
Strategies:

- Promote wildlife observation/photography opportunities on the Mingo Creek Unit.
- Promote shorebird observation/photography opportunities on the Farm Unit.
- Improve viewing opportunities by providing vegetative screening or photo blinds on the levees in the shorebird management area, if this does not conflict with cooperative farming or infrastructure management.
- Construct two accessible observation towers at appropriate sites, such as Granary West Road, that could double as an accessible hunting blind and another on the cross levee in the shorebird management area.
- Develop and provide a seasonal auto tour route at the Farm Unit and promote it on the refuge website.
- Develop and provide a wildlife observation/photography trail at the “Squirrel Woods” area, if feasible.

Bald Knob NWR Objective 4-6: Environmental Education and Outreach

Annually provide and expand quality, compatible environmental education and outreach opportunities as feasible.

Discussion: The refuge currently gives environmental education programs upon request from local schools, community groups, university classes, wildlife clubs, and garden clubs. There are several elementary, middle, and high schools in nearby communities such as Searcy, Bald Knob, and Newport, which are all within a 1-hour drive. Little Rock and Memphis are both over 1 hour away, which may be too far for schools to come. However, the refuge could be utilized by Boy and Girl Scout groups from these cities.

There are also opportunities in the immediate local communities for educational programs for Scout groups. Three universities are within the local area and there is occasional interest in the refuge on the part of instructors and students. The refuge occasionally gives programs offsite at local schools. There are currently no refuge facilities available to support environmental education. The AGFC’s Education Division has approximately 60 staff located across the state and effective partnerships help support this activity.

Outreach includes such activities as giving programs on and off the refuge, issuing news releases, providing information via the refuge website, and using personal contacts to communicate Service, Refuge System, and refuge messages. Refuge staff has not yet developed outreach plans for important individual resource issues or for addressing long-term resource issues important to the refuge, to the community, or to other audiences, such as waterfowl and migratory bird management, wetland restoration, and endangered species conservation.

The Service and Refuge System messages are incorporated into refuge programs and outreach. The key wildlife and habitat conservation messages for the refuge should include the importance of wetlands and of the refuge as habitat for wildlife. The significance of the refuge as a wintering ground for pintail and stopover habitat for shorebirds must also be emphasized.

Strategies:

- Recruit a park ranger (Visitor Services) position to plan and implement a comprehensive visitor services program for the refuge, including developing on-site and off-site environmental programs for school and civic groups.
- Develop three environmental education programs to present on request, with assistance available from the Regional Office, on such topics as waterfowl, shorebirds, moist-soil management, or reforestation.
- Recruit and train volunteers to conduct selected environmental education and outreach tasks on- and off-refuge.
- Partner with local Boy Scout troops to enable refuge staff to serve as merit badge counselors for badges such as Bird Study, Environmental Science, Fish and Wildlife Management, Fishing, Forestry, and Mammal Study.
- Promote public recognition and appreciation of Bald Knob NWR by:
 - Developing and maintaining favorable media contacts;
 - Joining a local Chamber of Commerce if appropriate;
 - Conducting an annual media day for the Complex;
 - Conducting a community open house with activities such as presentations, tree planting, tours, and a cookout in early November before the waterfowl sanctuary is closed.

Bald Knob NWR Objective 4-7: Interpretation

Annually provide and expand quality, compatible interpretation opportunities as feasible.

Discussion: Currently waterfowl and migratory bird management are the primary themes and messages that are interpreted on the refuge. There is no indoor space dedicated to resource interpretation for visitors. The headquarters is too small and the structure is inadequate for interpretive displays. The refuge offers a general brochure, posters, bookmarks, magnets, rulers, and stickers with general interpretive messages. The refuge also has several kiosks that offer space for hunting information and could be utilized for interpretive messages. At present, there are no portable exhibits or displays for interpreting key resources to offsite audiences.

Strategies:

- Develop and install interpretive panels at the porch area of the new office, along the seasonal wildlife drive, and at the observation towers. These panels would provide interpretation for the following topics: significance of Bald Knob NWR, the value of waterfowl sanctuary, reforestation, shorebirds, waterfowl, and moist-soil management.
- Develop and install signage at reforestation areas that provides the date when the site was reforested and at selected sites, also include an interpretive panel describing the reforestation process.
- Establish, if feasible, one or more interpretive trails that would highlight habitat management, feature unique habitats, or wildlife ecology.

REFUGE ADMINISTRATION

Bald Knob NWR Goal 5: Provide support and sufficient resources necessary to ensure that goals and objectives for habitats, fish and wildlife management, resource protection, visitor services, and refuge administration are achieved for Bald Knob NWR in particular and Central Arkansas NWR Complex overall.

Discussion: Both the Biological Review and the Visitor Services Review teams specified additional staffing, equipment, or facilities needed to implement the refuge's purposes, vision, goals, and objectives identified in this CCP. The availability of adequate resources will ensure that this CCP will be fully implemented.

Bald Knob NWR Objective 5-1: Staffing

As resources become available, strategically add at least 5 staff positions that will improve the capacity and capability of Bald Knob NWR to achieve its legislated purposes and accomplish conservation and management goals and objectives.

Discussion: The Biological Review team identified an immediate need for an additional full-time law enforcement officer (accomplished in December 2008). There is currently only one collateral-duty officer stationed at Bald Knob NWR. The need for at least one other law enforcement officer exists due to the continuous increase in consumptive public uses, especially during waterfowl hunting seasons. Numerous cases are made on and adjacent to the refuge each year, mostly related to migratory bird regulations. There has also been a dramatic increase in crimes related to the manufacture of the drug methamphetamine (meth), which places refuge personnel, as well as the general public users, at high risk. Several meth labs have been found on Bald Knob NWR and evidence of meth production is prevalent along refuge and surrounding county roads. A law enforcement position is also justified by the increase in non-consumptive users, such as bird watchers, photographers, and hikers. These visitors are increasing yearly and conflicts between preferred user groups and drug manufacturers are inevitable.

The team also identified an immediate need for a biological technician position to assist in shorebird, moist-soil management, beaver control, wetland restoration, and other labor-intensive programs. This position would also provide a much-needed body to mow, disk, manipulate water control structures (over 100 structures are present on the refuge at this time), and help in the shop with maintenance. Currently, the refuge manager and engineering equipment operator have proven to be outstanding at improving habitat for both resident and migratory wildlife and improving the public use programs available at the refuge. However, aches and pains are showing as the refuge continues to develop and grow. Additional maintenance personnel and resources are needed to help maintain the quality programs that were started and implemented over the past 15 years.

No visitor services staff exists on Bald Knob NWR or the Complex. A park ranger (Visitor Services specialist) must be recruited to develop and implement a visitor services plan as part of a comprehensive visitor services program for Bald Knob NWR. Additional responsibilities would include expanding the volunteer and intern programs and coordinating the establishment of a friends group. Environmental education and outreach programs would be implemented that would promote the refuge and help connect over 800,000 residents with nature. Development of an on-site interpretive program would involve updating and/or creating various printed materials, such as brochures and bird, reptile, and amphibian lists. The Visitor Services specialist also would coordinate planning and development of public use facilities, kiosks, information stations, nature trails, and observational towers and blinds.

Strategies:

- Upgrade current refuge manager position to appropriately reflect the true scope, complexity, and effect of the duties and responsibilities at Bald Knob NWR and within the Complex.
- Recruit a supervisory wildlife specialist to assist with administrative needs, provide daily supervision of staff, and coordinate operations and management projects on Bald Knob NWR.
- Recruit a park ranger (Visitor Services specialist) to develop and implement a comprehensive visitor services program, including environmental education.
- Recruit a biological technician to assist with surveying, monitoring, and habitat management programs.
- Recruit an engineering equipment operator to implement habitat improvement projects and maintain facilities, equipment, and infrastructure.
- Recruit a laborer to assist with maintenance of facilities and infrastructure and implementation of habitat management projects.
- Recruit a hydrologist based at Big Lake NWR to coordinate hydrological and water quality issues on all refuges within the Complex, coordinate hydrological research and monitoring, provide technical advice to adjacent landowners, serve as a liaison with COE, and coordinate aquatic restoration projects.
- Recruit a full-time park ranger (law enforcement) to provide critically needed protection for visitors and resources (accomplished December 2008).

Bald Knob NWR Objective 5-2: Volunteers, Partners, and Friends

Expand the volunteer and intern program, establish a friends group for the refuge within 5 years of the CCP completion, and cooperate with partners to accomplish refuge goals and objectives.

Discussion: Around the country, volunteers and refuge support groups fortify refuge staffs with their gift of time, skills, and energy. They are integral to the success of the Refuge System. The National Wildlife Refuge System Volunteer and Community Partnership Enhancement Act of 1998 (P.L. 105-242) strengthens the Refuge System's role in developing effective partnerships with various community groups. Whether through volunteers, refuge support groups, or other important partnerships in the community, refuge personnel will seek to make the refuge an integral part of the community, giving rise to a stronger Refuge System.

At present, Bald Knob NWR has three volunteers supervised by the refuge manager. Two of these volunteers conduct breeding bird and shorebird surveys and have expressed interest in assisting the refuge with other activities. The refuge gives the volunteers appreciation gifts and recognizes their contributions. Currently, the volunteers do not have position descriptions adequately describing their duties. The refuge does not have a friends group but can receive limited support from Friends of Felsenthal.

Strategies:

- Recruit a park ranger (Visitor Services specialist) to coordinate volunteer, friends, and partner programs.
- Develop a list and descriptions of projects that volunteers can assist with to facilitate accomplishment of refuge programs.

-
- Periodically place articles in local papers describing volunteer accomplishments and opportunities at the refuge and promoting the volunteer program.
 - Recruit Boy Scout troops for assistance with specific projects that would enable them to contribute to community service activities, and offer opportunities for scouts pursuing their Eagle Scout rank to perform projects that benefit the community and nation at the refuge.
 - Coordinate with universities in Arkansas and elsewhere to recruit high-quality interns to assist the refuge with operations, inventory, and management programs.
 - Recruit volunteers from local universities, high schools, church groups, and civic organizations.
 - Conduct a community open house on the refuge to promote volunteer opportunities and a friends group.
 - Enlist volunteers and community leaders to assist with establishing a friends group for Bald Knob NWR and consult with other refuges that have successful friends groups to learn from their experiences in establishing such groups.
 - The refuge manager and Visitor Services specialist should attend friends group training.

Bald Knob NWR Objective 5-3: Facilities, Infrastructure, and Equipment

Acquire and maintain all of the equipment necessary to perform habitat management, restoration, and enhancement on the refuge, in addition to maintaining and improving essential infrastructure such as roads and levees.

Discussion: Currently, the refuge has an excavator, bulldozer, backhoe, road grader, and dump truck. Most equipment is presently in good shape or in the process of being replaced, except for the excavator. The refuge's excavator is old, worn out, and has a history of major repairs. In fact, it was deemed a "lemon" by the manufacturer. Nevertheless, it is the most extensively used piece of equipment on the refuge. The refuge has over 100 miles each of roads, levees, and ditches and 90 percent are subject to frequent floods each year. Roads and levees require frequent maintenance because animals often dig and undermine these areas. Beavers continually plug pipes and ditches and hinder the cooperative farming program and can pose serious consequences to forests and reforested areas. A dependable excavator is a must on this refuge. An engineering equipment operator and laborer are necessary to implement habitat management and restoration projects, maintain infrastructure and facilities, and increase productivity in achieving refuge purposes.

The current refuge office at Bald Knob NWR, located approximately 2 miles south of Bald Knob Arkansas, in White County, is a single-wide government surplus trailer that has been in use since 1997. It is substandard and grossly inadequate to meet administrative and visitor service needs. Entry points, interior workspaces, and restroom are not fully accessible. The trailer does not contain actual office spaces, the exterior and interior walls are deteriorating and failing, the roof needs to be replaced, the HVAC system is inefficient, rooms are not sufficiently lighted or ventilated, health and safety issues exist, and it is infested with rodents and insects. Furthermore, there are no suitable spaces for staff/partners meetings, visitor reception, exhibit areas for education/interpretation, or secure storage. The trailer is unsightly due to its condition and appearance. Rehabilitation or renovations are not cost effective.

Funding has been obtained through the ARRA for replacement of the existing office with a suitable facility. The proposed headquarters/visitor contact station would be 1-story, approximately 2,500 square feet in size, and will include four staff offices, conference room, break room, unisex staff restroom, law enforcement storage, utility/storage closets, fax/photocopy/file room, mudroom, separate male/female public restrooms, an exhibit area, and volunteer/receptionist area. This facility

would be fully ADA-compliant, will provide adequate administrative function, and would enable suitable opportunities for visitor reception and interpretation. The building design would incorporate green-building design features, including energy-conserving lighting, HVAC, insulation, water-conserving systems, and options for alternate energy. These features would reduce carbon footprint compared to traditional buildings and would lessen environmental impacts. It also would provide a safe and comfortable environment for staff and visitors. The current office would be removed and the new headquarters/visitor contact station would be sited within close proximity to the current building within the existing office/maintenance shop grounds, which are already disturbed; therefore, new construction would necessitate minimal site disturbance and no wildlife habitat would be destroyed. The funding amount (approximately \$650,000), which would include planning/design, engineering, construction, furniture, and interpretive exhibits.

The current maintenance shop/equipment storage facility at Bald Knob NWR is inadequately sized and lacks the critical components to support maximum capacity and capability. The existing structure consists of a 40x40-foot shop building with an attached 60x40-foot 3-bay open pole shed. This facility does not provide enclosed workspace for heavy equipment repair and maintenance, contains no equipment lift, and is energy-inefficient. The exterior attached pole shed is not large enough to accommodate the refuge's heavy equipment fleet, thus causing millions of dollars of equipment to sit exposed to the elements. Due to these inadequacies, the shop building should be expanded by enclosing one of the existing pole shed bays, pouring a concrete floor, installing 2 overhead bay doors (to allow drive-through bay), adding energy efficient lighting, insulation, and HVAC systems, and installing a hydraulic vehicle lift and adequate shelving and work table space. The pole shed expansion would include adding three, 20-foot open bays, installing a metal roof, gutter system, gravel floor, and expanding the shop yard and security fence enclosing the compound. This project would enable the refuge to conserve energy, create a safer workplace, and facilitate implementation of habitat management projects on this 15,000-acre refuge that provides the best pintail duck and shorebird habitats in Arkansas. The project would be funded through the Deferred Maintenance Program.

Strategies:

- Replace the refuge office with a 2,500-square-foot headquarters/visitor contact station, to be constructed on the existing office/shop grounds, using ARRA funding (approximately \$650,000), and incorporating green-building design features to provide adequate facilities to meet the expectations and needs of the existing public, to conduct visitor services programs, to facilitate work with partners, and to enable refuge staff to administer programs and operations.
- Replace the old excavator with a new excavator.
- Keep all machinery, equipment, infrastructure, and facilities in good working order by regular upkeep and maintenance.
- Acquire improved and additional equipment that enables the refuge to better accomplish habitat and public use management needs.
- Recruit an engineering equipment operator to increase the refuge's capability and capacity to perform maintenance, habitat restoration, and other projects.
- Recruit a laborer to assist with the refuge's maintenance and repair operations.
- Expand the maintenance shop to allow proper storage of refuge equipment and provide safe and adequate enclosed work areas in which to maintain and repair equipment.
- Acquire a front-end loader and extendable side-boom mower.

BIG LAKE NATIONAL WILDLIFE REFUGE

NOTE: All goals, objectives, and strategies described below for Big Lake NWR are set in the time context of the 15-year planning cycle of this CCP unless otherwise indicated in individual objectives or strategies.

FISH AND WILDLIFE POPULATION MANAGEMENT

Big Lake NWR Goal 1: Manage and protect migratory birds and native wildlife populations on Big Lake NWR to fulfill the purposes for which it was established and to contribute to the mission of the Refuge System.

Discussion: Big Lake NWR was established to provide habitat and protection for migrating and wintering birds and is recognized as an important link in the Mississippi migration corridor. Over the years, the objectives of the refuge have expanded to include protection for endangered species, such as the Bald Eagle (now de-listed), as well as management of other game and non-game wildlife.

Big Lake NWR Objective 1-1: Migratory Waterfowl

Annually maintain 8,442 acres of managed waterfowl foraging habitats in swamp (5,250 acres), open water (2,600 acres), marsh (300 acres), moist-soil (250 acres), and cropland (42 acres) habitats in sanctuaries (November 1 – February 28), sufficient to meet the habitat and population goals of the NAWMP as stepped-down through the LMVJV.

