss.

PROcedures

Two independent long-term landscape level programs currently conducted by the USFWS and SCS provide opportunities for evaluating the status and trends of forested and potentially other wetlands in the LMV Joint Venture area. The USFWS is responsible for reporting on the Status and Trends Inventory (STI) of wetlands in the conterminous United States at 10-year intervals (Dahl and Johnson 1991). Aerial photography is the principal data source and trend estimates are based on a sample rather than a complete inventory. Similarly, the SCS conducts a NRI at 5-year intervals to determine the status and condition of the Nation’s soil, water, and related resources (U.S. Department of Agriculture 1994). Site visits to geo-referenced sampling units established in 1982 form the basis for data collection. Importantly, both programs were developed with statistical sampling frameworks.

Usefulness of data collected in these programs depends on the wetland classification system used, the sampling intensity in the area of interest, and subsequent statistical properties of the estimates.

The use of satellite imagery for evaluating forested wetland trends is possible and would allow a complete census rather than a sample estimate of forested wetland acres in the LMV. Relative ease in distinguishing forested from non-forested cover classes make classification of satellite imagery an attractive option for evaluating certain land cover changes, such as forested wetlands. It is important to note that the resolution of TM satellite imagery hinders the ability to identify small, seasonal, nonforested wetlands. Thus, the use of TM imagery with current capabilities would be specific to forested wetlands. Depending on the usefulness of STI and NRI image processing will be used to perform a supervised land cover classification to identify forested areas in the LMV. Total acreages of bottomland hardwoods will be compared directly with bottomland hardwood acreage totals from imagery for 1992. Raster images will be used to...

NATURAL FLOODING IN BOTTOMLAND HARDWOODS

The LMV once contained approximately 24 million acres of forested wetlands. However, the clearing of forested areas has changed the composition of wetland types in the LMV to include a large component of farmed wetlands that lack natural vegetation and are difficult to identify. To simplify evaluation and maintain the line of thought forwarded in the LMV Joint Venture Plan, the primary analysis of the evaluation will compare bottomland hardwood loss to the restoration of forested and herbaceous (e.g., most soil) wetlands on agricultural sites. This strategy will not preclude more detailed analysis of wetland trends as advances in technology allow reliable remote sensing of wetland types other than forested wetlands (e.g., 1988-89 Mississippi Delta Farmed Wetland Study).
analyze changes in the spatial distribution and size of forest blocks. Changes in forested wetlands not associated with LMV Joint Venture projects will be identified by cross-referencing GIS data with locations of new forest stands detected on the TM images.

The ITS and GIS will be used to store data for all wetland restoration and creation undertaken by LMV Joint Venture partners. Gains in wetland acreage will be summarized in tabular and graphical form, and vector files will be developed for restoration sites to allow visual analysis when overlaid on base maps depicting existing forest blocks.

**OPERATIONAL RESPONSIBILITIES:**
Investigation of the opportunities for evaluating wetland trends in the LMV Joint Venture will be the responsibility of the LMV Joint Venture Evaluation Coordinator with the assistance of other Joint Venture partners.

Land cover classification using 1992 TM satellite imagery for portions of eight scenes (i.e., Path 23 Rows 34, 35, 36, 37, 38, and 39, and Path 24 Rows 35 and 36) that comprise the LMV is currently being conducted by the Mississippi Valley Field Research Station (MVFRS) of the NWS Southern Science Center (SSC). The Nature Conservancy of Louisiana, and the University of Arkansas. Classification of subsequent satellite images purchased near the end of the Joint Venture will be the responsibility of the Evaluation Coordinator. Financial responsibility for purchases of subsequent satellite imagery will be the responsibility of LMV Joint Venture partners.

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Analyze the efficiency and effectiveness of techniques in reestablishing heavy seeded species of bottomland hardwoods.

BACKGROUND:
The LMV Joint Venture Plan called for bottomland hardwood reforestation on approximately 600,000 acres of public and private lands. Reforestation programs designed to provide wildlife habitat generally do not employ intensive silvicultural practices to promote the establishment and growth of hardwood seedlings. Instead, sites generally are planted with one or two oak species and "walked away from" with the assumption that in the following years a mixed bottomland hardwood forest with a strong oak component will develop. This assumption is critical considering that the desired result of reforestation in the LMV Joint Venture is to establish a viable oak component in restored bottomland hardwood forests. The evaluation issue is to conduct research to test this assumption and develop guidelines for effective reforestation that consider planting seeds vs. seedlings, site preparation, timing of planting, soil type, planting depth, water management, and other ambient conditions that result in the greatest likelihood that oaks will survive and become important tree species at a reforested site.

PROCEDURES:
Several tracts of previously farmed wetlands on NWRs and on private lands enrolled in the Wetland Reserve Program will be chosen as sample units to test the effects of site preparation, planting techniques (i.e., aerial seeding, direct seeding, seedling planting), depth of planting, timing of planting, and tree species on germination and/or seedling survival. Additionally, the occurrence and survival of naturally established light-seeded trees will be measured to evaluate the assumption that these tree species will invade on their own, and do not need to be planted. Techniques for evaluating the success of reforestation based on the survival of target tree species will be developed.

OPERATIONAL RESPONSIBILITIES:
Louisiana State University and Region 4 of the USFWS will initiate a study in Fall 1993 to address these issues. Researchers from Louisiana State University will be responsible for conducting field work, analyzing data, and publishing reports containing results. Additional research studies concerning the ecology of hardwood bottomland forests and techniques for reforestation to be coordinated by the NRS. SSC are also planned or ongoing in the LMV. The results of these studies will be reviewed for use in the development of reforestation methods recommended for the LMV Joint Venture area.

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WATERFOWL

Evaluation Issue 6
Develop LJV Joint Venture waterfowl population goals and foraging habitat objectives, and evaluate the success of the LJV Joint Venture in meeting foraging habitat objectives.

BACKGROUND:
The purpose of habitat Joint Ventures is to reduce the effect of factors that limit regional waterfowl populations. The L JV Joint Venture assumes that availability of foraging habitat is the most important factor affecting the number of dabbling ducks that can be accommodated in the L JV during winter. If foraging habitat is the primary limiting factor, then it is possible to calculate the amount of foraging habitat needed to satisfy the L JV Joint Venture waterfowl population goals. This evaluation issue addresses the methods needed to:

1. calculate L JV Joint Venture duck population goals and foraging habitat requirements; and
2. determine the extent to which availability of foraging habitat in the L JV area satisfies dabbling duck requirements.