Discussion: Big Lake NWR is almost surrounded by intensively farmed lands, but it is also the unfortunate recipient of silt-laden waters, draining many hundreds of thousands of agricultural acres in nearby Missouri. Most of the refuge's eastern boundary borders AGFC's Big Lake WMA (an 11,000+ acre bottomland forest), where duck hunting is a premier public use. Big Lake NWR's 2,600+ acre reservoir and fringe-flooded forests are key regional waterfowl wintering areas, often hosting peaks of 250,000 ducks or more. In addition, well over 5,000 geese, including White-fronted, Snow, and Canada Geese, may frequent the lake and a nearby 42-acre green-browse plot or the 250-acre moist-soil site.

Concern over waterfowl population declines in the 1980s resulted in establishment of the NAWMP, which focused the attention of federal, state, and private conservation groups on critical wintering and breeding areas. The LMVJV, which encompasses all four refuges in the Complex, was selected as one of the wintering habitat focus areas. One of the first tasks faced by the LMVJV was to develop a model or decision tool for determining how much habitat was needed, and a method for relating this objective to the population goals of the NAWMP. The solution was to consider wintering areas as responsible for contributing to the spring breeding population goals of NAWMP proportional to the percentage of ducks historically counted in wintering areas (Loesch et al. 1994, Reinecke and Loesch 1996). In order to contribute ducks to spring breeding populations, wintering areas must provide sufficient habitat to ensure adequate winter survival. To quantify winter habitat requirements, the LMVJV had to identify limiting factors and made an assumption that foraging habitat was the most likely factor to limit waterfowl populations in the LMV (Reinecke et al. 1989). The process of relating habitat objectives for individual management areas to overall habitat objectives for the LMV involved several steps (Biological Review for Bald Knob and Cache River NWRs, USFWS 2008). Step-down objectives were established for Big Lake NWR (Table 9). Duck-energy day (DED) objectives were calculated by multiplying the acreage objective by the assumed DED standard developed by the LMVJV for that habitat type.

The naturally occurring forage of Big Lake NWR, the lack of human disturbance factors on the lake, and the adjacent flooded refuge forests are keys to the success of this refuge in meeting its primary purpose for waterfowl. However, the refuge has limited opportunity for providing “hot foods” (agricultural crops) or natural foods in managed moist-soil units. More intensive moist-soil management is recommended. Also needed are agreements with the COE and the States of Missouri and Arkansas for modified water management schemes to reduce silt and contaminant deposition in the lake.

Strategies:

- Ensure sufficient sanctuary for wintering waterfowl and other water birds by maintaining appropriate quantity and quality of non-disturbance areas throughout the refuge.
- Maintain a majority of the 2,600-acre lake as a sanctuary for waterfowl during key use periods (early November through early March).
- Utilize best management practices, including drawdowns, vegetation control, water quality sampling, lake bottom consolidation, and other measures to enhance forage availability and overall habitat quality for dabbling and diving ducks in the lake and associated waters, and the 250-acre moist-soil unit.
- Assess the need, feasibility, and options for lake water manipulation and consider potential benefits and drawbacks of such actions.
- Monitor trends in lake vegetation communities and siltation levels over time, to determine the need, timing, and type of water management actions warranted to maintain quality waterfowl habitat.
- Use information gained from monitoring to adjust management actions accordingly to better achieve waterfowl management objectives (adaptive management).
- Inform and educate local officials and the public on the status of the lake and why management actions may be required in order to fulfill refuge purposes relative to waterfowl habitat management.

Big Lake NWR Objective 1-2: Wood Ducks

Annually maintain 7,409 acres of nesting and brood-rearing habitat along with 75 nest boxes to maintain or increase production and meet the Service’s Wood Duck banding quotas that will contribute to monitoring the flyway populations.

Discussion: With a total area of about 7,400 acres, Big Lake NWR’s forests comprise almost 70 percent of the refuge. Bald cypress swamps (5,250 acres) and bottomland hardwoods (2,159 acres) are the two main forest types present. Bottomland hardwoods include several species of oak, including Nuttall oak, overcup oak, and willow oak, and are particularly valuable habitats for nesting and foraging Wood Ducks. The Wood Duck is one of only three duck species (the others being the Mallard and the Hooded Merganser) that nests on the refuge.

Strategies:

- Use the Service’s 2003 Region 4 brochure “Increasing Wood Duck Productivity” to guide refuge management activities.
- Meet refuge pre-season (July – September) banding quotas (see 2003 Regional Wood Duck Guidelines).
- Maintain quantity and quality of beaver ponds, emergent wetlands, and greentree reservoirs as feasible for the benefit of Wood Ducks and other wildlife.

- Monitor Wood Duck use of these habitats and adjust management as needed.
- Monitor production and maintain Wood Duck boxes to increase Wood Duck production on the refuge and implement standardized waterfowl surveys/banding operations.

Table 9. Big Lake NWR - Current migrating and wintering waterfowl foraging habitat objectives established by the LMVJV

Habitat	Objective ¹ Acres (DED) ³	Current Capability ² Acres (DED) ⁴	(+ or -) Acres (DED)
Moist-soil	400 (747,200)	200 (373,600)	-200 (-373,600)
Bottomland Forest	0 (0)	0 (0)	0 (0)
Unharvested Crop	0 (0)	0 (0)	0 (0)
Harvested Crop	0 (0)	0 (0)	0 (0)
Open Aquatic	0 (0)	5,386 (*)	0*
Total	400(747,200)	200 (373,600)	- 200 (- 373,600)

¹ Acreage and DED objective provided by the LMVJV office.

² Current acreage and DED capability (has levees and water control structure, some have pumping capability) provided by refuge staff.

³ DED estimates, calculated by using standard DED figures provided by LMVJV.

⁴ Updated DED estimates adopted by the LMVJV Waterfowl Working Group in June 2006: moist-soil, 1,868 DEDs/ac; bottomland hardwood, 191 DEDs/ac; unharvested crop, 14,061 DEDs/ac (estimate based on actual acres of various grain crops left unharvested and flooded during the winter period); harvested crop, 287 DEDs/ac (estimate based on actual acres of various harvested grain crops flooded during the winter period).

Big Lake NWR Objective 1-3: Shorebirds

Annually provide a minimum of 5 - 10 acres of shorebird foraging habitat flooded to 4 inches or less from July – October to contribute to the objectives set forth in the U.S. Shorebird Conservation Plan, Lower Mississippi Valley/West Gulf Coastal Plain Shorebird Management Plan, and by the LMVJV.

Discussion: The 2,600-acre lake and fringe marsh provide foraging habitat for numerous wetland avian species, such as shorebirds during occasional partial drawdowns to expose mudflats. Control of cutgrass through periodic lake drawdowns and burning are additional activities that merit consideration. Fourteen species of shorebirds are recorded at Big Lake NWR, the majority of which are spring and fall migrants. Only three species – Killdeer, Spotted Sandpiper, and American Woodcock – are found at Big Lake NWR in the summer. In winter, the Common Snipe, Killdeer, and American Woodcock use the refuge.

Strategies:

- Consider whether implementation of periodic lake drawdowns and the use of prescribed fire and herbicides as vegetation control methods for invasive plant species, such as lotus and cutgrass, will provide improved habitats (e.g., temporary mudflats, shallow wading water) for shorebirds.
- Conduct shorebird counts on at least one water management unit, with emphasis on fall migration (July - October), that overlap with waterfowl counts, to provide information on shorebird species occurrence and habitat use and determine if opportunities exist to manage water levels to benefit waterfowl and shorebirds.
- Use results of these actions to adjust water management strategies as indicated (adaptive management).

Big Lake NWR Objective 1-4: Colonial Waterbirds/Wading Birds

Annually provide 250 acres of managed foraging habitat and protect all rookery sites from disturbance from March to August (breeding season) for long-legged wading birds to contribute to the objectives set forth in the North American Waterbird Conservation Plan.

Discussion: Big Lake NWR provides habitat for breeding and wintering colonial waterbirds in shallow water areas primarily on the more than 250-acre moist-soil unit, as well as along Big Lake or the major ditches. Although this group of species is not a major priority for the refuge, management for shorebirds and waterfowl similarly provides foraging habitat for wading birds. Additionally, surveys should be implemented to identify rookery sites and to record breeding bird numbers and production. Subsequently, these areas should also be protected from disturbance.

Strategies:

- In association with management for shorebirds or marshbirds, maintain or provide areas of shallow water and mudflat habitat that will double as habitat for wading birds.
- Implement surveys to identify rookery locations, and then provide protection to these areas from disturbance during the breeding and fledging period and monitor production.
- Monitor habitat use of managed habitats by waterbirds and adjust habitat management activities as needed to better achieve objectives (adaptive management).

Big Lake NWR Objective 1-5: Marshbirds

Annually maintain a minimum of 50 acres of tree-less wetlands with dense emergent vegetation at 40 to 80 percent coverage and open water from 20 to 60 percent coverage, flooded less than 12 inches deep, to provide high-quality breeding habitat for marshbirds in conjunction with meeting waterfowl habitat requirements.

Discussion: The more than 250-acre moist-soil area could very well harbor several rail species, especially if some summer water is available in areas where taller emergent vegetation is allowed to continue growing.

Strategies:

- Renovate and refurbish the moist-soil unit levees and water control structures to enable more effective and flexible water control options.
- Survey marshbird use of the moist-soil sites on a regular basis, using accepted monitoring protocols and inventorying techniques.
- Use the results of surveys to adjust moist-soil management practices as needed to benefit marshbirds while meeting the needs of waterfowl.

Big Lake NWR Objective 1-6: Forest Breeding Birds

In collaboration with the adjacent Big Lake WMA and Hornersville Swamp CA, maintain a healthy bottomland hardwood forest block of 20,000+ acres to support forest bird species designated as high priority in the Mississippi Alluvial Valley (Bird Conservation Region 26).

Discussion: Viewed in conjunction with the adjacent 11,000-acre, state-managed Big Lake WMA and Hornersville Swamp CA, Big Lake NWR provides a bottomland forest block of sufficient size (20,000+ acres) to support area-sensitive forest birds. The forests and understory characteristics of both areas need to be sampled and evaluated to help guide forest management programs for priority non-game bird species.

The refuge has been designated an Important Bird Area of Continental Importance, and it includes other unique sites of value, such as 5,000 acres as a National Natural Landmark and the 2,144-acre Big Lake Wilderness. The plant composition of these areas, and the character of bottomland forests, will soon change if innovative management of major flood waters and sediments is not continually implemented.

Strategies:

- Utilize forest inventories to ascertain current forest composition and structure in the contiguous NWR and WMA forests.
- Based on forest inventories, manage forest habitat for the benefit of priority forest bird species, using appropriate silvicultural techniques to improve forest stand quality, with emphasis on providing sufficient canopy openings, understory and ground cover, desirable regeneration, and overall complex structure.
- Monitor bird responses to habitat treatments and adjust management actions as necessary to achieve objectives (adaptive management).

Big Lake NWR Objective 1-7: Grassland Birds

Provide up to 93 acres of nesting habitat on levees for grassland bird species designated as high priority in the Mississippi Alluvial Valley (Bird Conservation Region 26).

Discussion: Few non-forested areas exist on the refuge. However, grasslands occur along the many miles of levees and these could be managed as habitats for several early successional and grassland avian species. Timing of mowing or the use of prescribed fire for maintenance of levees could be directed to benefit key species, such as the Painted Bunting.

Strategy:

- Plan and implement, if feasible, various management techniques, such as prescribed fire, mechanical control, and plantings, to modify and enhance grassland communities on levees.

Big Lake NWR Objective 1-8: Endangered Species and Species of Concern

Continue to support protection and enhancement of endangered species through research, surveys, recovery programs, and habitat conservation efforts.

Discussion: Almost 80 percent of the bottomland forests of the MAV region have been converted to other uses, primarily agriculture. Much of the region's remaining forests are scattered and fragmented into small blocks that often reduce the capacity of the landscape to support many species of wildlife. It is important that the remaining forests are conserved and managed to allow the continual regeneration of tree and plant communities that support native wildlife species. The refuge bottomland forests are indeed special habitats that need to be sustained and expanded.

Big Lake NWR has 5,000 forest acres designated as a National Natural Landmark. This acreage contains pure stands of bald cypress, the only virgin timber remaining in the area. Also, a portion of the refuge (2,144 acres) is designated as the Big Lake Wilderness and is managed as a unit of the National Wilderness Preservation System. Major impacts to these areas continue to be a severely altered hydrological system, which results in increased frequency and duration of flooding and silt accumulation.

The only current threatened or endangered species that has been found on Big Lake NWR is the fat pocketbook mussel located within the right-hand chute of the Little River, south of the South End Spillway. A more in-depth botanical survey of the refuge may identify additional rare plant species. Switch cane and river cane are historical plant communities that still occur on the refuge and could be enhanced. These cane communities are used by several bird species of concern, including Swainson's Warbler, American Woodcock, Hooded Warbler, and White-eyed Vireo.

Strategies:

- Improve the quality of the refuge's bottomland hardwood forests through active management, including stand inventories, silvicultural harvests, reforestation, and protection from excessive flooding and siltation.
- Inventory bat populations and implement actions to improve or maintain favored roosting, maternal, and feeding habitats, while meeting the needs of priority forest bird species.
- Initiate baseline inventories for vegetative communities (botanical survey), mussels, reptiles and amphibians, small mammals, and water quality of major waterways on the refuge.
- Identify locations of cane communities and implement actions to open forest canopies to allow more sunlight to reach such sites for the enhancement of native cane communities.
- Investigate techniques to establish cane via plantings (if feasible, establish several cane experimental plots).
- Monitor the water spider orchid habitats and ensure proper water conditions favorable to its continued existence.
- Continue locating active Bald Eagle nests and primary foraging areas, and protect nest sites from disturbance activities during the nesting season by use of seasonal closed areas.

Big Lake NWR Objective 1-9: Resident Game Species

Maintain a mosaic of open lands (e.g., agriculture, grasslands, scrub-shrub, reforested sites), incidental to habitat management for trust species, to complement mature forested habitats and sustain healthy populations of resident game species.

Discussion: Big Lake NWR is primarily forested and contains numerous forest game species, such as deer, squirrel, and raccoon. Hunting of these and other resident game species is a popular recreational pursuit. Flood frequency and silvicultural practices will often determine the population dynamics of such forest species.

Strategies:

- Consider maintaining open-type lands (early successional habitats) on all rights-of-way extending into the refuge.
 - Conduct silvicultural operations (harvests) on portions of hardwood forests to improve hard mast-producing dominated stands, as feasible within the context of forest bird management.
 - As appropriate, reduce basal area through group selection cuts to ensure oak regeneration, and to improve crown size/mast production.
 - When reforestation is undertaken, plant a mix of species including hard and soft mast-producing trees.
 - Coordinate game harvest reporting with AGFC and determine the need for more in-depth data and options for potentially obtaining such information.
 - Consider using university students or interns to operate deer check stations to obtain necessary biological data from harvested deer, or using self-checking check stations.
 - Continue deer spotlight surveys with the assistance of volunteers or local universities to determine trends in deer numbers.
 - Coordinate with SCWDS (University of Georgia) to conduct deer herd health checks (every 4 to 7 years).

Big Lake NWR Objective 1-10: Wildlife Investigations, Inventorying, and Monitoring

Within 5 years of the CCP completion, prepare and implement an Inventorying and Monitoring Plan (IMP) that will improve and expand investigations, inventorying, and monitoring of the refuge's fauna to obtain sufficient baseline data to inform management decisions, determine if management objectives are met, and enable adaptive management.

Discussion: The Improvement Act formally establishes the necessity of monitoring the status and trends of fish, wildlife, and plants on national wildlife refuges. Service policy is to collect baseline information on key plants, fish, and wildlife to monitor, as resources permit, critical parameters and trends of selected species and species groups on and around Service units, and to base management on biologically and statistically sound data derived from such inventorying and monitoring (701 FW 2, Inventorying and Monitoring of Populations).

Monitoring, inventorying, and surveying (MIS) are very important means for scientifically managing trust wildlife populations and habitat, as well as meeting national, regional, and refuge goals. Before any MIS is started, the surveyor should seriously and honestly determine if: (1) Objectives, which are clear, specific, and measurable, are defined and can be practically met; (2) the results will actually be used to benefit the resource or make informed decisions; (3) quality and quantity of data needed to meet the

objectives can be collected; (4) the MIS methodology is scientifically and statistically sound; (5) the costs of conducting the MIS are worth the results; (6) resources are available or will become available to complete the MIS; (7) the method of data analysis is pre-determined; and (8) MIS is prioritized so if resources become limited then more critical MIS will be conducted.