The L JV Joint Venture will be judged successful in achieving objectives for foraging habitat if the total duck-use days of food available meets or exceeds requirements calculated from population goals. Other criteria may include limits on the proportion of foraging habitat on public versus private land, the proportion of dependable 6e, with water control versus unpredictable 6e, naturally-flooded habitat, the proportion of natural 6e, forested wetlands and moist soil 6e versus agricultural habitats, and the amount of habitat needed to support desired goose populations.

PROCEDURES:
Development of Population and Carrying Capacity Goals

Dock Population Goal: L JV Joint Venture duck population goals were calculated using data from MWL, waterfowl harvest estimates, and the continental waterfowl population goals in Table 1 of the NAWMP (U.S. Fish and Wildlife Service and Canadian Wildlife Service 1986). In the first step, selected species were dropped from the list in Table 1 of the NAWMP so the analysis would be based only on continental population goals for species of ducks found in the L JV Joint Venture area in significant numbers (29,850,000 dabbling ducks of 7 species and 11,040,000 diving ducks of 5 species). Then, data from MWL for the years 1979-79 were used to calculate percentages separately for dabbling and diving ducks indicating the relative number of ducks in each species group that were counted in MWLs of the L JV Joint Venture States compared to the number counted in all 48 states. As an example, methods for computing the dabbling duck and wood duck population goal for Arkansas are provided in equations 1-5.

Equation #1

\[ \frac{5,828 \text{ (mean # of dabbling ducks counted in AR during MWL)}}{10,720,000 \text{ (mean # of dabbling ducks counted in all 48 states during MWL)}} = 0.0544 \text{ (mean # of dabbling ducks counted in continuous 48 states during MWL)}} \]

To determine the percentage of dabbling and diving ducks associated with the L JV Joint Venture area within each state, the average annual harvest of each of these groups of species in the Joint Venture counties of each state was divided by the statewide harvest of the same species group. A similar calculation was used to determine the percentage of dabbling and diving ducks associated with the Mississippi Alluvial Valley (MAV) area of each state. In doing this, the assumption was made that the distribution of the harvest of ducks within states is a good indicator of the distribution of ducks.

Equation #2

\[ \frac{99.36\% \text{ of dabbling ducks harvested in Joint Venture counties in AR}}{576,395 \text{ (mean # of dabbling ducks harvested in AR)}} = 572,799 \text{ (mean # of dabbling ducks harvested in Joint Venture counties in AR)}} \]

Population goals for dabbling and diving duck species groups were then calculated for the Joint Venture area of each state and for the MAV portion of each state by multiplying the continental goals for the selected groups of dabbling or diving ducks by the percentage of dabbling or diving ducks waterfaring in each state, and by the percentage of dabbling or diving ducks harvested in the Joint Venture or MAV area of each state.

Equation #3

\[ \frac{20,032,890 \text{ (dabbling ducks goal for AR)}}{5,828 \text{ (mean # of dabbling ducks counted in AR)} = 20,032,890(1.00 \times 0.0544 \times 0.9936 \times 0.572799) = 589,000 \text{ (dabbling duck goal)}} \]

Wood duck population goals for the states were calculated separately as indirect population estimates by assuming that average annual harvests are about 10% of winter populations of wood ducks.
Canada goose population levels for estimating foraging habitat needs were computed from 1985-89 MWI (January survey) results from parts of the survey conducted in the LMV Joint Venture area of the state. The years 1985-89 were selected because Canada goose breeding populations generally were at or near goals identified in Mississippi Flyway goose management plans and the numbers of geese counted are considered to represent the number of birds expected to winter in the Joint Venture area during periods of relatively high populations. It is beyond the scope of this evaluation plan to establish a desired distribution of Canada geese among states. Instead, we recognize the distribution observed during the 1985-89 MWI as the likely distribution of Canada geese for the duration of the NAWMP.

Similarly, MWI data (January results) were used to determine the number and distribution of snow geese in the Joint Venture portions of the respective states. However, because snow goose numbers have increased dramatically in recent years, the average number of snow geese observed during 1988-92 was used as a measure of the numbers of snow geese dependent on the LMV Joint Venture during winter. The distribution of snow goose among states is the same as that reflected by 1988-92 MWI results.

### Availability of Foraging Habitat

#### Food (for Energy)

<table>
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<tr>
<th>Food for Energy Required Per Duck Per Day</th>
<th>Food for Energy Available Per Duck Per Day</th>
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<tr>
<td>The amount of food consumed each day by a duck is determined primarily by its energy requirements, which in turn is a function of body size, temperature, and other variables. The predicted energy requirement of a 1.15 kilogram (2.5 pound) mallard subjected to temperatures typical of winter in the LMV (0-20 Centigrade or 30-70 Fahrenheit) is about 292 kilocalories per day. To keep the analyses of food requirements simple and to ensure that requirements for foraging habitat are not underestimated, it was assumed that all dabbling ducks wintering in the LMV Joint Venture area are mallard-sized.</td>
<td></td>
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</table>

### Goose Foraging Habitat Needs

To ensure that adequate habitat is available in the LMV Joint Venture to support goose and duck populations consistent with identified goals, a measure of the habitat needs of geese was required. The first step was to identify the number and distribution of Canada geese and snow geese (including white-fronted geese) wintering in the LMV Joint Venture during recent winters. A summary of Canada and snow goose populations and foraging needs is given in Tables 3 and 4.