Adaptive management is a system used by refuge managers to improve results by documenting management actions, measuring and documenting biological responses, and adapting (modifying) management actions to improve desired conditions/outcomes and determine if objectives have been met. Baseline inventorying and population monitoring at regular intervals provide data essential for informed decision-making by refuge managers and are fundamental for adaptive management. Inventorying and monitoring needs can often be met with the assistance of other Service programs and cooperative efforts with state resource agencies, universities, and USGS. Proper attention must be given to experimental and monitoring design, statistical procedure, and consistency in observation and data collection.

Moreover, inventorying and monitoring efforts for adaptive management purposes should be expanded to include additional refuge resources that lack sufficient baseline data, such as reptiles and amphibians, bats, and mussels.

Strategies:

- Increase the biological capability of the refuge by adding a biological technician to conduct surveys, assist with monitoring and research programs, and perform other wildlife/habitat management activities.
- Prepare and implement an Inventorying and Monitoring Plan in accordance with Service guidelines to improve basic biological information on occurrence and distribution of fauna on the refuge.
- Improve waterfowl inventory and survey efforts, in cooperation with AGFC, by:
 - Standardizing aerial and ground waterfowl surveys to be performed at least monthly starting in late October/early November through late February/early March,
 - Reporting waterfowl species numbers by units within the refuge,
 - Using the same waterfowl survey routes and times of day, conduct joint aerial waterfowl/ground surveys,
 - Ensuring funds are available for contracting with AGFC to provide monthly surveys conducted in conjunction with their regular nearby surveys, and
 - Performing aerial surveys of the refuge at least once during the coordinated statewide mid-winter inventory.
- Increase knowledge of priority bird species for the MAV (BCR26) and associated management practices for their benefit by:
 - Cooperating with AGFC, other Service offices/programs (e.g., Ecological Services, Fisheries, Migratory Birds), other agencies, and universities to initiate specific inventories and monitoring of wildlife and associated habitats on the refuge, including priority bird species for BCR26, American Woodcock, reptiles and amphibians, occurrence and habitat use of bats, occurrence of mussels, fish and aquatic macroinvertebrates, and fish and macroinvertebrate tissue sampling for identification and contaminants;
 - Coordinating with the Division of Migratory Birds and other ornithological specialists to design, develop, and implement bird monitoring procedures that will provide population status and trends information and nest productivity data;
 - Determining nest productivity for highest priority bird species in various habitat types;

-
- Designing and implementing more intensive nest search and monitoring protocols in each of the major habitats of the refuge;
 - Determining habitat use in relation to specific management actions on the refuge;
 - Conducting a series of point counts across major habitat types on the refuge during passerine nesting season (about May – June);
 - Conducting a series of roadside counts placed randomly, but which represent typical habitats surrounding the refuge, within a 30-mile (50 km) circle around the refuge;
 - Conducting a series of transects or block area searches during non-breeding seasons for both migrating and wintering birds;
 - Monitoring any known heron rookeries on the refuge for species composition, number of nesting birds, and nest productivity;
 - Using information derived from these actions to guide management for priority species at the refuge to contribute to eco-regional, regional, and range-wide populations.

HABITAT MANAGEMENT

Big Lake NWR Goal 2: Protect, restore, and manage the functions and values associated with diverse bottomland hardwood forests and open wetland systems in order to achieve refuge purposes, wildlife population objectives, and to benefit migratory waterfowl and other native wildlife.

Discussion: Over the eons, the Mississippi River deposited a large volume of sediments just north of what today is known as Big Lake Bottoms. With the advent of human settlement, an extensive network of ditches was developed, which drained over 2,500 square miles of Missouri farmland, resulting in large quantities of silt being transported into Big Lake. Over the years, this silt deposition caused Big Lake to become a shallow lake. For several decades, the lake was mandated to function as a sump and its waters were described as “too thick to drink and too thin to plow.” Eventually, local interest groups and the COE reached an agreement to divert some silty waters around the lake, provide for adequate flow to maintain and improve the area’s ecosystem, and yet still have flood-control capacity.

Big Lake NWR Objective 2-1: Moist-Soil Habitat Management

Expand the current level of managed moist-soil habitat from 250 acres to 400 acres and increase production of desired moist-soil plants (e.g., wild millet, annual smartweed, sedges, panic grass) to > 500 pounds of seeds/acres or > 50 percent coverage that will annually provide 747,200 DEDs of waterfowl foraging habitat and meet the LMVJV forage objectives.

Discussion: The refuge currently manages approximately 200-250 acres of moist-soil habitats. Moist-soil units are maintained in early successional native plant communities for the production of annual seed crops to be used as forage by waterfowl and water levels are managed to provide suitable feeding conditions for waterfowl, wading birds, and shorebirds. Management actions used to maintain moist-soil units typically include timing and duration of flooding and dewatering, fire, disking, soil disturbance, mowing, and/or herbicide application.

Strategies:

- Consult and implement recommendations from the July 2005 “Moist-Soil Management Guidelines for the USFWS, Southeast Region,” available from the Regional Migratory Bird Program.
- Improve moist-soil habitats and forage yields for waterfowl and other migratory birds by:
 - Maintaining 200-250 acres of quality moist-soil habitat and providing 20-40 acres of green browse on nearby upland sites.

-
- Obtaining, using, and/or installing necessary equipment required for more intensive management actions (e.g., tractors, special plows, mobile pumping equipment, water control gates, and water gauges).
 - Monitoring and evaluating moist-soil vegetation growth during summer and fall, and change and refine manipulations as needed.
 - Utilizing intensive water control/manipulations and recording associated water depth conditions throughout spring/summer drawdowns.
 - Sampling plant responses within the first 30 days of drawdowns and responding to resulting conditions with further water level management as needed to encourage preferred plant communities.
 - Sampling units in the fall to determine the composition of poor, fair, and good waterfowl foods.
 - Conducting seed estimation surveys in late summer and/or early fall.
 - Disturbing soils through disking or other action to set back succession and enhance desired plant responses every 2 to 3 years.
 - Monitoring and evaluating waterfowl use at least monthly throughout the winter period.
 - Recording observations and associated management practices, and adjusting actions accordingly to meet waterfowl and shorebird objectives (adaptive management).
 - Increase moist-soil habitat by a minimum of 150 acres through future land acquisitions.

Big Lake NWR Objective 2-2: Forest Management

Enhance the bottomland hardwood forestland complex to attain the desired forest conditions as described in the report *Forest Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat (2007)*, as appropriate to fulfill refuge purposes.

Discussion: Forestland is the dominant habitat of Big Lake NWR, covering 67 percent of the 11,000-acre refuge. The forest contains 5,250 acres of bald cypress swamp and 2,159 acres of bottomland hardwoods, for a total forested area of 7,409 acres. The forest types range from pure bald cypress swamp to sweetgum-willow oak-water oak assemblages on the higher sites. The intermediate sites are comprised of Nuttall oak, overcup oak, green ash, elm, and other common bottomland hardwood species.

Big Lake NWR was incorporated into the existing Forest Habitat Management Plan for Central Arkansas NWR Complex under a 2006 revision. There has not been an extensive forest survey of Big Lake NWR and there has not been any commercial harvest since the refuge's establishment. Thus, existing forest stands are mature and undergoing stages of stem exclusion. According to past and present managers, the forestland is greatly affected by hydrology and siltation of the area. Stands containing larger, older trees consist of flood-tolerant species, and younger stands found on higher sites may have been formed from old fields.

The refuge is divided into three forest compartments for management purposes. Compartment 51 is dominated by mature bottomland hardwoods of various types. Approximately 104 acres in two old fields were planted to hardwoods in 1995 with minor replanting in 1997. Compartment 72 is dominated by bald cypress, with some ridges containing mixed bottomland hardwood types. Also in this compartment are seven fields containing about 77 acres that were reforested at various times between 1989 and 1999. The third compartment is the Big Lake Wilderness, which is dominated by bald cypress with a very limited amount of bottomland hardwoods.

The landscape surrounding the refuge is unforested farmland for several miles, except for the adjacent Big Lake WMA that is forested. Together with the Big Lake WMA, Big Lake NWR forms a 21,000-acre forest block, the only sizable forest area within 30 miles.

Overall, the current conditions of refuge forests are the result of former habitat modifications. However, most Big Lake NWR forests contain a component of desirable overstory species. With a lack of disturbance, most stands have grown to full stocking and full crown closure. Full stocking and the age of the forest stands indicate that the trees have reached a point where growth has begun to slow and a stage of stem exclusion will occur over several years. That is, weaker stems will gradually die as others become dominant. Full crown closure has resulted in minimal development of the forest's midstory and understory, with sparse regeneration and recruitment of young stems and saplings. Most stands are even-aged, that is, dominant trees are about the same age, as indicated by the presence of the intolerant trees in the overstory and the narrow range of diameters. The average diameter in measured stands ranges from 12-16 inches dbh (diameter at breast height).

The purpose of Big Lake NWR is to be a "refuge, reserve, and breeding ground for native birds," and for "use as an inviolate sanctuary, or for any other management purposes, for migratory birds." In order to pursue these purposes, the refuge must maintain a healthy, productive forest for resident and migratory birds. Recently, the LMVJV's Forest Resource Conservation Working Group has been working on the development of "Desired Forest Conditions" to benefit priority wildlife species in forested wetlands. Attaining of desired forest conditions outlined in the report *"Forest Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat"* will provide habitat to benefit a wide array of priority wildlife species.

The current conditions represent an altered state from that of the natural system, in that species composition and productivity have been negatively impacted due to modified hydrology and sedimentation. The forest management program at the refuge should include inventories to characterize the current habitat, including measurements that indicate impacts from the alterations, establish a sedimentation baseline, and assimilate information from previous inventories. The inventory regime should include permanent plots that can be routinely inventoried to track changes over time.

Based on forest inventories, active management may be warranted. The context of the refuge habitat within the landscape or larger forest block should be considered; the adjacent Big Lake WMA contains expansive bottomland hardwoods that are actively managed through commercial sales. Inventories on Big Lake NWR should collect data for managers to consider regarding stand replacement and stand structure. A shift to shade-tolerant species and minimal understory and midstory is not desirable for the foraging and cover needs of wildlife. Management will have to determine whether the needs for target wildlife are being met through passive management on the refuge and the areas of active management on the adjacent Big Lake WMA, or in contrast, whether active management is needed on the refuge to regenerate desirable species, increase mast production, release dominant trees and provide the benefits of older stage trees (cavities, decay, limb structure, and other niches), produce understory cover and forage, develop midstory canopy, and/or develop forest diversity in terms of species composition and structure for the targeted wildlife species.

Forest management at Big Lake NWR will have to take into account several threatened and endangered species. The Bald Eagle, although de-listed, is still protected by the Bald and Golden Eagle Protection Act. No active forest management will be conducted within 660 feet (200 meters) of an active nest. To avoid potential impacts on the endangered fat pocket mussel,

BMPs will be implemented when conducting forestry operations. Although not threatened or endangered, certain rare bats, such as the Rafinesque and Southern myotis, undoubtedly use the refuge for summer brood rearing habitat. In the summer months, bats use trees with hollows or with exfoliating bark exposed to sunlight. Treatments should be designed to retain sufficient amounts of hollow trees and trees with exfoliating bark.

Strategies:

- Develop and implement an inventory of the refuge's forest to determine baseline data for stand habitats and site conditions (including siltation impacts) and establish a permanent forest habitat monitoring system.
- Place several Continuous Forest Inventory plots in each major forest management compartment.
- Determine current siltation conditions with actual measurements, establish permanent monitoring plots, and characterize future conditions if siltation levels increase.
- Utilize on-the-ground inventories to assess the need for silviculture actions such as Timber Stand Improvement (TSI), group selection harvest, individual tree selection, and one to two-acre clearcuts, with a focus on improving status and regeneration of shade-intolerant tree species and improving habitats for priority migratory species.
- Develop annual work plans focused on using silvicultural actions to improve forest stands for priority wildlife species by promoting (within most stands):
 - development of super-dominant trees,
 - development of habitat diversity to the extent possible,
 - retention of cavity trees (with small and large diameters), and
 - tree species characterized by exfoliating bark exposed to sunlight.
- Coordinate with universities and other experts to conduct a botanical survey to identify unique habitats and plants.
- Utilize GIS and satellite imagery procedures to characterize past, current, and future vegetation community trends.
- Administer the forest management program in compliance with 50 CFR 29.1.

Big Lake NWR Objective 2-3: Habitat Investigations, Inventorying, and Monitoring

Within 5 years of the date of this CCP, prepare and implement an Inventorying and Monitoring Plan that will improve and expand investigations, inventorying, and monitoring of the refuge's wildlife habitat and use to obtain sufficient baseline data to inform management decisions, determine if management objectives are met, and enable adaptive management.

Discussion: The Improvement Act formally establishes the necessity of monitoring the status and trends of fish, wildlife, and plants on national wildlife refuges. Service policy is to collect baseline information on key plants, fish, and wildlife to monitor, as resources permit, critical parameters and trends of selected species and species groups on and around Service units, and to base management on biologically and statistically sound data derived from such inventorying and monitoring (701 FW 2, Inventorying and Monitoring of Populations).

Monitoring, inventorying, and surveying (MIS) are a very important means for scientifically managing trust wildlife populations and habitats, as well as meeting national, regional, and refuge goals. Before any MIS is started, the surveyor should seriously and honestly determine if: (1) Objectives, which are clear, specific, and measurable, are defined and can be practically met; (2) the results will actually be used to benefit the resource or make informed decisions; (3) quality and quantity of data needed to meet the

objectives can be collected; (4) the MIS methodology is scientifically and statistically sound; (5) the costs of conducting the MIS are worth the results; (6) resources are available or will become available to complete the MIS; (7) the method of data analysis is pre-determined; and (8) MIS is prioritized so if resources become limited then more critical MIS will be conducted.

Adaptive management is a system used by refuge managers to improve results by documenting management actions, measuring and documenting biological responses, and adapting (modifying) management actions to improve desired conditions/outcomes and determine if objectives have been met. Baseline inventorying and monitoring at regular intervals provide data essential for informed decision-making by refuge managers. Appropriate inventorying and pre- and post-treatment monitoring of refuge habitats are fundamental for adaptive management. Inventorying and monitoring needs can often be met with the assistance of other Service programs and cooperative efforts with State resource agencies, universities, and USGS. Proper attention must be given to experimental and monitoring design, statistical procedure, and consistency in observation and data collection.

Management of moist-soil sites in particular requires intensive monitoring throughout critical establishment and manipulation periods to determine whether vegetative growth and production of waterfowl or shorebird foods are sufficient to meet habitat goals. While water gauges in each impoundment allow detailed records on water levels, data on soil moisture, plant germination, and composition also will be required to successfully manage moist-soil areas.

Strategies:

- Prepare and implement an Inventorying and Monitoring Plan in accordance with Service guidelines.
- Utilize satellite imagery, aerial photos, and GPS/GIS mapping to illustrate and demonstrate refuge environmental and habitat changes over time.
- Coordinate with universities, COE, and USGS to measure sedimentation rates and to establish long-term monitoring techniques that document flooding events, changes in sediment deposition, and related habitat and wildlife impacts over time, including impacts to the Big Lake Wilderness Area.
- Investigate historical water regimes and system-wide hydrologic cycles of the refuge's watershed and compile and analyze all water quality data collected.
- Utilize a geomorphologist and/or other trained specialist to obtain better information on the physical attributes of the surrounding watershed and identify any management implications for the refuge.
- Obtain historic data on flooding events as correlated to gauge readings (i.e., obtain pictorial views of flood conditions at different gauge readings).
- Coordinate with COE, USGS, and state agencies to establish a long-term system for monitoring water quality parameters on the refuge and measuring concentrations of contaminants in waters, sediments, fish, and aquatic invertebrates.
- Utilize forest inventory procedures, such as Continuous Forest Inventory, to establish current forest conditions and monitor forest changes over time.
- Coordinate with universities or other appropriate sources to have a comprehensive botanical survey conducted.

RESOURCE PROTECTION

Big Lake NWR Goal 3: Promote communication, cooperation, and partnerships between local, state, and federal agencies, land managers, and private citizens to minimize impacts from extended habitat degradation and other threats to the functions and values of the refuge's associated wetland ecosystems and watersheds.

Discussion: In order to achieve its purposes and vision, Big Lake NWR must address a number of issues that threaten to degrade or diminish the value of its resources. These threats include water quality and contaminant issues, siltation, and invasive plant and animal species.

Big Lake NWR is a remnant of a formerly extensive bottomland forest system now surrounded by agricultural development. In addition to numerous drainage ditches in Arkansas, there are several thousand miles of drainage ditches in the Missouri bootheel that send farmland runoff from approximately 2,000 square miles (over one million acres) into refuge waters.

During flood periods, most refuge inflows are heavily laden with silt. Sediment has continually filled the bottomland forest and adjacent swamps until Big Lake is now very shallow, with an average depth of just 3 feet. If the current processes continue, the lake and bottomland forests will be unable to function as productive habitats supporting numerous fish and wildlife species. Furthermore, the Big Lake Wilderness is also suffering from these negative impacts and its future as a healthy cypress system is questionable.

Big Lake NWR Objective 3-1: Water Management and Sedimentation

Collaborate with the COE (and AGFC) to modify water management actions and guidelines related to the operation of structures and water levels in Ditch 81 by revising and reauthorizing the Memorandum of Understanding (MOU) between the Service and the COE.

Discussion: The refuge serves as a hydrologic sump for drainage from surrounding agricultural lands. The Service has cooperated with the COE to manage water flows, but siltation loads during large flood events indicate that a modified MOU is needed for improving the management of several key water control structures. A similar partnership exists with AGFC regarding management of the adjacent Big Lake WMA and such prior agreements will need to be re-evaluated to determine mutually beneficial water levels during fall periods and improved management options.

Across the watershed, improved conservation practices on private agricultural lands could significantly improve the quality and quantity of waters entering the refuge. Additional efforts aimed at promoting use of United States Department of Agriculture (USDA) conservation methods on private lands should be a priority for the Service's private land initiatives. For lands adjacent to the refuge, another priority should be partnering with NRCS to bring together each agency's outreach programs (i.e., the Service's Partners' Program and the NRCS's Conservation Security Program).

Although the water control structures in Ditch 81 reduce a large volume of the undesirable silt and water, more flexible water management operations are needed. This is due primarily to improvements made on statewide drainage lines in Missouri and Arkansas and due to a greater frequency of major flood events. Preferred activities may require tree planting, rip-rapping, land purchasing, and modifying operating guidelines for lands and waters associated with Ditch 81.

Strategies:

- Recruit a hydrologist based at Big Lake NWR (but serving all refuges in the Complex) to coordinate with COE on water management programs, sedimentation, and flood control issues, and to coordinate research, assessments, and monitoring of aquatic habitats and water systems.
- Coordinate with AGFC regarding collaborative management of Big Lake NWR and Big Lake WMA to accomplish mutually beneficial and compatible programs for water management, water quality, aquatic habitat restoration, and lake enhancement, and to ensure the integrity of the Big Lake Wilderness.
- Pursue land acquisitions from willing sellers and via a Minor Boundary Expansion between the levees near the southern water control structure on the Diversion Canal to reduce the chance of any enhanced water management operations negatively impacting several hundred acres of adjacent private agricultural areas.
- Coordinate with Arkansas and Missouri state wildlife agencies, NRCS, and COE to identify and implement solutions to water level issues and to seek potential partners for cooperative projects (e.g., new water control structures and levee modifications).
- Coordinate with NRCS to encourage and reward private landowners for conservation actions that reduce erosion and sedimentation on farmed lands in the watershed on a basin-wide approach.
- Document current habitat quality and plant composition of the Big Lake Wilderness, including studies to establish baseline conditions and evaluate impacts of siltation.

Big Lake NWR Objective 3-2: Big Lake Wilderness

Continue to appropriately protect and manage the Big Lake Wilderness.

Discussion: The Big Lake Wilderness (Wilderness) was established in January 1976. The legislated size was 2,600 acres, but it has been adjusted to 2,144 acres. There are no special legislated conditions established for the Wilderness. There is no information available about the Wilderness at the front desk. Compatibility determinations have not been completed for activities in the Wilderness and minimum tool analysis has not been conducted for recreation-related activities. Visitation to the Wilderness is unknown because visitor numbers are not recorded specific to the Wilderness and entrance permits are not required.

The visitor can experience solitude or a primitive and unconfined type of recreation in the Wilderness; however, external factors, such as boat traffic and noise, may interrupt these experiences and affect the solitude of the Wilderness. Litter and debris from flood waters are also detracting factors. Lack of resources to monitor activities and provide safety, education, and outreach and to reduce user conflicts hinders appropriate management. The refuge manages for primitive and unconfined recreation experiences in the Wilderness, including an archery hunt. Refuge personnel are generally present in the Wilderness during the hunting season. Wilderness-specific regulations are not described in refuge brochures, in signs, or on the website.

Strategies:

- Revise all current brochures, visitor areas, and the website to depict the Wilderness boundary and provide regulations.
- Mark the Wilderness boundary at key locations, such as Seven-Mile boat access and Timm's Point boat launch, and along the canal.

-
- Conduct minimum tool analysis for all recreation-related activities in the Wilderness using the Minimum Resources Decision Guide.
 - Update station information on wilderness.net and the refuge's website home page.
 - Post Wilderness regulations at Seven-Mile access and visitor advisory that the Service is not responsible for their safety while using the Wilderness, including while using it under extreme weather, hazard, or emergency conditions.
 - Evaluate using a permit system to manage visitation and group size in the Wilderness.
 - Conduct minimum impact outdoor ethics training for local communities.
 - Provide "Leave No Trace" materials to refuge visitors utilizing the Wilderness.
 - Include information about the Wilderness in presentations and media reports about the refuge.
 - Contact the Regional Wilderness Coordinator and provide Wilderness stewardship training for Complex staff, law enforcement officers, maintenance workers, and State WMA partners.
 - Periodically provide safety talks to personnel and volunteers to understand the provisions and approaches of the different agencies' emergency responses in the Wilderness.
 - Develop exhibits about the Wilderness at Timm's Point and Seven-Mile Boat Access.
 - Evaluate the feasibility of limiting air or boat traffic along the canal next to the Wilderness to reduce noise and disturbance to the Wilderness.
 - The refuge manager should attend National Wilderness Training (accomplished June 2008).

Big Lake NWR Objective 3-3: Invasive Plant and Nuisance Animal Control

Annually identify and eradicate or control invasive, exotic, or nuisance plants and animals, and develop and implement a database to systematically track occurrences and treatments within 2 years of the date of this CCP.

Discussion: Currently, cutgrass and American lotus invasions in the lake are cause for concern. Mimosa and saw tooth oaks will need to be controlled if they proliferate. No current management practices dictate that exotics will be planted on the refuge.

Problems can be encountered with beaver, nutria, muskrat, feral swine (hogs), rabies-infected furbearers (or other disease), and excessive predation on priority species. Trapping is a biologically sound management tool to help refuges meet wildlife objectives and control injurious, overabundant, or dangerous wildlife. Trapping by the public for commercial purposes can be biologically sound and economically feasible for the refuge, but is currently not allowed. Any future commercial trapping activity would be subject to appropriateness and compatibility, and regulated by special use permit.

Strategies:

- Implement invasive species prevention and control programs in compliance with 50 CFR 29.1 and EO 13112.
- Control beaver, nutria, and muskrat populations as necessary in order to protect roads, levees, structures, infrastructure, and certain forested tracts.
- Utilize mechanical, water drawdown, chemical, and prescribed fire techniques to control undesirable aquatic (e.g., cutgrass and lotus) and upland (e.g., mimosa and saw tooth oak) species that impact wildlife habitat on the refuge.
- Initiate public outreach to alert the public that swine introductions are illegal, and there are negative impacts of feral swine on wildlife and their habitats.

-
- Do not allow introduction of swine or encourage recreational hunting of this species.
 - As feasible, utilize commercial trapping and hunting to help reduce damage to habitats and infrastructure from beaver, nutria, muskrat, and other nuisance animals, and to protect priority species from disease or over-predation.

Big Lake NWR Objective 3-4: Land Acquisition

Acquire from willing sellers priority lands within or adjacent to the acquisition boundary to enhance conservation programs, achieve legislated purposes of the refuge, and fulfill the mission of the Refuge System.

Discussion: Big Lake NWR has no option for further acquisition inside its current boundary. It is expected that the refuge will have an opportunity to receive property adjacent to the refuge via fee title donation from the Arkansas Department of Transportation as replacement property for existing refuge property involved in the impending expansion and realignment of Highway 18, which runs through the southern boundary of the refuge. However, because there is no approved acquisition boundary within which the refuge can acquire land, the means are not available to accept this donation. A minor boundary expansion would enable acceptance of replacement property.

Additionally, there are several potential willing sellers adjacent to or within 1 mile of the current boundary, and these lands would provide benefits to the refuge for wetland, waterfowl, and aquatic habitat restoration and management. If purchased, the narrow strip of private lands adjacent to and along the west side of Big Lake NWR's Ditch 81 would enable the refuge or COE to bolster stabilization of the ditch banks and thus allow more flexible water gate operations. Additional lands below or near the Ditch 81 southern end structure (a few hundred acres) are also worthy of acquisition to prevent potential flooding of private lands, if more flexible operation of the water control structures is implemented. The private lands along the refuge's southeastern boundary include about 160 acres of trailers and camps below Mallard Lake that could merit acquisition to help improve wildlife habitats, decrease sources of contamination, and reduce potential for boundary disputes.

Strategies:

- Strategically enlarge the refuge to better enable fulfillment of refuge purposes by purchasing priority land from willing sellers.
- Pursue a minor boundary expansion (1,104 acres) in order to acquire lands from willing sellers suitable for conservation and restoration that are adjacent to the existing refuge boundary on the west and south.
- Explore the feasibility of acquiring additional lands along Ditch 81 to allow more flexible operation of water control gates.
- Explore the feasibility and desirability of purchasing lands located below Mallard Lake (the narrow strip of trailers and campsites adjacent to Big Lake NWR).

Big Lake NWR Objective 3-5: Cultural Resources

Develop and implement a Cultural Resources Management Plan (CRMP) within 10 years of the date of this CCP.

Discussion: Refuge management will protect refuge cultural resources in accordance with federal and state historic preservation legislation and regulations.

Strategies:

- Prepare a CRMP for the refuge.
- As guided by the CRMP:
 - Conduct a Phase I archaeological survey of the non-flooded areas of the refuge by qualified personnel as a necessary first step in cultural resources management;
 - Conduct a Phase II investigation if archaeological resources are identified during the Phase I survey, to determine the eligibility of identified resources for listing on the National Register of Historic Places prior to any disturbance;
 - Conduct a Phase III data recovery if the resources identified in Phases I and II are determined to be eligible in order to recover data and mitigate the adverse effects of any undertaking;
 - Follow procedures detailed in the CRMP for inadvertent discoveries of human remains;
 - Ensure archaeological and cultural values are described, identified, and taken into consideration prior to implementing undertakings.
- Follow procedures outlined in the CRMP for consultation with the Service's Regional Historic Preservation Office, the State Historic Preservation Office, and potentially interested American Indian tribes.
- Develop a step-down plan for surveying lands to identify archaeological resources and for developing a preservation program.

VISITOR SERVICES

Big Lake NWR Goal 4: Develop compatible, wildlife-dependent recreation programs that lead to enjoyable experiences, a greater understanding of fish, wildlife, and habitat conservation, and a greater appreciation for the value of Big Lake NWR.

Discussion: Big Lake NWR supports each of the priority public uses of national wildlife refuges as identified in the Improvement Act. These priority uses are hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation. The primary public uses of Big Lake NWR are hunting and fishing.

Big Lake NWR Objective 4-1: Visitor Services Plan and Public Use Management

Continue to promote and manage appropriate and compatible public uses, and prepare and implement a Visitor Services Plan within 6 years of the date of this CCP.

Discussion: An up-to-date Visitor Services Plan does not exist for Big Lake NWR. All public uses occurring on the refuge have been evaluated for appropriateness and compatibility. All of these activities are one of the six priority public uses or support one of the priority public uses and are compatible with refuge purposes, goals, and objectives.

Visitor services staff are lacking for Big Lake or Wapanocca NWRs and the Complex. Existing staff have neither the expertise nor the time to devote to expanded public use on the refuge. A park ranger (Visitor Services specialist) must be recruited (stationed at Wapanocca NWR but also serving Big Lake NWR) to develop and implement a visitor services plan as part of a comprehensive visitor services program for Big Lake and Wapanocca NWRs. Additional responsibilities would include expanding the volunteer and intern program and coordinating the establishment of friends groups. Environmental education and outreach programs would be implemented that would promote the refuges and help connect more than 1,000,000 residents with nature. Development of an on-site

interpretive program would involve updating and/or creating various printed materials, such as brochures and bird, reptile, and amphibian lists. The Visitor Services specialist also would coordinate planning and development of public use facilities, kiosks, information stations, nature trails, and observational towers and blinds.

Strategies:

- Recruit a park ranger (Visitor Services specialist) to be stationed at Wapanocca NWR but also to serve Big Lake NWR, to plan and implement a comprehensive visitor services program for both refuges.
- Monitor, evaluate, and modify, as necessary, all public uses to ensure compatibility and to minimize conflicts between user groups, re-evaluating compatibility determinations as necessary.
- Develop and implement a Visitor Services Plan (with public and partner involvement) that addresses the current and future recreational needs of refuge visitors and associated visitor services, including opportunities for mobility-impaired visitors; reflects applicable legislation, Service and Refuge System missions, directives, and policies; and supports refuge goals and objectives.
- Continue to prohibit camping, horseback riding, and ATVs.

Big Lake NWR Objective 4-2: Visitor Welcome and Orientation

Implement visitor welcoming and orientation recommendations of the Big Lake NWR Visitor Services Review Report according to the staggered timeframe (now, intermediate, and long-term) as outlined in that document.

Discussion: The refuge has entrance signs that meet Service sign standards and other signs that display hours of operations, regulations, directions, and interpretive themes. In addition, a 6-panel kiosk is located at the refuge entrance near the beginning of Wildlife Drive. A second 3-panel kiosk is located next to the fishing pier and viewing platform at Bright's Landing. The kiosks are accessible to visitors with mobility impairments. Wayside exhibits are lacking on the wildlife drive and there is also a lack of information on wildlife viewing opportunities along the drive.

The refuge does not have a visitor center but does have a contact station at the headquarters office. It is open during peak week day hours, but not on weekends. Staff have not received visitor service and volunteer related training. Information is posted at the refuge entrance door so that visitors can locate staff who can answer their questions. Because of the small staff size and their work demands in the field, staff are often not available at the contact station to provide immediate assistance to visitors.

The current refuge office at Big Lake NWR is an outdated metal building that is not suitable for visitor reception and any type of environmental education or interpretive activities. The building is not fully accessible at the entrance or on the inside. The building is unsightly due to its condition and appearance and is uninviting to the public. Funding has been obtained through the American Reinvestment and Recovery Act (ARRA) for replacement of the existing office with a suitable facility to allow for efficient public use management and administration of a visitor services program, including opportunities for environmental education and interpretation. The proposed headquarters/visitor contact station would be 1-story, approximately 2,500 square feet in size, fully ADA-compliant, and would include an exhibit hall, volunteer/receptionist area, conference room, break room, law enforcement storage, public restrooms, staff offices, and public parking.

This facility would be constructed within close proximity (approximately 75 yards) of the current office site and would incorporate energy and resource conserving features to reduce environmental impacts. It would not result in the loss of wildlife habitat.

The gravel surface of the Wildlife Drive is well-maintained and the roadside is mowed as needed. However, a number of improvements is needed, such as enlarged universally accessible parking areas, wayside signs, and directional signs.

The refuge's general brochure contains welcoming and orienting information, basic refuge background and resource management information, basic regulations, information regarding visitor services activities, refuge contact information, and a refuge map with visitor services facilities noted. A welcoming and orienting audio visual program has not yet been developed, but the refuge does maintain an up-to-date website on the Internet.

Strategies:

- Replace the existing refuge office, within the existing office/shop complex, with a 2,500-square-foot headquarters/visitor contact station, using ARRA funding (approximately \$650,000) and incorporating green-building design features to provide adequate facilities to meet the expectations and needs of the visiting public, to conduct visitor services programs, to facilitate work with partners, and to enable refuge staff to administer public use programs and associated operations.

Implement now

Improve informational signage by:

- Placing additional directional signs to the refuge in Blytheville at appropriate locations;
- Placing a sign at the start of the Wildlife Drive that identifies the length of the drive and installing mile markers along the drive; and
- Placing a sign on the office door that provides normal office hours and refers visitors to additional information available at the headquarters kiosk.
- Remove the existing administration desk (or significantly reduce size) to enlarge the display area inside the headquarters.
- Modify the artifacts displays inside the headquarters so that the right side has a panel indicating the depths from which the artifacts came and the left side has a panel identifying the time period of each layer.
- Re-roof and paint (brown) the headquarters kiosk. Consider using a dark blue or dark green metal roof as the standard for the refuge to help create an identity.
- Ensure parking areas are well-marked and parking spots are delineated, using concrete bumpers and perimeter fencing if necessary, and universally accessible parking spots are designated with signs in all parking areas.
- Ensure that refuge brochures, maps, and other visitor services products are up-to-date and readily available to the public,

Implement over the intermediate future

- Improve the access road and establish a parking area on the east side of Ditch 81.
- Develop a wildflower area and eliminate the parking area on the west side of Ditch 81.
- Replace the existing Headquarters kiosk with a u-shaped kiosk or move it to the outdoor exhibit area in front of the refuge office to mask front of building. (This area could be connected to a trail leading down to the bank fishing area beside the office.)