#### TABLE 3

| Estimates of Population goals for dabbling ducks (including wood ducks) and diving ducks in the Lower Mississippi Valley Joint Venture and the number of Canada geese and snow geese expected to winter in LMV Joint Venture states. |
|---|---|---|---|---|---|---|---|
| State | Dabbling Ducks | Diving Ducks | Total | Dabbling | Diving | Total | Canada Geese | Snow Geese |
| Arkansas | 2,954,310 | 90,290 | 2,145,210 | 2,488,200 | 107,730 | 2,593,930 | 33,400 | 480,000 |
| Illinois | 10,890 | 0 | 10,890 | 262,130 | 5,750 | 267,880 | 287,000 | 1,000 |
| Indiana | 0 | 0 | 15,360 | 620 | 15,970 | 6,000 | 0 |
| Kentucky | 21,500 | 230 | 21,180 | 57,700 | 1,950 | 59,650 | 58,000 | 10,000 |
| Louisiana | 1,145,330 | 386,130 | 1,531,460 | 1,910,980 | 982,530 | 2,893,520 | 1,000 | 198,000 |
| Missouri | 103,350 | 4,250 | 107,600 | 103,350 | 4,250 | 107,600 | 28,000 | 12,000 |
| Mississippi | 590,490 | 53,510 | 744,500 | 744,750 | 61,770 | 806,520 | 700 | 6,000 |
| Oklahoma | 0 | 0 | 308,070 | 3,640 | 311,710 | 3,700 | 15,000 |
| Tennessee | 313,810 | 17,470 | 331,120 | 466,890 | 27,250 | 494,140 | 57,300 | 5,000 |
| Texas | 0 | 0 | 809,270 | 312,900 | 1,122,170 | 500 | 1,000 |
| Total | 4,339,770 | 550,050 | 4,890,220 | 7,145,650 | 1,333,430 | 8,492,900 | 892,900 | 717,210 |

### Notes:

1. Estimates for portions of the Lower Mississippi River Joint Venture focused within the Mississippi Alluvial Valley.
2. Estimates are for the entire Lower Mississippi Valley Joint Venture.
3. Dabbling ducks include mallard, northern pintail, American black duck, redhead, American widgeon, American green-winged teal, northern shoveler, and wood duck.
4. Diving ducks include American wigeon, canvasback, greater and lesser scaup, ring-necked duck, and redhead duck.
5. Estimates are for all Canada goose subpopulations.
6. Estimates include white-fronted geese.
7. Estimates include male and female dabbling ducks.
**Food for Energy**

Available Per Acre of Moist-Soil Habitat

The food value (in duck-use days) of moist-soil habitats is based on:

1. the seed production of moist-soil plants;
2. the energy value of moist-soil seeds; and
3. the daily energy requirements of ducks (from above).

Researchers have recommended that 450 kg/ha (400.6 lbs/acre) is a reasonable value to use for the average seed production of moist-soil areas. However, not all of this food is used by ducks, because they generally move to new foraging habitats when food densities become too low for efficient feeding. Circumstantial evidence indicates that this threshold is at a density of about 500 kg/ha (446 lbs/acre) (Reinecke et al. 1989).

The amount of energy that ducks can metabolize from moist-soil seeds has been estimated at about 2.5 kilocalories of energy per gram of seeds (Reinecke et al. 1989).

Combining data from the steps described above indicates that an acre of moist-soil habitat provides an average of 1,380 duck-use days of potential food (Table 5).

**Food for Energy** Available Per Acre of Cropland

The food value of croplands is based on:

1. the yield of the crop or amount of grain lost during harvest;
2. the presence of other food sources such as weed seeds and
3. the energy value of the foods.

Generally, the energy value of domestic grains averages about 3.5 kilocalories per gram. For croplands that are harvested, estimated densities of waste grain and weed seeds have been published (Reinecke et al. 1989). With these data and the methods used to calculate the food value of moist-soil areas, the duck-use days available for harvested fields of each of the major crop types in the LMV Joint Venture area can be calculated (Table 5).

### TABLE 4

Waterfowl foraging habitat needs expressed in duck-use days (million) for dabbling ducks (including wood duck and diving ducks in the Lower Mississippi Valley Joint Venture and as goose-use days (million) for Canada geese and snow geese.

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a Estimates are for portions of the Lower Mississippi Valley Joint Venture located within the Mississippi Alluvial Valley.

b Estimates are for the entire Lower Mississippi Valley Joint Venture.

**Table 5**

Carrying capacity of selected foraging habitats (expressed as duck-use days/acre) of dabbling ducks wintering in the Lower Mississippi Valley Joint Venture area

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<th>Habitat</th>
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<td>Soybean</td>
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<td>Millet</td>
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<td>75609*</td>
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Yield estimates used to compute duck-use days/acre for harvested and unharvested cropland are derived from the results of the 1983 Inventory of Waterfowl Management Capability on Public Land and therefore are relevant primarily to public lands managed for wildlife.
For croplands that are not harvested, food production can be estimated as crop yield by local land managers, or in the case of crops on public lands in the LMV Joint Venture, computed as an average for similar areas by the Evaluation Coordinator as was done for Table 5. Thereafter, food values of unharvested croplands are estimated with the same methods as for harvested croplands and moist-soil habitats.

Food for Energy Available Per Acre of Bottomland Hardwood

The food value of bottomland hardwoods is based on:
1. the density of acorns, aquatic invertebrates, and the moist-soil seeds found in forest openings; and
2. the average energy value of these foods.

The density of aquatic invertebrates used in this evaluation (13.7 kg/ha) is an average taken from a study in Missouri, and the density of moist-soil seeds (22.5 kg/ha) is based on the assumptions that openings occupy 5% of the area of bottomland hardwood stands and that the density of moist-soil seeds in openings is the same (450 kg/ha) as in moist-soil habitats. The energy value of foods from bottomland hardwoods is about 3.5 kilocalories per gram, because of the high energy content of acorns.

The density of acorns available to ducks undoubtedly varies with the percent of red oaks 6% oaks other than overcup oak in the forest canopy. A long-term study in Missouri reported that a forest with 50% of its basal area in willow and pin oaks produced an average of 142 kilograms of acorns per hectare. Because acorns contain about 50% shell and water, average food availability at this site was about 71 kilograms per acre. To calculate the food value of forest stands with varying canopy composition, we used data from the Missouri study and assumed that acorn production is proportional to the percent basal area of red oaks in the canopy. Representative values for bottomland hardwood stands are listed in Table 5.

Monitoring Acreage of Available Foraging Habitat

Availability of foraging habitat will be inventoried in three land ownership categories (i.e., public lands, managed private lands, and naturally-forested lands) that parallel the principal habitat management strategies of the LMV Joint Venture. The public lands category includes state and federal lands that contain significant waterfowl habitat. Availability of foraging and other waterfowl habitats on public lands in the LMV Joint Venture area is being determined with a questionnaire titled “Inventory of Waterfowl Management Capability on Public Lands.” The questionnaire is designed to obtain information on the acreage of the three primary foraging habitats (i.e., moist-soil areas, croplands, bottomland hardwoods) and the extent to which they are subject to water management control. By determining water management capability, we can separate habitats with predictable (i.e., partial or completed) water control from less predictable (i.e., naturally flooded) habitats for inventory and management planning.

The capability of public lands to provide foraging habitat will be determined as the sum of the acres of each foraging habitat (i.e., moist-soil, cropland, and bottomland hardwoods) multiplied times the appropriate number of duck-use days, with calculations done separately for each state and water management category (i.e., managed vs. naturally flooded).

The managed private lands category includes private lands on which some purposeful action has been taken to increase benefits to waterfowl. The majority of these lands are rice fields managed to retain winter rainfall or water pumped from surface or ground sources. Significant acreages of soybean fields are also managed in this way as are lesser acreages of other crops, moist-soil areas, and bottomland hardwoods. Some rice farmers flood fields to level the surface of the soil that has been disturbed by harvesting equipment or to increase the rate of decomposition of the rice straw. Because these practices and the management of shallow impoundments for crappie production provided benefits as great as intentional management for ducks, we will include them in the managed private lands category.

Inventorying managed private lands will be limited to the MAV. The method selected for initial investigation is a modification of the aerial sample survey designed by
Reinecke et al. (1992) to estimate mallard populations. Flight altitude and transect width will increase because of the size of the habitat units under investigation, but survey stratum and substratum boundaries will remain the same to ensure that data on managed private land can be used in further analyses of factors affecting the abundance and distribution of mallards in winter.

During aerial surveys, approximately 10% of the MAV will be sampled and the size, habitat type, and location of managed private lands will be recorded. Data from the samples will be used to estimate the total acres of managed private land in the MAV and the acres of managed private land in the primary habitat types (e.g., rice and soybeans). The capability of managed private lands to provide foraging habitat will be determined as the sum of the acres of each habitat type multiplied times the food value per acre.

The category of naturally flooded lands includes all lands that benefit waterfowl but do not have a controlled water regime. Large acreages of forested wetlands and low-lying croplands are included in this category, as well as smaller areas of moist-soil habitat. Evaluation of the contribution of this category to the foraging habitat requirements of ducks will be restricted to the MAV and will involve habitat classification using satellite imagery and GIS analysis.

First, a digital habitat map of the entire study area must be developed. Supervised supervised unsupervised methods of image analysis will be used to classify land cover into habitat types in the MAV using data from thematic mapper satellite imagery collected during June and October 1992. Ground truth data will be obtained and error rates for the habitat classification will be determined as part of a separate study conducted by the NYS MVFRS.

The extent and spatial distribution of natural flooding will be determined separately by analysis of multi-spectral scanner imagery dated January 1988, 1989, 1990, and December 1988 and 1989. By combining (i.e., overlaying) the habitat classification and flooding data, the acreage of various habitat types affected by flooding can be calculated. As for the public lands and managed private lands, the capability of naturally-flooded lands to provide foraging habitat for ducks will be determined as the sum of the acres of each habitat type multiplied times the food value per acre of the habitat.

**OPERATIONAL RESPONSIBILITIES**

Evaluation of this issue will require completion of several cooperative studies. The LMV Joint Venture Evaluation Coordinator will have primary responsibility for work done by the Joint Venture Office and for acting as liaison between the research community and the Joint Venture Office.

Evaluation of the contribution of public lands to the foraging habitat objectives of the LMV Joint Venture will be based on data from the Inventory of Waterfowl Management Capability on Public Lands. The public lands questionnaire will be administered by the LMV Joint Venture Evaluation Coordinator and analyzed by the coordinator with help from NYS researchers. Results will be reported to the LMV Joint Venture Management Board as data become available.

Evaluation of the contribution of managed private lands to the foraging habitat objectives of the LMV Joint Venture will be based on data from a cooperative study involving NBS MVFRS, Mississippi State University, and the LMV Joint Venture Office. The Evaluation Coordinator will be responsible for ensuring that estimates of managed private land from the cooperative study can be related to the foraging habitat objectives of the Joint Venture. Results will be provided to the LMV Joint Venture Management Board at the end of the research study.

Evaluation of the contribution of naturally flooded lands to the foraging habitat objectives of the Joint Venture will be based on data from a cooperative study involving the NBS MVFRS, The Nature Conservancy of Louisiana, the University of Arkansas Center for Advanced Spatial Technology, the COE, and the LMV Joint Venture Office. The Evaluation Coordinator will be responsible for ensuring that estimated acreages of naturally flooded lands can be related to the foraging habitat goals of the Joint Venture. Results will be provided to the LMV Joint Venture Management Board at the end of the research study.

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17
Evaluation Issue 7

Test the assumption that foraging habitat is the primary determinant of carrying capacity in the LMV Joint Venture area.

BACKGROUND:
Each Joint Venture explicitly or implicitly identified limiting factors in its respective area when goals and objectives for habitat protection were established. To date, researchers in the LMV Joint Venture area have not documented strong density effects (i.e., habitat limitation on wintering area). However, evidence of increases in body weights, survival rates, reproductive indices, and numbers of mallards present in the LMV during winters of greater habitat availability suggests that some degree of habitat limitation exists except during winters of extensive natural flooding.

There currently is little evidence that disease, environmental contaminants, or predators limit carrying capacity of habitats in the LMV in important ways. Instead, availability of wetland habitat generally, and availability of foraging habitat specifically, are thought to have the greatest influence on the abundance, distribution, and body condition of ducks in the Joint Venture area. For these reasons, the management strategy for achieving the LMV Joint Venture waterfowl goal assumed that increasing foraging habitats, especially those with managed or predictable water regimes, is the most effective way to provide adequate carrying capacity for ducks.

Because the assumption that foraging habitat is the most important determinant of carrying capacity could greatly affect the success and effectiveness of LMV Joint Venture management strategies for waterfowl, testing this assumption is an important part of the evaluation strategy. Testing such an assumption involves making quantitative predictions regarding relationships that should be observable if the assumption is true and then comparing the predictions with appropriate observations.

The issue of limiting factors is critical to waterfowl research and management in the LMV. Consequently, the evaluation strategy includes encouraging others to explore independent approaches to testing this assumption or other assumptions about different limiting factors.

PROCEDURES:
Two predictions that can be used to test the assumption about the importance of foraging habitats in the LMV Joint Venture area are:

1. the regional distribution and abundance of ducks are more closely associated with measures of availability of foraging habitat than with measures of other habitat characteristics; and

2. food resources at most foraging sites will become depleted, and decreases in food supply will be accompanied by changes in the use of foraging habitats and in the behavior of foraging ducks (e.g., faster rates of movement while feeding).