-
- Install a trail head kiosk at all recreational areas to provide visitors with basic information that includes the length of the trail, permitted/prohibited activities, and what to see along the trail.
 - Consider installing a portable toilet at the Bright's Landing area, if feasible.
 - On the next edition of the general refuge brochure, work with Service's Regional Office Visitor Services staff to make modifications regarding the map, identify the refuge's Big Lake Wilderness, and identify the adjacent Big Lake WMA.

Implement over the long-term future

- Continue to improve informational signage on the refuge by:
 - Coordinating with AHTD and FHWA for the installation of Big Lake NWR signs on Interstate 55,
 - Installing early warning signs on Highway 18 before turns to recreational areas,
 - Installing turn signs before Oak Island Nature Trail and Timm's Point off of the Big Cypress Wildlife Drive,
 - Installing a bank fishing sign at the Mid-Lake water control structure,
 - Changing the sign on the closed gate past Timm's Point to "Foot travel only – closed to vehicular traffic,"
 - Installing a "Thanks for Visiting Big Lake NWR" sign on the back of the Permitted/Prohibited sign exiting the Wildlife Drive, and
 - Including a regulations sign at all public use areas.
- Close the parking area at the West Dam bank fishing area.
- Improve the access road and establish an improved parking area at the East Dam bank fishing area.
- Consider the following locations for additional welcome and orientation kiosks: Seven-mile boat launch, Bright's Landing observation area, and East Dam bank fishing area.
- Consider developing permanent restrooms at the Bright's Landing area and at the East Dam bank fishing parking lot, as feasible.

Big Lake NWR Objective 4-3: Hunting

Annually provide and expand quality, compatible hunting opportunities as feasible.

Discussion: Biologically sound hunting is a legitimate activity and it is one of the six priority public uses to be allowed (when compatible) as outlined in the Improvement Act. However, there are times and periods when hunting on some sites will need to be curtailed due to the lack of refuge personnel to responsibly administer the hunt, safety reasons, the need for sanctuary sites for certain wildlife, and a lack of sufficient land acres.

Big Lake NWR is not open to waterfowl hunting but serves instead as a waterfowl sanctuary. Waterfowl hunting is available adjacent to the refuge at Big Lake WMA, which is managed by AGFC.

Squirrel, rabbit, and furbearer hunting is allowed on the refuge but under a shorter season than the state regulations. Trapping of furbearers is prohibited.

As a result of a joint project between AGFC and the Service at the Big Lake WMA and Big Lake NWR, the turkey population has increased to the point where limited hunting is offered on Big Lake WMA. Turkey numbers and habitat use on the refuge should be monitored to evaluate population and carrying capacity. If it appears feasible and compatibility can be ensured, the refuge should coordinate with AGFC to plan and implement limited youth turkey hunting on the refuge.

Archery deer hunting is permitted on the refuge from November 1 – December 31. All harvested deer must be checked at the refuge check station and recorded on the hunter's license. The refuge manager and the Complex biologist review the deer harvest to formulate decisions on season length and bag limits. Whenever high water levels force deer to higher ground, the refuge closes to hunting.

The refuge has a current and approved hunting plan that will be revised and updated upon implementation of this CCP. The current hunt plan addresses special access by permit for mobility-impaired hunters. A hunt brochure is produced annually in accordance with Service Graphics Standards. Access is by walking, motor vehicle, bicycle, boat, canoe, and kayak. ATVs, personal watercraft (e.g., jet skis and hovercraft), airboats, and horses/mules prohibited. All vehicles, including bicycles, are restricted to designated roads, levee tops, and parking areas. Public access to hunt areas may be closed at any time necessary to protect refuge resources or visitors. No accessible alternatives exist for visitors with visual disabilities to obtain hunting information. Federal and state regulations are made available to hunters at headquarters and kiosks.

Big Lake NWR does not have any law enforcement officers on staff. State officers lend some enforcement help. A law enforcement officer is needed to provide coverage for Big Lake and Wapanocca NWRs.

Strategies:

- Improve the enforcement of federal and state hunt regulations on the refuge by adding a law enforcement officer to the staff, to be stationed at Big Lake NWR but also to serve Wapanocca NWR.
- Provide a statement in the hunt brochure and on the website to the effect that, "Archery season may be closed due to high water."
- Explore the possibility of establishing a water elevation gauge reading that would allow the refuge to predict when a closing due to flooding will be necessary and then use the refuge website and a recorded phone message to inform hunters of a closure before they travel to the refuge.
- Develop an interpretive panel about the history of hunting at Big Lake NWR to be displayed at the hunt check station or in the visitor contact area.
- Implement a self-check station at the Seven-Mile Boat Ramp.
- Continue to conduct annual cooperative AGFC/Refuge hunt regulation meetings and standardize regulations across Arkansas NWRs and WMAs where feasible.
- Continue to coordinate with AGFC biologists and Big Lake WMA managers to formulate hunting seasons that will, in many cases, follow existing regional/statewide regulations, but with additional refuge-specific limitations or restrictions as needed.
- Utilize methods such as quotas, permits, period limitations, and hunt area zoning, if needed to maintain quality and safety of hunt activities.
- Consider implementing youth hunts, in conjunction with AGFC, to provide some additional hunting opportunities, such as a youth turkey hunt coinciding with the adjacent Big Lake WMA, if compatible and feasible.
- Provide additional sanctuary and non-disturbance areas for waterfowl, if necessary to ensure compatibility.
- Consider allowing quail and woodcock hunting with pointing or flushing dogs and increasing the length of some small game seasons, if compatibility can be ensured and no or minimal visitor conflicts would result.

-
- Allow mobility-impaired hunters to use ATVs on Oak Island Trail through the issuance of special use permits. Provide hunting opportunities for mobility-impaired hunters as feasible.

Big Lake NWR Objective 4-4: Fishing

Annually provide and expand quality, compatible fishing opportunities as feasible.

Discussion: Fishing is a major public use activity at Big Lake NWR. The refuge is open to bank fishing and boat fishing from March 1 through October 31, 24 hours a day. The areas on both the east and west side of the Floodway Dam south of the Highway 18 bridge are open to bank fishing all year. Access is by walking, bicycle, motor vehicle, boat, canoe, and kayak. ATVs, personal watercraft (e.g., jet skis and hovercraft), airboats, and horses/mules are prohibited. There are boat ramps and parking areas at three locations: Timm's Point, Bright's Landing and Seven-Mile. Motorized boats are not allowed within the Big Lake Wilderness, but fishing is permitted. One site on the refuge is posted as a "Closed Area" to prevent disturbance to nesting Bald Eagles. Fishing in the Sand Slough-Mud Lake area is permitted with non-motorized boats and boats equipped with electric trolling motors only from November 1 - February 28, during daylight hours to minimize disturbance to waterfowl.

No management strategies are employed to control angler numbers but this has not been a problem to date. Boat and bank access on Big Lake and its tributaries is limited, which helps to control angler numbers. Because of limited bank fishing access points, the potential for overcrowding may occur during periods of heavy seasonal use. At present, however, there are no known conflicts between users with regard to bank and boat fishing opportunities. Fishing and boating laws are enforced by state and federal officers. No fishing information has been kept on species, numbers taken, or residency of anglers. Routine compliance checks and patrols of fishing areas are conducted by state law enforcement officers. The program is evaluated annually and changes are made, as needed. The refuge is not enrolled in the Recreational Fee Program and no consideration has been given to including the fishing program in the Recreation Fee Program. Coordination of the refuge fishing program has been routinely conducted with the AGFC.

Refuge regulations require anyone engaged in commercial fishing activities to first obtain a special use permit and pay a \$25 fee. Special conditions for commercial anglers are stipulated with the special use permit.

A universally accessible route has been established at Bright's Landing parking lot and the fishing pier. Trails open to anglers are maintained and are free of hazards (especially for use in low-light or inclement weather conditions). The area around the floodway receives frequent floods and more attention is needed to remove logs and debris near the paths. No public restrooms are available to anglers.

Fishing tournaments are not permitted on refuge waters. The refuge staff is not active in state boater safety education programs. A fishing plan exists and will be updated according to the schedule in Chapter V. Other fishing opportunities are considered regularly by staff. Title 50 of CFR (Code of Federal Regulations) contains regulations for the current fishing program.

Strategies:

- Enhance the refuge's main lake habitats for the benefit of aquatic life and to improve fishing success.
- Lower lake levels or drain the lake periodically, in conjunction with waterfowl habitat management, as necessary and feasible to enable habitat improvements and lake bed rehabilitation.
- Consider holding high water in Big Lake (perhaps to late May) every 3 to 4 years to facilitate natural reproduction of fishes, if deemed necessary and feasible.
- Improve quality of fishing experience on Big Lake NWR by:
 - Abandoning the 5 ½ -Mile Bank fishing area,
 - Closing the West Dam bank fishing area and enhancing the access to the East Dam area,
 - Improving the access road and parking on the east side of Ditch 81,
 - Installing a universally accessible fishing pier near the outflow of the water control structure at Timm's Point,
 - Improving the enforcement of refuge fishing regulations by adding a law enforcement officer to cover Big Lake and Wapanocca NWRs on a regular basis, and
 - Posting state health advisories related to fish consumption when necessary.
- Avoid boating, sport fishing, commercial fishing, and other forms of active disturbance to waterfowl on Big Lake during the November to March period of high migratory bird use to ensure compatibility.
- Monitor fishing activities to ensure that waterfowl disturbance is minimal and compatibility with refuge purposes is maintained, and adjust activities as warranted.

Big Lake NWR Objective 4-5: Wildlife Observation and Photography

Annually provide and expand quality, compatible wildlife observation and photography opportunities as feasible.

Discussion: The refuge has a 3.1-mile wildlife auto drive (Wildlife Drive), which begins at the headquarters and extends along the shore of Big Lake. There is ample parking at the end of the drive and space for visitors to turn vehicles around to return to the headquarters. Viewing opportunities are best during winter months when water levels are high.

Big Lake NWR has two hiking trails. Oak Island Nature Trail is 1.2 miles in length each way. There is a trail sign posting the name of the trail, but no additional signs are located on the trail to provide information on trail length or interpretive topics. Bright's Trail is a 1-mile loop trail with ample directional signage, but without interpretive signage. Bicycles are prohibited on these two trails.

Bright's Landing has an observation deck overlooking part of the lake. This facility offers views of migratory waterfowl during late fall and early winter, and with year-round viewing of Wood Ducks. White-tailed deer also can be viewed from the pier during the winter months. The area is universally accessible with parking and concrete pads for visitors with disabilities. There is one kiosk for orientation and interpretation.

The Timm's Point observation area is universally accessible via the Wildlife Drive and offers viewing of the largest portion of the lake. Visitors can observe winter migrants such as eagles, osprey, and large concentrations of waterfowl from this vantage point. There are no improved structures and part of the area is currently roped off until repairs can be made to a deteriorated retaining wall.

The refuge has plans to construct a photo blind/observation tower near the moist-soil management area. The blind will be constructed to offer concealment, while also providing appropriate openings for photographing wildlife.

The refuge general brochure, updated in September 1999, provides a general map of the entire refuge, which indicates the approximate locations for the Wildlife Drive, observation areas, and trails. The map will need to be amended in the future to accurately depict the locations of the new photo blind, boat ramp, and kiosk at Seven-Mile Boat Access.

Strategies:

- Build an observation tower with spotting scope at Timm's Point.
- Build an observation tower and provide year-round access at Baker's Island Mud Slough.
- Create some openings in the vegetation along Wildlife Drive to allow views of the lake.
- Install photo blinds in strategic locations on the refuge to provide additional wildlife observation and photography opportunities, as feasible.
- Place a wayside exhibit at Cow Opening (Oak Island Trail) that highlights wildlife and habitats to be viewed and photographed.

Big Lake NWR Objective 4-6: Environmental Education and Outreach

Annually provide and expand quality, compatible environmental education and outreach opportunities as feasible.

Discussion: There is not an organized environmental education program at Big Lake NWR. The refuge manager provides one presentation per month to school groups or to community organizations. There are more requests for presentations than the staff has time to fulfill. The refuge staff also participates in one or two job fairs at local schools each year. Scout groups come to the refuge for programs and sometimes to participate in projects such as building bird boxes and kiosks. The refuge has great potential for expanding environmental education in the area with two school systems within 15 miles of the refuge and also a community college nearby.

The refuge enjoys considerable support in nearby communities, but refuge staff have not yet had the opportunity to develop outreach plans or goals for important individual resource issues or for addressing long-term resource issues. Issues important to the refuge, to the community, or to other audiences include waterfowl and migratory bird management, fishing, wetland and lake restoration, water level control and management, and management of the Wilderness. Hunters, anglers, and birders have the most at stake with the prevalent refuge-related issues and potential actions. The state, members of Congress, businesses, community leaders, conservation groups, stakeholders, special interest groups, and media have been included in the list of audiences for outreach.

Both Service and Refuge System messages are incorporated into the refuge's programs. They are communicated through outreach activities, such as when the refuge manager presents programs both on and off the refuge. The refuge uses news releases, personal contacts, and website to communicate outreach messages. The refuge would benefit from a portable exhibit to use in delivering these messages. Articles in local newspapers and other media and personal contacts have been the primary methods for communication to various audiences. In addition, an effort should be made to establish a friends group. Before expanding outreach, additional resources would be needed.

Strategies:

- Develop three standard environmental education programs to be available for presentation on request.
- Develop standard PowerPoint presentations to present to community groups about the value of the refuge to the environment.
- Partner with a local college to apply for and implement a Nature of Learning grant to develop environmental education programs for the refuge.
- Collaborate with local teachers to develop teacher-led field trips that could include environmental education activities at Bright's Landing, Wildlife Drive, and Timm's Point.
- Recruit and train volunteers to assist with developing and presenting environmental education programs.
- Foster relationships and coordinate with media to highlight the refuge in local newspapers, radio programs, and television news spots.
- Conduct an annual refuge event, such as an open house, with an environmental theme.
- Hold a congressional field day (either for Big Lake/Wapanocca NWRs or for the entire Complex) to highlight the role of the refuges in the community.
- Continue to participate in local job fairs.

Big Lake NWR Objective 4-7: Interpretation

Annually provide and expand quality, compatible interpretation opportunities as feasible.

Discussion: Information about the refuge is available to the public at kiosks located at the refuge office, Timm's Point, and Bright's Landing. Taxidermy mounts and artifacts are on exhibit in the visitor reception area of the office. The general brochure provides information about management of the refuge, as well as public use opportunities. Additionally, the refuge has a portable exhibit about fish.

Strategies:

- Develop and install interpretive panels at the following locations that would highlight key topics of interest on the refuge such as:
 - Headquarters kiosk (cultural history, basic welcome and orientation information),
 - Headquarters visitor contact station (archaeological - depicting the depth of soil layers and timeframes for artifacts),
 - Timm's Point (migratory birds, water management),
 - Bright's Landing fishing pier (fishes, wildlife viewing opportunities),
 - Photo blind/observation tower at moist-soil unit (moist-soil management activities, wildlife observation),
 - Seven-Mile boat landing (wilderness, history of hunting at Big Lake NWR, partnership with Big Lake WMA, cooperative management),
 - Eastside bank fishing area (water management, drainage and sedimentation issues, refuge history, fishes), and
 - Wildlife Drive (champion tree, connections between natural and cultural history).

REFUGE ADMINISTRATION

Big Lake NWR Goal 5: Provide support and sufficient resources necessary to ensure that goals and objectives for habitats, fish and wildlife management, resource protection, visitor services, and refuge administration are achieved for Big Lake NWR in particular and Central Arkansas NWR Complex overall.

Discussion: Both the Biological Review and the Visitor Services Review teams specified additional staffing, facilities, and equipment needed to implement the refuge's purposes, vision, goals, and objectives identified in this CCP. Adequate resources will ensure that filling these positions and acquiring the necessary facilities and equipment will be possible.

Big Lake NWR Objective 5-1: Staffing

As resources become available, strategically add 4 staff positions that will improve the capacity and capability of Big Lake NWR to achieve its legislated purposes and accomplish conservation and management goals and objectives.