Tests of prediction #1 will focus on mallards because winter population data are available from aerial surveys conducted in the LMV during winters 1987-89 (Reinecke et al. 1992). Measures of habitat availability will be obtained from the GIS database (Evaluation Issues #2 and #12) and from studies of waterfowl habitat on public and private lands (Evaluation Issue #6). Data analyses will require statistical modeling to determine if availability of foraging habitat has a greater effect on the distribution and abundance of mallards than weather, disturbance, or availability of non-foraging (i.e., resting, sanctuary) habitats.

Tests of prediction #2 will require sampling food resources and documenting patterns of habitat use and foraging.
behavior, including nocturnal feeding activity. Data analyses should determine if:
1. food supplies decline over time to a relatively low level on most study sites;
2. decreases in food resources are related to cumulative habitat use by ducks;
3. habitat use by ducks decreases only after depletion of food occurs and
4. decreases in food availability over time are associated with changes in foraging behavior (e.g., percentage of time spent feeding or rates of movement).

OPERATIONAL RESPONSIBILITIES:
For testing prediction #1, staff from the NBS MVFRS will have primary responsibility for statistical analyses and preparation of reports. The role of the LMV Joint Venture Evaluation Coordinator will be to:
1. provide researchers with waterfowl habitat data from the Public Lands Questionnaire,
2. participate in ongoing research studies of waterfowl habitat on private lands (see Evaluation Issues #6 and #9), and
3. participate in any future transect surveys of waterfowl distribution and abundance.

The NBS MVFRS currently is completing a study that addresses the depletion of food resources in selected foraging habitats. In addition, they have proposed research to address behavioral aspects of prediction #2.

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19
Evaluation Issue 8
Evaluate criteria used to determine the potential food (or energy) value of foraging habitats.

BACKGROUND.
Judgments about the success of the LMV Joint Venture in providing adequate foraging habitat for waterfowl rest on two assumptions. The first is that providing additional foraging habitat will result in the greatest increase in total carrying capacity for ducks examined in Evaluation Issue #7. The second assumption is that the criteria used to measure the food value of foraging habitats accurately reflects their value to ducks.

Because dabbling ducks wading in the LMV obtain most of their food from croplands, moist-soil areas, and forested wetlands, criteria used to measure the food value of these habitats are of most concern. Evaluation efforts for this issue will have three objectives:
1. update the criteria as new research data become available;
2. use simulation analysis to determine the sensitivity of estimates of total foraging habitat capacity in the LMV to sampling errors and biases in the food values used; and
3. recommend new research, where needed, to understand the food value of foraging habitats.

PROCEDURES.
The first objective can be satisfied by periodically reviewing research at universities and state and federal agencies. For example, results from an ongoing study of food densities on croplands and moist-soil sites in the LMV by the NBR MVRFS, and from recently completed research at Mississippi State University investigating invertebrate abundance in bottomland hardwoods, moist-soil, and agricultural habitats will be used to reassess the values currently assigned to selected habitat types.

Determining how sensitive estimates of total foraging habitat capacity are to errors in assessing food value will require two sources of data:
1. estimates of acreages of foraging habitats; and
2. estimates of the means and variances of food values of habitats.

Estimates of the acres of foraging habitats available on public lands, private lands managed for waterfowl, and private lands subject to natural flooding will be available from Evaluation Issue #6 and will be maintained in the GIS. Estimates of the food values of habitats and their sampling errors will be taken from published literature.
The dependent variable in the simulation analysis will be total foraging capacity expressed as duck-use days (see Evaluation Issue #63). Acreages of foraging habitat for the three principal habitat types (i.e., bottomland hardwood, moist soil, and cropland) will be combined with estimates of food value to calculate foraging capacity for public lands, managed private land, and naturally flooded land (see Reinecke et al. 1989). This value will serve as the baseline foraging habitat capacity.

Two approaches will be used to assess the effects of errors in food values assigned to foraging habitats. The first approach will be to systematically manipulate estimates of food value (e.g., 25, 50, 75, 100, 125, 150, and 175% of current value) to determine how these changes affect estimates of total foraging habitat capacity. The second approach will be to use Monte-Carlo simulation to determine effects of random sampling errors on variation in estimates of total foraging habitat capacity. Results from the evaluation will provide guidance regarding the reliability of estimates of available foraging capacity and recommendations regarding the need to obtain better information on the food value of selected habitats.

OPERATIONAL RESPONSIBILITIES:
The LMV Joint Venture Evaluation Coordinator will monitor ongoing research and incorporate improved estimates of the food value of foraging habitats in evaluation analyses as they become available. The Evaluation Coordinator also will conduct the sensitivity analyses, with guidance from researchers representing the NRS MVFRS and interested universities.

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Evaluation Issue 9

Determine the effectiveness of using small water control structures to retain run-off and provide waterfowl foraging habitat.

BACKGROUND:

Winter water management is a major feature of the LMV Joint Venture strategy for public and private lands enhancement and restoration, and for water resource development. Historically, seasonal flooding provided extensive habitat for wintering waterfowl in the LMV. However, drainage for agricultural purposes has eliminated most of this potential foraging habitat. Winter water management programs attempt to duplicate seasonal flooding typical of an undrained landscape by temporarily blocking drainage systems to retain winter rainfall on natural wetlands and croplands. This management strategy is designed to increase waterfowl habitat available in years of normal to below normal precipitation at minimal expense. A critical assumption implicit in this strategy is that rainfall is adequate in most years to provide sufficient run off to achieve intended wetland acreages. The evaluation issue is to test the validity of this assumption.

PROCEDURES:

A GIS database of cooperative private lands wetland projects will be developed with data submitted by field personnel. Random samples of these projects will be selected during winters 1992-93 through 1994-95 and photographed from the air to document acreages of surface water achieved by winter water management. Ocular estimates will also be made. The evaluation will consist of comparing the flooded acres actually achieved by projects receiving different amounts of rainfall to their acreage objectives and comparing amounts of observed rainfall to long-term precipitation patterns. Integrating these data will provide information for predicting how much habitat the winter water management strategy is likely to achieve given historic rainfall patterns in the LMV.

OPERATIONAL RESPONSIBILITIES:

The LMV Joint Venture Evaluation Coordinator will be responsible for managing the GIS database of private lands projects. Researchers from the NBS MVFRS and Mississippi State University will be responsible for conducting field studies, analyzing data, and preparing reports.

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Evaluation Issue 10

Determine if harvested cropland can be managed to provide habitat for waterfowl while maintaining or improving farm profitability and water quality.

BACKGROUND.

Managing harvested cropland as waterfowl foraging habitat is critical to achieving the goals and objectives of the LMV Joint Venture. Among the Joint Venture objectives (Appendix 1), the largest acreage objective relates to water management on private agricultural lands. Likewise, the strategy considered most important in producing landscape-level changes in land use is the integration of waterfowl and wetland conservation with traditional soil and water management practices. To date, Joint Venture partners have been successful in recruiting private landowners willing to manage their croplands for wintering waterfowl. The landowners involved generally have an interest in waterfowl conservation and operate from the unstated assumption that although waterfowl management involves extra expense, it is at least neutral with respect to agricultural production.

Limited resources make it unlikely that objectives on private lands can be achieved by providing financial assistance to expand the group of interested landowners. Management of winter water at the level called for in Joint Venture objectives will likely occur only if it can be demonstrated that costs associated with waterfowl management are offset by decreases in costs of agricultural production or in increases in crop yield.

Fortunately, there is a growing perception that flooding of croplands following harvest benefits both economic and ecological sustainability. Informal studies and anecdotal reports from landowners suggest that production benefits from winter flooding may include: a reduced need for tillage; reduced red rice infestation; reduced application of pre-emergent herbicides; and reduced erosion and sedimentation. Evaluating the LMV Joint Venture's water management strategies on agricultural lands will require that these relationships be researched.

PROCEDURES.

Evaluation efforts will address two critical issues:
1. documenting the effects of winter water management on the economics of rice/soybean production; and
2. determining the effects of winter water management on water quality of agricultural runoff.

A study will be designed to document the effects of winter water management practices on the economics of rice.
production. The study will include a review and compilation of existing literature and individual case studies, and initiation of directed studies as needed to provide additional information on specific issues. Because rice production generally involves soybeans as the rotational crop, information of value for integrating waterfowl management practices with soybean production is expected from what might otherwise be viewed as a "rice" study. Information will be distributed to individual producers through brochures, tours of demonstration farms, and articles in various industry publications.

Assessing the effects of habitat management practices on the water quality of agricultural runoff will require directed studies contrasting the water quality of runoff from fields managed for migratory birds with that of unmanaged fields. The development and conduct of these studies will require collaboration with as well as support from the Environmental Protection Agency, SCS, state water quality organizations, and Soil and Water Conservation Districts.

OPERATIONAL RESPONSIBILITIES:
The LMV Joint Venture Office will be responsible for coordinating the participation of Joint Venture partners in the rice production economic benefit study. Public relations support from member agencies and organizations of the LMV Joint Venture Management Board will be required in disseminating study results.

The LMV Joint Venture Office will be responsible for the development of a study proposal for assessing water quality impacts and developing funding partnerships for implementing such studies.

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24
Evaluation Issue 11

Determine winter waterfowl population responses to NAWMP and LMV Joint Venture habitat enhancement and restoration.

MALLARDS

BACKGROUND:

Although population responses are the ultimate measure of success of waterfowl habitat enhancement and restoration, they are difficult to quantify. Population responses will be the focus of NAWMP continental evaluations, whereas Joint Venture evaluations will emphasize habitat accomplishments more than population responses. The LMV Joint Venture population goal is to provide sufficient winter habitat for 8.7 million ducks or about 14% of the breeding population goal of the NAWMP.

Methods for estimating numbers of diving ducks wintering on catfish ponds in Mississippi have been developed (Dubovskiy et al. 1989) and possibly could be adapted to sample diving ducks using lakes, reservoirs, and aquaculture ponds throughout the LMV. Methods also have been developed to estimate numbers of mallards wintering in the LMV (Reinecke et al. 1992). Methods used in the mallard surveys probably could be used to estimate total numbers of dabbling ducks, but population estimates for individual species other than mallards most likely would not be reliable. A further complication is that there are currently no reliable methods to determine population size of wood ducks over large geographic areas.

The LMV Joint Venture strategy for evaluating waterfowl population responses will include two independent approaches. Data sources for the first approach will be the operational USEWS Breeding Population Survey, waterfowl harvest, and MWI and the resulting evaluation will relate to the entire Joint Venture. Data for the second approach will be the USFWS Breeding Population Survey and special winter surveys modeled after the mallard aerial transect survey (Reinecke et al. 1992) and evaluation will be restricted to the MAV. Part of the rationale for recommending additional aerial transect surveys of the MAV is that the data obtained will contribute to evaluation of habitat limiting factors (see Evaluation Issue #7) as well as population responses. An additional potential data source that could replace the intensive winter survey and provide information at more frequent time intervals is the less intensive annual MWI modified sufficiently to provide statistically valid quantitative estimates.

PROCEDURES:

The first approach will be used to determine if, when the NAWMP satisfies its goals of a breeding population of 62 million ducks and a full flight of 100 million ducks, the LMV Joint Venture area has continued to winter the same average percent use, 1400 of ducks during 1986-2000 as it did during the 1970s. For this part of the evaluation, annual survey data will be obtained from the Office of Migratory Bird Management and statistical analyses will include simple comparisons of averages and tests for linear trends in the percent of ducks wintering in the Joint Venture area.

The second approach to evaluating population responses will involve conducting aerial transect surveys in the LMV similar to those of Reinecke et al. (1992) at intervals of approximately 5 years (e.g., in January 1994 or 1995 and again in January 2000). Recommended changes in survey methods include:

1. observers will estimate numbers of ducks observed in three categories (e.g., "mallards", "other dabbling ducks", and "diving ducks") rather than only mallards as done previously, and
2. sample allocation will be modified as recommended in Reinecke et al. (1992)

If results from this modified survey indicate that observers can estimate numbers of all three categories of ducks, consideration will be given to scheduling one of the surveys in a year when continental population goals have been satisfied and direct comparisons can be made between survey estimates and LMV population goals. In this case,
LMV survey population estimates of dabbling and diving ducks will be used as an indirect measure of the success of the LMV Joint Venture.

Modification of the annual MWI to replace the 5-year intensive survey will be explored. Two advantages potentially exist in using a modified MWI:

1. it is conducted on an annual basis which would increase the likelihood that measures of duck densities would be available during a year of "normal" habitat conditions and
2. survey results would be available for the entire LMV Joint Venture area instead of just the MAV.