Discussion: Currently, the refuge has only two full-time employees located on site – the refuge manager and an engineering equipment operator. Other Service personnel may be called upon for additional expertise and assistance. However, it is obvious that the refuge could use additional on-site employees to meet the many administrative, biological, habitat improvement, and management actions that are required on a daily basis. A law enforcement officer is critically needed to provide adequate protective services to Big Lake and Wapanocca NWRs. A biologist with forestry expertise or a biological technician would be highly beneficial. Additionally, due to the number of water-related issues on Big Lake NWR and the Complex overall, a hydrologist is needed to provide expertise and technical assistance to management. The refuge could also use a maintenance person (laborer) to assist with day-to-day operations and maintenance. Hiring additional staff will reduce the time the refuge manager currently expends on non-administrative and operational tasks.

Strategies:

- Recruit a park ranger (law enforcement) to be stationed at Big Lake NWR, but would provide resource and visitor protection and outreach for both Big Lake and Wapanocca NWRs.
- Upgrade current refuge manager position to appropriately reflect the true scope, complexity, and effect of the duties and responsibilities on Big Lake NWR and within the Complex.
- Coordinate with AGFC law enforcement personnel for their cooperation and assistance in preventing and controlling illegal activities on the refuge.
- Recruit a wildlife biologist or biological technician, preferably with forestry background, to implement habitat management projects, perform surveying and monitoring, and assist with other biological programs.
- Recruit a park ranger (Visitor Services specialist), to be stationed at Wapanocca NWR, but also would serve Big Lake NWR, to develop and implement improved and expanded visitor services programs.
- Recruit a hydrologist based at Big Lake NWR to coordinate hydrological and water quality issues on all refuges within the Complex, coordinate hydrological research and monitoring, provide technical advice to adjacent landowners, serve as a liaison with COE, and coordinate aquatic restoration projects.
- Recruit a maintenance person (laborer) to assist with day-to-day maintenance of facilities, equipment, and infrastructure.

Big Lake NWR Objective 5-2: Volunteers, Partners, and Friends

Expand the volunteer and intern program, re-establish a friends group for the refuge within 5 years of the date of this CCP, and cooperate with partners to accomplish refuge goals and objectives.

Discussion: The refuge manager supervises and trains volunteers on an as-needed basis. Volunteers are managed by refuge staff to help with maintenance and to conduct wildlife surveys. A volunteer program needs assessment has not been conducted. Volunteer position descriptions, that specify duties and assignments, have not been prepared. Volunteers are not actively recruited for the refuge. Proper workspace, materials, and equipment are provided to the volunteers so that they can work safely and properly.

The refuge partners with various other agencies, especially the AGFC, and is committed to establishing a friends group.

Strategies:

- Recruit a park ranger (Visitor Services) to be stationed at Wapanocca NWR, but would also serve Big Lake NWR as coordinator for volunteers, interns, and friends group programs.
- Work with the regional volunteer coordinator to develop and implement a volunteer plan for the refuge.
- Identify specific volunteer opportunities and prepare job descriptions for which volunteers and interns might be suited, such as office help, maintenance, environmental education, outreach, wildlife surveys, and duck banding.
- Incorporate volunteer, intern, and friends recruitment into public presentations and media outreach.
- Adopt a volunteer recognition plan that includes awards for volunteering a certain number of hours.
- Over the long term, provide two volunteer camper pads, if feasible, for long-term refuge volunteers.
- Coordinate with universities in Arkansas and elsewhere to recruit high-quality interns to assist the refuge with operations, inventory, and management programs.
- Cooperate closely with staff from other government agencies, non-governmental organizations, and community groups to establish and nurture partnerships that would provide mutual benefits for those involved and help achieve refuge goals and objectives.
- Identify and facilitate a core group of individuals that is concerned with the interests and needs of the refuge, and coordinate with them to initiate and establish a friends group for Big Lake NWR.
- The refuge manager and Visitor Services specialist should attend friends group training.

Big Lake NWR Objective 5-3: Facilities, Infrastructure, and Equipment

Acquire and maintain all of the facilities, infrastructure, and equipment necessary to perform habitat management, restoration, and enhancement on the refuge, in addition to maintaining and improving essential infrastructure, such as roads and levees.

Discussion: The current refuge office at Big Lake NWR, located approximately 3 miles east of Manila, Arkansas, in Mississippi County, and built in 1976, is substandard and inadequate to meet administrative and visitor service needs. Entry points, interior workspaces, and public areas, including restrooms, are not fully accessible. The exterior and interior walls are deteriorating and failing, the roof needs to be replaced, a restroom does not function, the HVAC system is inefficient, offices are not sufficiently lighted or ventilated, and health and safety issues exist. Furthermore, there are no suitable spaces for staff/partners meetings, visitor reception, or exhibit areas for

education/interpretation. The building is unsightly due to its condition and appearance. Rehabilitation or renovations are not cost effective.

Funding has been obtained through ARRA for replacement of the existing office with a suitable facility. The proposed headquarters/visitor contact station would be 1-story, approximately 2,500 square feet in size, and would include 4 staff offices, conference room, break room, unisex staff restroom, law enforcement storage, utility/storage closets, fax/photocopy/file room, mudroom, separate male/female public restrooms, an exhibit area, and volunteer/receptionist area. This facility would be fully ADA-compliant, would provide adequate administrative function, and would enable suitable opportunities for visitor reception and interpretation. The building would incorporate green-building design features, including energy-conserving lighting, HVAC, insulation, water-conserving systems, and options for alternate energy. It also would provide a safe and comfortable environment for staff and visitors. The current office would be removed and the new headquarters/visitor contact station would be sited within close proximity to the current building within the existing office/maintenance shop grounds, which are already disturbed; therefore, new construction would necessitate minimal site disturbance and no wildlife habitat would be destroyed. The funding amount (approximately \$650,000), would include planning/design, engineering, construction, furniture, and interpretive exhibits.

The maintenance facility at Big Lake NWR is deteriorating, failing, and is inadequate and unsafe for staff using the premises. The building elevation is improperly sited and up to 50 percent of the building floods during heavy rains, placing employees at risk from electrocution and injury from slipping and falling. Additionally, the building does not have properly enclosed space for servicing or repairing heavy equipment, and the outdoor pole shed is not large enough to allow all the refuge's heavy equipment to be stored under roof and adequately protected from the elements.

Funding (approximately \$590,000) has been obtained through ARRA for replacement of the existing shop building with a suitable facility of approximately 3,000 square feet that would include 2 enclosed drive-through bays, concrete floors, adequate storage for materials and supplies, vehicle lift, environmentally sound vehicle wash pad, and outdoor equipment storage with an insulated roof. The new building would be located on approximately the same site as the existing building, thereby minimizing site disturbance, and not destroying any wildlife habitat. The building would use energy-conserving features, such as efficient HVAC, lighting, and water systems, and potential alternate energy sources. The current building would be removed, but existing shop yard, vehicle approaches, and parking areas would be utilized for the replacement facility.

Utilizing and sharing equipment with Wapanocca NWR and the Complex generally would help reduce extensive equipment purchases for Big Lake NWR. The refuge does need additional equipment to improve moist-soil management capabilities, such as a larger tractor and implements.

Strategies:

- Replace the existing refuge office at the same location with a 2,500-square-foot headquarters/visitor contact station, using ARRA funding (approximately \$650,000) and incorporating green-building design features to provide adequate facilities to meet the expectations and needs of the visiting public, to conduct visitor services programs, to facilitate work with partners, and to enable refuge staff to administer programs and operations.

-
- Replace the existing maintenance shop and equipment storage pole shed at the same location with an approximately 3,000-square-foot structure using ARRA funding (approximately \$590,000), and incorporating green-energy building design features to provide sufficient facilities that would enable employees to work in a safe environment, to increase capability to accomplish refuge projects, to provide adequate equipment maintenance and storage space, and to protect refuge investments.
 - Acquire a tractor and special attachments to enhance the refuge's moist-soil management capability, and other specialized equipment necessary to maintain the refuge's facilities and infrastructure.
 - Keep all machinery, equipment, facilities, and infrastructure in good working order by regular upkeep and maintenance.
 - Recruit an engineering equipment operator to operate and maintain equipment and infrastructure (accomplished January 2009).
 - Recruit a laborer to assist with day-to-day maintenance activities.
 - Annually update and maintain the Equipment Priority Index (EPI) report to identify station heavy equipment needs.
 - Construct a heavy equipment wash pad area that meets environmental requirements adjacent to the existing equipment storage shed.
 - Replace heavy equipment within the guidelines and time frames established by the regional heavy equipment coordinator.

CACHE RIVER NATIONAL WILDLIFE REFUGE

NOTE: All goals, objectives, and strategies described below for Cache River NWR are set in the time context of the 15-year planning cycle of this CCP unless otherwise indicated in individual objectives or strategies.

FISH AND WILDLIFE POPULATION MANAGEMENT

Cache River NWR Goal 1: Manage and protect migratory birds and native wildlife populations on Cache River NWR to fulfill the purposes for which it was established and to contribute to the mission of the Refuge System.

Discussion: Each refuge in the Complex was established for the purpose of providing for the needs of migratory waterfowl. Cache River NWR was established to protect significant wetland habitats and provide feeding and resting areas for migrating waterfowl. As one of the few remaining areas in the LMRV not drastically altered by channelization and drainage, the Cache River basin contains some of the most intact and least-disturbed bottomland hardwood forests in the Mississippi Valley region. This unique and valuable wetland complex has been recognized by the Ramsar Convention as a "Wetland of International Importance."

Cache River NWR Objective 1-1: Migratory Waterfowl

Within 5 years of the date of this CCP, increase DED's from current level of approximately 11 million to 18 million DEDs provided by managed waterfowl habitat that includes moist-soil, bottomland hardwood, un-harvested cropland, and harvested cropland habitats, flooded to a depth of 2 feet or less, in sanctuaries (November 1 – February 28) and hunted areas, sufficient to meet the habitat and population goals of the NAWMP as stepped-down through the LMVJV.

Discussion: The MAV is an important ecoregion for migrating and wintering ducks and geese in North America. Cache River NWR provides important foraging and resting (sanctuary) habitats within the MAV for waterfowl and serves in an integral role in both the NAWMP and LMVJV.

Concern over waterfowl population declines in the 1980s resulted in establishment of the NAWMP, which focused the attention of federal, state, and private conservation groups on critical wintering and breeding areas. The LMVJV, which encompasses all four refuges in the Complex, was selected as one of the wintering habitat focus areas. One of the first tasks faced by the LMVJV was to develop a model or decision tool for determining how much habitat was needed, and a method for relating this objective to the population goals of the NAWMP. The solution was to consider wintering areas as responsible for contributing to the spring breeding population goals of NAWMP, proportional to the percentage of ducks historically counted in wintering areas (Loesch et al. 1994, Reinecke and Loesch 1996). In order to contribute ducks to spring breeding populations, wintering areas must provide sufficient habitat to ensure adequate winter survival. To quantify winter habitat requirements, the LMVJV had to identify limiting factors and made an assumption that foraging habitat was the most likely factor to limit waterfowl populations in the LMV (Reinecke et al. 1989). The process of relating habitat objectives for individual management areas to overall habitat objectives for the LMV involved several steps (Biological Review for Bald Knob and Cache River NWRs, USFWS 2008). Step-down objectives were established for Cache River NWR (Table 10). DED objectives were calculated by multiplying the acreage objective by the assumed DED standard developed by the LMVJV for that habitat type.

The intensity of waterfowl hunting activities and large harvest numbers in Arkansas create the need for providing waterfowl sanctuaries on Arkansas' national wildlife refuges. Activities such as maintaining body temperature, searching for food and roost sites, molting, courtship, pair bonding, and avoiding disturbance are energy-consuming activities for waterfowl in winter. Sanctuaries provide secure areas where waterfowl can rest and perform these activities with a minimum of interruption and disturbance, and thus, less energetic cost. Sanctuary areas are critical for waterfowl to allow them to conserve energy to survive the winter period and physiologically prepare for undergoing other life functions, particularly northward migration and reproduction. Due to its strategic location in the heavily hunted MAV, coupled with the ability of this refuge to manage for a concentrated source of high-quality waterfowl food resources, Cache River NWR fulfills an important role as a waterfowl sanctuary. This function must be maintained on the refuge in order to provide areas free from disturbance for wintering waterfowl. Providing waterfowl sanctuaries is critical to the refuge achieving its legislated purposes and the mission of the Refuge System. Cache River NWR currently has only 8 percent of its acreage in waterfowl sanctuary status.

Strategies:

- Annually provide 100-200 acres of flooded habitats for early migrating waterfowl (e.g., Teal and Northern Pintail) beginning no later than September 1.
- Integrate water management for shorebirds and early migrating waterfowl as feasible.
- Flood additional acreage from November through December to continually provide food resources for wintering waterfowl and meet the refuge's foraging habitat objectives.
- During the period from January into April, slowly decrease water levels in selected impoundments to concentrate invertebrates for spring migratory birds.
- Record management actions by type and date for each waterfowl impoundment to document vegetation response by species and estimated food production, and document habitat use by waterfowl via waterfowl surveys conducted at least twice monthly from November through February, and once monthly in September, October and March. Use monitoring results to adapt waterfowl habitat and population management as necessary to meet objectives.

- Annually review waterfowl objectives set for the refuge and compare with actual performance to determine if refuge and landscape-level (e.g., LMVJV) objectives are being met.
- Develop and implement a step-down water management plan for the refuge, to include flood dates and drawdown dates for all water management units.
- Coordinate with AGFC and the LMVJV to determine the need for additional waterfowl sanctuaries of appropriate type, size, and location within the refuge and establish those areas with signage, depicting them on maps and brochures, and implement appropriate restrictions. New acquisitions proposed for designation include portions of Bayou DeView LTD and the King Lake Tract.

Table 10. Cache River NWR - Current migrating and wintering waterfowl foraging habitat objectives established by the LMVJV

Habitat	Objective ¹ Acres (DED) ³	Current Capability ² Acres (DED) ⁴	(+ or -) Acres (DED)
Moist-soil	490 (679,140)	81 (151,308)	-409 (-527,832)
Bottomland Forest	850 (107,100)	850 (162,350)	0 (+ 55,250)
Unharvested Crop	1,360 (17,165,920)	767 (10,784,540)	- 593 (-6,381,380)
Harvested Crop	0 (0)	591 (169,698)	+ 591 (+169,698)
Total	2,700 (17,952,160)	2,289 (11,267,896)	- 411 (- 6,684,264)

¹Acreage and DED objective provided by the LMVJV office.

²Current acreage and DED capability (has levees and water control structure, some have pumping capability) provided by refuge staff.

³DED estimates, calculated by using standard DED figures provided by LMVJV.

⁴Updated DED estimates adopted by the LMVJV Waterfowl Working Group in June 2006: moist-soil, 1,868 DEDs/ac; bottomland hardwood, 191 DEDs/ac; unharvested crop, 14,061 DEDs/ac (estimate based on actual acres of various grain crops left unharvested and flooded during the winter period); harvested crop, 287 DEDs/ac (estimate based on actual acres of various harvested grain crops flooded during the winter period).

Cache River NWR Objective 1-2: American Woodcock

Enhance American Woodcock foraging and roosting habitats in conjunction with management for other trust species to contribute to the objectives of the American Woodcock Management Plan.

Discussion: American Woodcock are migratory game birds that occur throughout the forested portions of the eastern United States. Cache River NWR is within the Central Region as designated for administrative purposes. Woodcock populations in this region have declined 19 percent since 1968, probably due to land use changes associated with land conversion and the maturing of forest habitats.

The American Woodcock Management Plan (U.S. Fish and Wildlife Service) was completed in 1990, and included an objective to protect and enhance wintering and migrating habitat on public lands to increase woodcock carrying capacity. Other objectives established in the plan included inventorying and monitoring woodcock habitat and developing management demonstration areas.

Woodcock are dependent on specific habitat conditions including availability of earthworms, their major food source (Krementz and Jackson 1999). Wintering habitat for woodcock includes moist bottomland hardwood forests with brush and understory, especially when found in close association (within about 0.5-mile) with agricultural fields and “old field” succession. These sites are typically thickets with spongy wet soil, a high density of vertical plant stems, but with sparse ground cover below. Typical cover includes privet, cane, and briars that result from openings in the canopy. The scrub-shrub and dense bottomland hardwood habitats created to benefit priority forest interior nesting birds (Swainson’s Warbler and Cerulean Warbler) will also provide good daytime cover for woodcock.