OPERATIONAL RESPONSIBILITIES.
The LMV Joint Venture Evaluation Coordinator will be responsible for obtaining data from the Office of Migratory Bird Management and conducting analyses for part one of the evaluation.

The LMV Joint Venture Evaluation Coordinator will provide data management expertise for part two of the evaluation but modifications of survey sampling design and supervision of field data collection will be the responsibility of personnel from the NBSMVFRS. Observers for special survey flights will be recruited from among NBS researchers, Region 4 of the USFWS, and from interested states and universities.

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NON-WATERFOWL MIGRATORY BIRDS

Evaluation Issue 12

Evaluate changes in forest fragmentation that result from LMV Joint Venture activities and relate these changes to habitat requirements of neotropical migratory forest birds.

BACKGROUND

Implicit in the NAWMIP and LMV Joint Venture Plan was the assumption that wetland enhancement and restoration activities benefiting waterfowl would provide benefits for other wetland wildlife as well. Conserving forested wetlands, especially bottomland hardwoods is emphasized in several LMV Joint Venture strategies. In doing so, the LMV Joint Venture will affect forest fragmentation and habitat availability for neotropical migratory forest birds. Forest fragmentation has been implicated in the decline of neotropical migratory forest birds, particularly those considered area sensitive or requiring mature forests. Evaluating the degree of forest fragmentation is relatively simple in concept—it is quantifying the variation in size of forest blocks and their spatial relationships. However, the issue becomes complex when attempting to relate factors such as connectedness, intersection by roads, block dimensions, perimeter length relative to area, and cover type to the survival and productivity of selected wildlife species. The use of satellite imagery and GIS has greatly increased the ability to address these fragmentation issues at a landscape level.

GIS analysis of data collected as part of other evaluation issues can be used to evaluate changes in forest fragmentation. Consequently, the LMV Joint Venture is capable of developing habitat information that can be used to relate neotropical migratory bird abundance and distribution to spatial characteristics of forested wetlands.

PROCEDURES

Maps of forest blocks resulting from the classification of land cover in Evaluation Issue #6 will be used to describe forest fragmentation in the LMV. A database of individual forest fragments will be developed to include information such as block size, ratio of edge to area, cover type, ownership, location, and/or an index of road dissection.

Evaluating the effects of LMV Joint Venture activities on changes in forest fragmentation will be accomplished by combining data layers (e.g., boundary files of Wetland Reserve Program tracts) of accomplishments with the results from forest fragment classification of satellite imagery already available (e.g., 1992) or acquired in the future to depict conditions at the conclusion of Joint Venture activities (e.g., 2000). The spatial relationship of reforestation projects, state and federal acquisition programs, easements, and other projects affecting bottomland hardwoods will be subject to visual and quantitative analysis of their effectiveness in augmenting the size or connectedness of existing forest blocks.

Trends in the relative abundance and distribution of breeding neotropical migratory forest birds in the LMV Joint Venture area can be used as an index of the cumulative impact of conservation efforts. LMV Joint Venture activities will be viewed as positive if increasing trends are evident. Habitat conditions in Central and South America will be considered when interpreting neotropical migratory bird trends observed in the Joint Venture area. The results of recently completed research conducted by D. J. Tweddell, NBS-MVFRS, will be used to establish baseline information on the current distribution and relative abundance of neotropical migrant birds breeding in forest blocks of varying size in the LMV.

Breeding Bird Survey data are an additional source of information for evaluating trends in neotropical migratory birds. Trend analysis and GIS will be used to evaluate mean relative abundance and trends in populations of select species. Surface modelling procedures will be used to develop contour maps depicting trends, both positive and negative.
Additional intensive research evaluating specific bird-habitat relationships is needed to better understand the effects of LMV Joint Venture activities; however, this research is beyond the scope of Joint Venture evaluation and should be pursued by the Partners in Flight initiative. Of primary concern are species diversity, density, and productivity, and how they relate to silvicultural practices, forest composition, structure, and age, forest block size, changes in successional stages on reforestation sites, and impacts of natural flooding and green-tree reservoir management during winter.

**OPERATIONAL RESPONSIBILITIES:**
The LMV Joint Venture Evaluation Coordinator will be responsible for developing databases and conducting analyses of forest fragmentation in the LMV. This includes preparation of spatial data sets representing accomplishments reported in the ITS and development of a relational database of existing forest blocks in the LMV. The land use classification of 1992 satellite imagery will be developed by the NBS MVFRS, The Nature Conservancy of Louisiana, and the University of Arkansas. Classification of land cover for subsequent imagery and preparation of reports will be the responsibility of the Evaluation Coordinator.

Researchers from the NBS MVFRS conducted field studies in 1993 to establish baseline information on the distribution and relative abundance of breeding neotropical migrant birds in the LMV within forest fragments of different size categories.

The Evaluation Coordinator will work with Partners in Flight to design and implement a long-term LMV Joint Venture-wide survey of the relative abundance and distribution of neotropical migratory birds in forested and reforested sites on public and private lands. Researchers from NBS Patuxent Environmental Science Center currently are integrating GIS in the analysis of continental Breeding Bird Survey data to evaluate trends by physiographic regions. The Evaluation Coordinator will work with these researchers to interpret the results of their study relevant to the LMV Joint Venture Area.

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28
Evaluate opportunities to integrate the habitat needs of migratory shorebirds into management practices used to provide waterfowl foraging habitat.

BACKGROUND:
Implicit in the conservation strategies of the LMV Joint Venture is recognition that waterfowl populations wintering in the Joint Venture area cannot be maintained solely with the existing or anticipated forested wetland acreage. Accordingly, the management of farmed wetlands and moist-soil areas is necessary to provide adequate waterfowl foraging habitat. Studies conducted to date indicate that such management also sometimes provides foraging opportunities for migratory shorebirds. Inasmuch as past wetland losses have impacted shorebirds as well as waterfowl, management of wetland resources to benefit both species groups is essential for maintenance of their populations. Although the predominant use of the LMV Joint Venture area by shorebirds occurs during fall and spring migration and roost current habitat management is directed at providing foraging sites for waterfowl during winter (i.e., November–February), minor variations (e.g., timing or speed of drawdown) in moist-soil management and rice production are known to provide suitable shorebird habitat. Consequently, integrating the foraging habitat needs of waterfowl and shorebirds relates not necessarily to a need for different habitat types as to a need for similar habitats at different times.