At dusk, most woodcock move to open or brushy fields to forage and conduct courtship activities throughout the night. These habitats include agricultural fields that were not fall disked and sparse grasslands that may have received a cool fall burn to create patchy openings of exposed soil interspersed between grass clumps 1-3 feet in height. The grassland and some field crop areas of the refuge provide this specific habitat preferred by woodcock, as well as other priority species (e.g., Northern Bobwhite, Dickcissel, and other grassland birds).

Strategies:

- Inventory and assess suitable woodcock habitat on the refuge.
- Conduct surveys at least twice monthly from mid-November to mid-February to document occurrence, estimate population density, document migration chronology, and determine nocturnal habitat use.
- Create suitable diurnal habitat in existing forest stands through thinning and patch clearcuts.
- Create and maintain preferred nocturnal habitat that consists of openings at least 5 acres in size and situated within 0.5-mile of good diurnal habitat (e.g., wet agricultural fields, wet afforestation sites, and grasslands) containing exposed soil and patchy cover 1-3 feet in height.
- Continue to restrict or eliminate fall disking of crop fields that would reduce earthworm numbers.

Cache River NWR Objective 1-3: Shorebirds

Annually provide a minimum of 50 acres of shorebird foraging habitat flooded to 4 inches or less from July to October to contribute to the objectives set forth in the U.S. Shorebird Conservation Plan, Lower Mississippi Valley/West Gulf Coastal Plain Shorebird Management Plan, and by the LMVJV.

Discussion: Several recently acquired WRP tracts, including Howell, Revel, and Dark Corner, contain numerous impoundments that provide opportunities for shorebird management. On a rotational basis, mudflat habitat can be created by disking during the dry years or by herbiciding emergent vegetation (primarily water primrose) during the wet years and then reflooding naturally or by pumping. Monitoring vegetation and shorebird responses to these management techniques will be necessary in order to adjust management actions accordingly (i.e., adaptive management).

Strategies:

- Create mudflat habitat in selected impoundments by disking during the dry years or by herbiciding emergent vegetation (primarily water primrose) during the wet years and then reflooding naturally or by pumping.
- Conduct weekly shorebird surveys during late summer and early fall, and analyze data to determine species numbers, migration chronology, impoundment use based on habitat conditions (e.g., water depth and minimal pool size), and adapt habitat management as needed.
- Monitor shorebird numbers to help evaluate underlying assumptions of the regional Shorebird Conservation Plan by contributing to estimates of the number of birds moving through the area and the amount of time spent during migration.

Cache River NWR Objective 1-4: Colonial Waterbirds/Wading Birds

Annually provide a minimum of 400 acres of managed foraging habitat, and protect all rookery sites from disturbance from March to August (breeding season) for long-legged wading birds to contribute to the objectives set forth in the North American Waterbird Conservation Plan.

Discussion: Cache River NWR provides habitat for breeding and wintering colonial waterbirds in shallow water areas, forested wetlands, and along the banks of the Cache River. Although management of this group of species is not a major priority for the refuge, management for shorebirds and waterfowl can also provide foraging habitat for wading birds. Additionally, there is a need to identify rookery sites, document breeding bird numbers and production, and identify areas to be protected from disturbance.

Strategies:

- In association with management for shorebirds, provide areas of shallow water and mudflat habitat that will also provide suitable conditions for wading birds.
- Monitor nest production and identify areas that need to be protected from disturbance during the breeding and fledging periods.

Cache River NWR Objective 1-5: Marshbirds

Annually maintain a minimum of 50 acres of tree-less wetlands with dense emergent vegetation at 40 to 80 percent coverage and open water from 20 to 60 percent coverage, flooded less than 12 inches deep to provide high-quality habitat for breeding and migrating marshbirds in conjunction with meeting waterfowl objectives.

Discussion: Loss of freshwater emergent wetlands has occurred throughout the southeast as development pressures have increased. The King Rail is thought to have been seriously impacted and there is great concern over inland numbers of this secretive marshbird. The Least Bittern is another species of high concern. Marshbirds occurring at Cache River NWR rely on emergent vegetation, thus the needs of these species should be considered within the context of management of moist-soil units for wintering waterfowl and Wood Duck brood and rearing habitat. Ideal secretive marshbird habitat ranges from 40 to 80 percent coverage for emergent vegetation, with little to any woody vegetation.

Current secretive marshbird habitat on the Cache River NWR, such as semi-permanently or permanently flooded marshes with emergent vegetation like cattails and rushes (*Juncus* spp.), are limited primarily to WRP impoundments, low sinks, or beaver ponds in recently reforested areas. Also some of the shallow oxbow lakes may have limited habitat around their edges.

Strategies:

- Implement marshbird surveys for a better understanding of species occurrence, numbers, and habitat use on the refuge.
- Continue to survey secretive marsh birds using playback calls during May and June in sites surveyed by Budd and Kremetz in 2005-06. Establish additional survey points as needed to determine habitat use/preference.
- Use mowing, disking, or herbiciding to maintain suitable habitat in areas identified through surveys by reverting succession every 5 to 8 years, depending on the percentage of marsh in emergent and woody vegetation.
- Where appropriate, implement marsh restoration projects to convert areas to suitable habitat for marshbirds.
- Determine minimal patch size necessary to manage habitat in blocks of sufficient size to contribute to population and not create predator sinks.

Cache River NWR Objective 1-6: Forest Breeding Birds

Continue to provide and enhance sufficient forest habitat to support forest breeding birds designated as high priority in the MAV (Bird Conservation Region 26) through forest restoration on newly acquired parcels and silvicultural management of existing forested tracts.

Discussion: In many areas of the LMV, minimum forest block size, forest fragmentation, and poor stand quality are issues affecting forest breeding birds and other wildlife species. Cache River NWR is an important component of a larger forested landscape held in public ownership, including Dagmar WMA, Henry Gray/Hurricane Lake WMA, Rex Hancock/Black Swamp WMA, and White River NWR.

The large block of contiguous forest on the Cache/White River ecosystem is now considered the most important in MAV. The Partners in Flight Bird Conservation Plan for the MAV (Twedt et al. 1999) established avian population goals to support source populations of high-priority species in contiguous bottomland hardwood forests. Species and recommended minimal patch size for numerous bottomland hardwood bird species are listed in Table 11. For example, the minimal patch size required to maintain a source population of 500 breeding pairs of Swainson's Warblers and Prothonotary Warblers is 10,000 acres and 20,000 acres for Cerulean Warblers. A block of 100,000 acres is a minimal patch size that will support 80 breeding pairs of Swallow-tailed Kites.

Within the Cache River NWR acquisition area and adjacent public lands (old White River North Bird Conservation Area), there is one contiguous block greater than 10,000 acres but smaller than 20,000 acres, and five blocks of contiguous forest greater than 20,000 but less than 100,000 acres. The largest forested block totals 72,984 acres. While some of the refuge's forested tracts are separated by agricultural fields, there is great opportunity for re-establishing contiguous tracts as the refuge continues to expand and reforest. Furthermore, forest stand quality can be improved, using appropriate silvicultural treatments.

Forest restoration in areas adjacent to existing forest blocks will increase forest block size to benefit more area-sensitive breeding birds and might reduce potential depredation and parasitism by Brown-headed Cowbirds. If forest restoration is considered, placement adjacent to current blocks would provide habitat for several years for early forest successional species such as Northern Bobwhite Quail, and for forest edge species, such as Painted Bunting and Bell's Vireo. Over time, maturation of the restoration sites would increase the current forest block size and re-connect disjunct forested blocks.

Strategies:

- Maintain or increase complexity of forest habitat structure to achieve desired conditions for priority breeding bird species with appropriate silvicultural practices, including creating canopy openings that allow sunlight to reach the ground and simulate increased ground and understory cover.
- Where appropriate, continue forest restoration in areas adjacent to other forest blocks to increase block size and provide suitable habitat for early successional species.
- In select areas, maintain at least 70 percent forested cover within a 6-mile radius of prime nesting habitat to reduce nest predation and brood parasitism.
- Maintain scattered patches of understory to increase first-year bird survival, and to provide foraging opportunities for migratory birds.

Cache River NWR Objective 1-7: Scrub-shrub or Early Successional Birds

Provide and enhance habitat for scrub-shrub bird species designated as high priority in the MAV (Bird Conservation Region 26) through forest restoration on newly acquired parcels and development and maintenance of early successional habitat.

Discussion: Scrub-shrub and early successional bird species as a group have continued to decline in the southeastern United States and would benefit from increased maintenance and restoration of suitable habitat on Cache River NWR. Due to the amount of recent reforestation on the refuge, a substantial acreage of early successional habitat is currently being provided. In time, most of the reforested sites will transition to mature forested stands. While reforestation and provision of habitat for species associated with forested habitats is the highest priority, it is important to routinely evaluate the availability of early successional habitats. Additional areas of the refuge could be maintained in an early successional condition, perhaps with the use of prescribed fire on a 5- to 10-year rotation. In addition, buffer strips along forest field edges and crop fields, as well as narrow corridors linking fragmented forest patches, could be managed as scrub-shrub habitat. These practices would benefit the highest priority scrub-shrub species, as well as other important early successional species including Field Sparrow, Orchard Oriole, White-eyed Vireo, Northern Bobwhite Quail, and Bell's Vireo. Additionally, Northern Bobwhite Quail would be positively influenced by management directed toward early successional and scrub-shrub management. Quail population restoration recently has been designated as a major management initiative throughout Arkansas by AGFC.

Table 11. Hypothesized forest area required to support viable populations of 500 breeding birds within the MAV

Species	Patch Size (Acres) Recommendation	Habitat Area (Acres) Objective
Swainson's Warbler	12,079	10,280
Cerulean Warbler	20,560	20,560
Swallow-tailed Kite ^a	102,800	102,800
Prothonotary Warbler	6,939	10,280
Northern Parula	7,710	10,280
Hooded Warbler	6,425	10,280
Kentucky Warbler	21,588	20,560
Yellow-billed Cuckoo	16,962	20,560
Wood Thrush	7,196	10,280
Louisiana Waterthrush	18,504	20,560
Acadian Flycatcher	7,196	10,280
Eastern Wood-pewee	14,135	20,560
Yellow-throated Vireo	20,303	20,560
Yellow-throated Warbler	20,046	20,560
Blue-gray Gnatcatcher	10,280	10,280
Summer Tanager	16,962	20,560
Great-crested Flycatcher	18,504	20,560
Red-shouldered Hawk	148,546	102,800
Scarlet Tanager	12,593	20,560
Red-eyed Vireo	4,626	10,280
American Redstart	11,822	10,280
Broad-winged Hawk	259,570	102,800
Pileated Woodpecker	48,830	102,800
Cooper's Hawk	115,650	102,800
White-breasted Nuthatch	22,102	20,560

Source: Mueller et al. 1999.

^a Based on Cely and Sorrow (1990), a 40,000 ha patch of bottomland hardwood forest would only support approximately 80 pairs of Swallow-tailed Kites. A secure (source) population would realistically have to be based on a regional (southeastern U.S.) population.

Strategies:

- Where and when appropriate, continue forest restoration in areas adjacent to existing forest blocks to expand block size and provide habitat for early successional bird species.
- Maintain early successional/scrub-shrub habitats in selected areas to provide permanent habitat for bird species dependent on such habitats.

Cache River NWR Objective 1-8: Grassland Birds

Annually provide a minimum of 100 acres of nesting habitat through management of old fields and reforestation areas (< 7 years old) for grassland birds designated as high priority in the MAV (Bird Conservation Region 26).

Discussion: Although management for grassland birds is not a priority at Cache River NWR, some breeding species (e.g., Dickcissel, Eastern Meadowlark, and Northern Bobwhite Quail) and some winter species (e.g., Henslow's Sparrow, Sedge Wren, LeConte's Sparrow, Northern Harrier) will benefit from provision of this habitat in larger blocks (25-100 acres). In areas where it is feasible and does not compete with reforestation efforts or waterfowl/shorebird management, agricultural areas should be converted to native grasses and forbs.

Habitat conversions should not result in weeds that characterize idle agricultural land, but should involve an intentional planting of warm season bunch grasses (e.g., little bluestem, Indian grass) and a large component of native forbs. Such grass-forbs areas will require periodic disturbance (mowing or burning) to maintain vigor.

Land parcels that are distant from existing forests (e.g., some Farm Service Agency tracts) may be suitable for development and maintenance of additional grass-forb habitat, provided they would not function as habitat sinks. These areas could be planted heavier to grasses and as a result may be more beneficial to birds breeding or wintering in grasslands.

Strategy:

- Provide a minimum of 30 acres of native warm season grasses dominated by bunch grasses and native forbs to benefit grassland birds.

Cache River NWR Objective 1-9: Eastern Wild Turkey

Provide and enhance habitat for Eastern Wild Turkeys, incidental with habitat management practices for trust species, and provide quality recreational opportunities.

Discussion: The Eastern Wild Turkey is the primary resident game bird in the ecosystem, as well as one of special public interest. Being most associated with mature hardwood forests, turkeys were once distributed throughout the ecosystem. However, today, due to habitat destruction and conversion of forests to agriculture, turkeys are generally restricted to the remaining larger blocks of forests, as well as adjacent afforestation and open fields. Despite quality habitat management, turkey populations can fluctuate widely due to a combination of factors other than habitat suitability itself. A disease outbreak can cause as much dilemma in good habitat as in bad. Weather conditions, especially during the spring nesting season, can determine reproductive success, regardless of habitat quality, and thus be a major limiting factor on turkey numbers. Wetter than normal weather during May and drier than normal summers adversely impact turkey production.

However, the primary limitation on Eastern Wild Turkey populations in the Cache River ecosystem is the limited acreage of forested lands above the 1- or 2-year floodplain. Although turkeys will readily roost over water, they require dry land for feeding on acorns and other hard-mast during the winter and early spring when flooding is most common. Flooding during the nesting season adversely impacts recruitment by destroying nests, and by directly affecting survival of young poults. Turkey populations in the area have demonstrated the ability to grow relatively rapid with several successive years of favorable water conditions, but are observed to decline as a result of late spring and summer flooding, particularly if it occurs in successive years. Turkeys are not a priority species for forest management on this refuge, and as such, their numbers may not be consistently maintained at optimum levels. However, many of the management activities implemented for priority wildlife, such as forest interior and early successional forest birds, will provide collateral benefits to turkeys.

Forest management can benefit turkeys by increasing the diversity and availability of foods, such as hard and soft mast, grasses, sedges, and forbs. Nesting habitat is often improved by selective thinning of trees that provides more ground cover for nest concealment. Removal of more than 50 percent of the overstory degrades turkey habitat in the short term by resulting in extremely dense undergrowth that is generally avoided by turkeys.

Turkey habitat is often enhanced by the presence of small, well-dispersed forest openings that contain grasses and forbs. These openings are especially important to turkey poults foraging for insects. Openings are also used for nesting and courtship activities. A large percentage of the refuge's open grasslands occur along utility rights-of-way and in newly reforested fields. Continued habitat management through timber thinning, along with land acquisition and reforestation, should increase turkey nesting cover and improve production of hard and soft mast food sources.

Turkeys are hunted on Cache River NWR where suitable habitat occurs and birds are available. Gobbler surveys were initiated on the refuge during spring 2007, as an index to determine general abundance and monitor population trends over time.

Strategies:

- Continue to conduct annual gobbler call surveys.
- Conduct turkey poult surveys in partnership with the AGFC to determine annual production.
- Monitor suitable habitat conditions for turkeys through existing forest inventory data and aerial photos.
- Continue to implement an active forest management program on the refuge, considering turkey habitat needs as appropriate when conducting forest and open land management activities.
- Partner with the National Wild Turkey Federation on habitat projects, where and when feasible.
- Set turkey harvest objectives, monitor harvest, and adjust practices as necessary in coordination with AGFC.

Cache River NWR Objective 1-10: White-tailed Deer

Continue to maintain a healthy deer herd with a balanced sex and age structure at a level consistent with long-term habitat capability, to prevent degradation of habitat important to priority species, and to provide quality recreational opportunities.

Discussion: Although not a federal trust species, white-tailed deer are important to the public as a game species and are a popular subject for observation and photography. Deer utilize a wide range of habitats and most refuge management actions aimed at priority species, such as migratory birds, will also provide direct benefits to deer.