It has been demonstrated at various latitudes of the LMV that shorebird management can be successful on public lands where timing of water management is appropriate. However, acceptable methods for integrating shorebird management and agricultural production on private lands are lacking. Additionally, benefits to shorebirds from winter water management for waterfowl is not well understood. This evaluation issue is to develop methods for integrating shorebird management with agricultural practices on private lands, and to increase the understanding of shorebird benefits as they relate to winter water management.

PROCEDURES:
Evaluation studies are proposed for four “management situations” representative of LMV habitats and programs:

1. management of harvested rice fields and set-aside lands
2. management of wetland units where a capability exists to augment natural flooding by pumping
3. management of wetland units where water management relies solely on the seasonal flooding by rainfall runoff and
4. management of wetland units as semi-permanent wetlands with no attempt made at drawdown other than that occurring as a result of natural processes.

Development of shorebird management strategies for the first management situation, rice production on private land, will relate to the research identified in Evaluation Issue #10 that will also evaluate management practices, such as the timing of water level manipulation, most beneficial to shorebirds. Studies ideally will occur at different latitudes within the LMV Joint Venture area in light of the effect that latitude has on planting and harvesting dates and shorebird migration chronology.

Addressing the second management situation will require an extension of preliminary studies conducted by the USFWS and Northeast Louisiana University at mid-latitude habitats of the LMV. Identification of management opportunities are needed for situations when pumping is available to augment natural runoff.

DOWITCHERS
The third management situation, where drawdown schemes are combined with natural flooding, requires study on state or federal management areas having sufficient habitat units to implement different management strategies on selected wetlands. The budgets of most state and federal refuges within the Joint Venture area do not allow pumping, and shorebird management opportunities need to be better defined for those situations where pumping is not an option. Ideally these studies should focus on the middle to lower latitudes of the Joint Venture area to evaluate the management regimes that have been successful at northern latitudes of the LMV.

The fourth management situation is becoming quite common on public lands; studies are needed to document habitat conditions and shorebird use during fall and spring migration periods, and to determine the utility of periodically interrupting vegetative succession.

**OPERATIONAL RESPONSIBILITIES:**
The LMV Joint Venture Evaluation Coordinator will be responsible for coordinating with Joint Venture Partners in selecting study sites and developing study proposals. Studies would ideally be conducted by universities as part of graduate level programs with funding support from state wildlife agencies, Region 4 USFWS, and/or NBS MVFRS.

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Evaluate the effects on wading birds of providing seasonally flooded foraging habitat by using small water-control structures to restore wetlands.

BACKGROUND

As wetlands declined in the LMV as a result of drainage and flood control projects, so did foraging opportunities for wading bird populations. LMV Joint Venture activities are offsetting some of these losses by restoring the hydrology of seasonal wetlands to provide waterfowl habitat. However, restored wetlands may also provide foraging habitats that contribute to the maintenance and expansion of wading bird populations.

Restoration of seasonal wetlands is being accomplished on both public (e.g., FmIA lands, NWRs) and private lands using small water-control structures to impound water during selected seasons. However, two different management strategies exist. Wetlands on public lands are generally managed for natural vegetation, and flooding schedules are at the discretion of wildlife managers. In contrast, flooding of private lands must be compatible with crop production, and flooding schedules are dictated by farming practices. The biological consequence is that private lands generally provide winter habitat only for waterfowl, whereas public lands can provide wintering as well as breeding and migration habitat for various wetland birds. The evaluation issue is to better understand if seasonal wetlands created as the result of LMV Joint Venture activities are used and benefit wading bird populations throughout their annual cycle.

PROCEDURES

Wading bird population and habitat use research are needed to evaluate benefits to regional wading bird populations from the LMV Joint Venture's programs that restore seasonal wetlands. If (e.g., presence, absence, when (e.g., diet, seasonally), how many (e.g., numbers, species), and for what purposes (e.g., foraging, breeding, roosting) wading birds use various types of seasonally flooded wetlands on.

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public and private lands must be determined to assess benefits and refine management recommendations for these habitats. This information and the development of population survey methods will be needed to evaluate potential landscape impacts of providing seasonally flooded wetlands.

OPERATIONAL RESPONSIBILITIES

No research is currently planned to address this evaluation issue. Development of Private, Federal, or University research programs are needed to undertake necessary field studies.
LITERATURE CITED


GOALS:
Reversing the long-term trend of wetland loss by conserving existing forested wetlands and restoring and managing wetlands on marginal agricultural sites.
Provide an adequate quantity, quality, and distribution of migration and wintering habitat on public and private lands to ensure that the LMV Joint Venture Area can support a wintering population of at least 8.7 million ducks and 1.4 million geese during years of normal precipitation.
Develop private, State, and Federal partnerships for the conservation and management of waterfowl and wetlands in the LMV.

OBJECTIVES:
Protection of Existing Wetlands
Private Conservation Easements—100,000 acres
Public Acquisition for Inclusion in the System of State and Federal Management Areas—355,000 acres

Wetland Restoration and Enhancement—Public Lands
Wetlands Currently Owned or Proposed for Acquisition by State/Federal Wildlife Agencies—324,000 acres
Wetlands Transferred in Fee Title or Conservation Easement by FmHA to State/Federal Wildlife Agencies—74,000 acres

Wetland Restoration and Enhancement—Private Lands
Restoration of 521,000 acres of Marginal Agricultural Land to Wetlands
Restoration and Management of Wetland Hydrology on 982,000 Acres of Farmed Wetlands and Prior Converted Wetlands Remaining in Agricultural Production.
Operation of Corps of Engineers Flood Control/Drainage Structures to Manage Wetland Hydrology on 100,000-200,000 acres of Public and Private Lands.
Acquisition and Management of 75,000 acres as Mitigation for Authorized Corps of Engineers Projects.
# APPENDIX 2

Budget summary for the Lower Mississippi Valley Joint Venture Evaluation Plan.

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<td>2,988,000</td>
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⁻ National Biological Survey, Southern Science Center.
⁵ National Biological Survey, Mississippi Valley Field Research Station, Southern Science Center
⁶ Mississippi State University
⁷ United States Fish and Wildlife Service, Region 8 (funds allocated prior to conversion to NBS).
⁸ States participating in the Lower Mississippi Valley Joint Venture.