Deer are commonly observed on the refuge and generally appear to be abundant. A deer herd health check conducted by SCWDS in the early 2000s, determined that the population was healthy and below carrying capacity. A subsequent health check conducted by SCWDS in 2007, indicated that deer on the south part of the refuge were in good physical condition and the herd appeared to be below carrying capacity. However, deer collected by SCWDS in the central part of the refuge showed signs of a higher population size that was nearing carrying capacity. Consequently, SCWDS recommended reducing the population to a more healthy level, using public hunting as the management tool. Harvest densities, based on AGFC check station reports, have been less than one deer per 200 acres, which is considered a low harvest. The refuge conducts a 2-day, either-sex youth hunt, a 7-day either-sex Quota Gun Deer Hunt, a 5-day either-sex muzzleloader hunt in October, and a 3-day either-sex muzzleloader hunt in late December. The archery season is open from October 1 to February 28, and is also an either-sex hunt. Currently, specific population objectives for the herd have not been established. Biological data from harvested deer were collected during the 2007 season to help begin formulating a data set that over time will help determine density-dependent parameters about the herd condition, and make inferences about the population.

The refuge consists of a mixture of farm fields, afforestation, moist-soil impoundments, and bottomland hardwood forests that create a habitat mosaic that provides excellent cover and forage for deer and other wildlife. Prior to refuge acquisition, much of the hardwood forest was actively logged for timber production, especially the portion formerly owned by the Potlatch Corporation. These harvested areas provided abundant food and cover for deer. Similarly, habitat management activities implemented for trust species, particularly forest management activities, will coincidentally increase the quality and quantity of deer habitat.

Strategies:

- Continue to collect biological harvest data during the refuge Quota Gun Deer Hunt and other hunts if feasible, in order to collect sufficient data to make inferences about the deer population.
- Determine herd condition/densities relative to carrying capacity by analyzing harvest data and interpretation of density-dependent factors, such as age-specific weights, antler characteristics, and reproduction.
- Determine age structure and buck:doe ratio of deer population by analyzing and interpreting harvest data.
- Determine current herd condition/densities relative to carrying capacity and past disease history every 5 years through herd health checks conducted and analyzed by SCWDS.
- Set harvest objectives, monitor harvest and population trends, and then adjust harvests based on data in concert with AGFC to meet deer herd objectives.
- Use public hunting as the management tool to meet herd objectives.

Cache River NWR Objective 1-11: Furbearers

Maintain healthy populations of furbearers consistent with habitat and population management objectives for trust species, and control nuisance animals when necessary.

Discussion: Raccoon, mink, muskrat, opossum, coyote, bobcat, beaver, nutria, river otter, red fox, gray fox, and striped skunk appear to be common on the refuge. Raccoons are well-adapted to all existing habitats, and opossum, coyote, foxes, and bobcat are more associated with drier forests and afforestation sites. Muskrat, river otter, beaver, and mink are associated with the more permanently inundated wetlands and bayous. Little data are available to provide formal population estimates for these species; however, general observations indicate that beaver and raccoon numbers have increased in recent years. These two species are of particular concern because of their potential to significantly impact habitat and other wildlife species. Raccoons have the potential to negatively impact nesting birds and carry infectious diseases, such as distemper and rabies. Flooding problems and associated negative habitat impacts resulting from beaver damming activities and damage to culverts, water control structures, levees, and roads are common. Numerous man-days and resources are expended dealing with these problems.

Strategies:

- Monitor population trends of terrestrial and semi-aquatic furbearer species and monitor damage to infrastructure, habitat, and other wildlife and take necessary action to prevent and control such damage.
- Continue to control, through trapping and dispatching, nuisance animals and their associated negative impacts to wildlife and habitats and remove beaver dams as necessary to protect refuge and adjacent private property and habitat.
- Consider opening the refuge to fur trapping by permitted individuals or to the general public (according to state regulations and under a special use permit) to reduce and prevent damage to habitat and infrastructure, disease outbreaks, predation on nesting birds, and increasing cost of nuisance animal control.

Cache River NWR Objective 1-12: Small Game (Mammals)

Provide and enhance habitats for small game mammal species, incidental to habitat management practices for trust species, and provide for quality recreational opportunities.

Discussion: Gray and fox squirrels are abundant on the refuge where suitable, mast-producing forested habitat is available. Although they share habitats to some degree, gray squirrels are most common in deep woods, whereas fox squirrels prefer small woodlots and the edges of larger forested tracts. Their high recruitment rates (controlled largely by levels of available hard mast), high natural mortality rates, and other population processes indicate that no significant long-term changes in squirrel population densities are expected to occur in available habitat. Squirrel hunting is popular during the fall and winter and harvests are probably fairly high, but given the reproductive ability of this species, the harvest does not appear to negatively affect the population. Forest management activities enhance habitat quality for most species of small mammals, including squirrels.

Cottontail rabbits and swamp rabbits are relatively common and are hunted in late winter. Their numbers are largely controlled by habitat availability. The rabbit population is usually higher in and around afforestation sites. Similar to squirrels, the reproductive potential of rabbits is much higher than potential harvest and thus hunting is believed to be compensatory to other causes of mortality.

Strategies:

- Implement forest and open land management activities designed to benefit trust species that incidentally create and improve small game habitat.
- Continue to allow small game hunting.

Cache River NWR Objective 1-13: Black Bears

Provide and enhance habitats, incidental to habitat management practices for trust species, to promote use by black bears for foraging, denning, and resting.

Discussion: Bears were once common in the Cache/Lower White Rivers system before large blocks of forest were cleared for farming and other purposes. By the early 1900s, black bears had been virtually eliminated from Arkansas except for a very small population that survived in the most remote portion of the lower White River. As a result of protection afforded by the refuge and state hunting regulations, black bear numbers increased significantly on the lower White River NWR and surrounding forested areas to the point that hunting was allowed for this species on private lands surrounding the White River NWR beginning around 2000.

Black bears are sighted on or near Cache River NWR several times a year. Sightings are probably transient adult males or dispersing juvenile males searching for unoccupied territory. Female bears, which are necessary for population expansions in an area, are not thought to occur on the refuge, with the possible exception of the large, forested Biscoe Tract on the southern end. Bears use large contiguous tracts of diverse and mature bottomland forests that can be interspersed with farmland and reforested areas to obtain their foraging, cover, and denning needs. As contiguous blocks of forests expand in size and number due to land conservation and afforestation, forests mature to hard mast-producing conditions, and existing forest blocks receive forest improvement treatments, bear numbers could increase on the refuge through natural bear dispersal. Additionally, populations could be augmented through repatriation or colonization.

Bear hair-snare surveys were conducted during the summers of 2007 and 2008 in the Biscoe area by refuge personnel, in cooperation with the AGFC, in an attempt to determine bear occurrence and sex ratios. Records of all bear sightings reported to the refuge office over the last 5 to 10 years have been maintained.

Strategies:

- Continue to conduct hair snare surveys to determine bear occurrence, densities, and monitor trends; expand surveys to entire refuge if warranted.
- Record and map all bear sightings.
- Consider bear habitat needs such as hard and soft mast, escape cover such as cane thickets, and den trees when conducting forest and open land management activities.
- Create large contiguous forest blocks through land acquisition and afforestation, whenever feasible.
- Monitor suitability of habitat for bears through existing forest inventory data and aerial photos.
- Coordinate bear management activities with AGFC.
- Consider bear repatriation in suitable habitat in unoccupied areas if appropriate.

Cache River NWR Objective 1-14: Bats

Provide and enhance habitats, incidental to habitat management practices for trust species, to support use by various bat species.

Discussion: Several species of bats are thought to occur on the refuge, although no research or inventories on bats have been conducted. However, eight species of bats, including the Rafinesque's big-eared bat, were collected on the adjacent Rex Hancock/Black Swamp WMA during a research/monitoring project in the 1990s. Before management actions for the benefit of bats can be planned, a basic assessment of which species use the refuge needs to be conducted. Surveying for all species of bats on the refuge would be logistically time consuming and expensive. Other alternatives, such as literature searches, would help initiate a species list. Target species or species of concern could then be focused on for more intensive monitoring or research.

Strategies:

- Research the literature including range maps for species that should occur in east-central Arkansas.
- Conduct annual mist net surveys in different habitats throughout the refuge, with assistance from universities and volunteers.
- Maintain or improve bat habitats such as roosting, maternal, or feeding areas incidental to forest management activities for trust species.

Cache River NWR Objective 1-15: Reptiles and Amphibians

Continue to provide and enhance habitats, incidental to habitat management practices for trust species, to support a diverse assemblage of reptile and amphibian species.

Discussion: Amphibian conservation and management are of great interest to conservationists due to global declines. Habitat loss, fragmentation, and degradation appear to be the primary factors influencing declines. This group of animals requires quality wetland habitat for its survival and it also serves as important indicators of environmental health. Reptiles and amphibians are in decline across the southeastern United States, due mostly to direct loss of habitat and adverse modification of habitat. The White/Cache Rivers watershed is a highly modified system as the result of extensive drainage, flood control, and clearing of forested lands for agriculture. These changes in habitat structure and hydrology have, without a doubt, similarly affected the historic distribution and populations of reptiles and amphibians. As such, Cache River NWR plays an important role in conserving remnant habitat, as well as in restoring habitat and ecological functions for reptiles and amphibians in a largely agricultural landscape. The floodplain forests, sloughs, brakes, and isolated wetland habitats of the refuge are suitable for numerous species of reptiles and amphibians. No herpetological population or occurrence surveys have been conducted to date on refuge lands. The riverine, floodplain forest, and isolated wetland habitats of Cache River NWR are suitable for numerous species of reptiles and amphibians. Many species of snakes, lizards, frogs, toads, salamanders, and turtles occupy the refuge. A 1985 species list (species known or expected to occur) for the adjacent White River NWR included 47 species of reptiles and 20 species of amphibians, lending perspective to the presumed diversity of herpetological resources of Cache River NWR. Also, reptiles and amphibians were surveyed by University of Arkansas at Monticello (UAM) personnel in the mid- and late-1980s on Rex Hancock/Black Swamp WMA and lands purchased for the refuge, as part of an overall research project of the Waterways Experiment Station in Vicksburg, Mississippi. Of the species potentially occurring on Cache River NWR, two species (mole

salamander and western chicken turtle) have been recognized as Species of Greater Conservation Need by the State of Arkansas (Arkansas State Wildlife Action Plan 2006).

Cache River NWR has participated in the Service's Abnormal Amphibian Study to document amphibian abnormalities in refuge populations. This 3-year sampling period was initiated in 2006 by the refuge biologist. The survey has not yet indicated any problems on the refuge.

Strategies:

- Coordinate with partners (e.g., AGFC, universities, USGS) to conduct reptile and amphibian surveys, in various habitat types across the refuge.
- Restore and maintain habitat connectivity to allow reptiles and amphibians unrestricted movement among habitats, thus ensuring that life cycle and resource needs are met.
- Restore and maintain health of wetland and terrestrial ecosystems and associated hydrologic function.

Cache River NWR Objective 1-16: Fisheries, Mussels, and Aquatic Habitat Management

Continue to provide and enhance riverine and floodplain aquatic habitats, and monitor fish and freshwater mussel occurrence and abundance.

Discussion: Flowing rivers and bayous, such as the White River, Cache River, and Bayou DeView, represent one form of permanent aquatic habitat on Cache River NWR. Abandoned channel scars in the form of open-water oxbow lakes or forested brakes provide most of the permanent lentic habitats. Many of these habitats are seasonally connected to rivers during flood events. The frequency and duration of connection is dependent on flood stages and the elevation of lakes. There are also a small number of man-made ponds and borrow pits. During large flood events, a major portion of the bottomland hardwood habitats found throughout the refuge serve as temporary habitats for many aquatic species. Many fishes use the flooded forests, sloughs, and lakes for spawning and/or nursery habitat. Fishes and freshwater mussels occupy rivers, bayous, and deep lakes on the refuge throughout the year.

The aquatic habitats within Cache River NWR support a large diversity of species. Some species popular with anglers include white crappie, black crappie, largemouth bass, spotted bass, bluegill, flathead catfish, and blue catfish. Many non-game and commercial fishes are also found in the various habitats of the refuge. At least 50 fish species are documented from the Cache River, Bayou DeView, and associated backwaters (Mauney and Harp 1979; Killgore and Baker 1996). Twenty-nine species of larval fish were detected in the forested floodplain of the Cache River (Killgore and Baker 1996). Limited data exist to document occurrence of both adult and larval forms of fish species within refuge waters. It is likely that many species occur as larvae, juveniles, and adults.

Freshwater mussels are found throughout the refuge in flowing waters and to a lesser degree in permanent backwater sloughs and lakes. Specific information on the abundance, species richness, and distribution of mussels within the refuge is limited mostly to studies of the Cache River. Christian *et al.* (2005) surveyed the lower 42 miles of the Cache River and documented 26 species. Other authors previously documented an additional 13 species for a total of 39 known species (Wheeler 1914; Gordon *et al.* 1980; Ecological Consultants 1983; Jenkinson and Ahlstedt 1988). In 2007, the Service's Arkansas Field Office documented the presence of 20 species of mussels in Bayou DeView from Jackson County downstream to the confluence with the Cache River. There are no comprehensive studies characterizing the mussels of other tributaries of the Cache River or floodplain lakes.

Strategies:

- Work with partners to gather baseline data and conduct investigations on fish and mussel populations within the refuge.
- Continue to reforest cleared land in the floodplain to provide more complex cover and forage opportunities for larval, juvenile, and adult fishes that use the floodplain during flood events.
- Restore connectivity between rivers and floodplain lakes and/or forests through the following actions:
 - Remove or breach the levee along Jackson Bayou in the George Tract;
 - Remove the levee at the former Bayou DeView Ltd Tract near Bulltown on Highway 260;
 - Remove or breach the levee within the waterfowl sanctuary near Highway 145;
 - Remove the levee at the Jackson Tract;
 - Remove debris from the slough connecting Old River Lake to the White River.
- Attempt to acquire the small strip of private land that currently prevents land access to Slaughter's Lake (only if landowners are willing sellers).
- Participate in the planning of restoration and water development projects or regulatory actions that may affect fisheries and mussel resources within the Cache River NWR.
- Coordinate with the ANRC and other agencies, such as AGFC, NRCS, and COE, to establish minimum flows and/or establish flow allocations for Cache River and Bayou DeView.
- Participate in the development of the COE Section 1135 restoration project to redirect flows into historic channel meanders along the channelized lower seven miles of the Cache River.
- Continue to alert the COE about expected negative impacts to the hydrology of the lower White/Cache River ecosystem associated with the proposed White River navigation improvement project.
- Continue to coordinate with the Service's Ecological Services Office and the COE regarding planning for the removal of a blockage on the Cache River near Grubbs.

Cache River NWR Objective 1-17: Endangered Species and Species of Concern

Continue to support the protection and enhancement of endangered species through research, survey, recovery, conservation, and management programs.

Discussion: During the winter, Bald Eagles commonly use Cache River NWR. They are often seen in open areas or near bodies of water searching for prey. Eagles frequently congregate near large waterfowl concentrations during the fall and winter months. Additionally, Arkansas does have a breeding Bald Eagle population. In the past 5 years, two pairs of eagles have nested near Rainbow Lake and near Opossum Creek and both nests were successful.

Although Bald Eagles were recently removed from the endangered species list, they are still protected by the Bald and Golden Eagle Protection Act. Continued protection of Bald Eagles and monitoring to determine any potential breeding attempts is essential. The Service will continue to work with the AGFC for at least 5 years to monitor breeding. The refuge should encourage the public to report Bald Eagle nests and follow up on reports in conjunction with state agency biologists. If a nesting attempt occurs, appropriate buffer zones should be implemented to prevent any disturbance to the nesting pair. Nest monitoring to determine success of the nest will also be important.

Neither the Least Tern nor the Piping Plover has been documented on Cache River NWR, but it is likely that these two species use the refuge during spring and fall migration for a stopover site. The Wood Stork, which is not federally listed in Arkansas but is a species of concern, has been observed more frequently in recent years on the refuge during the spring and fall. Many high priority shorebird species move through the MAV during the spring and fall migration periods. They are particularly limited by foraging opportunities at mudflats during the fall migration from August to October. Availability of shallow water sites is low because much of this habitat is in cropland during this time. Improving water control and provision of shallow water impoundments on newly acquired WRP sites or sites being taken out of agricultural production and put into impoundments would benefit these two species and a number of other shorebird and wading bird species.

Several endangered mussel species occur in Arkansas and although none have been documented on the refuge, it is possible that they do occur here. The pink mucket, fat pocketbook, and scaleshell occur on the White River. Two major threats to mussel species include sedimentation and chemical runoff from agriculture. Sedimentation is caused by a number of sources including agricultural runoff, headcutting in fields and drainage tributaries, stream bank erosion, and stream channel instability and degradation. A wide variety of chemicals are used in modern agriculture in Arkansas, including pesticides, herbicides, defoliants, and fertilizers. Some of these chemicals are detrimental to fish and wildlife when they accumulate in streams and water bodies. Malacologists generally agree that contaminants are partially responsible for the decline of freshwater mussels.

Limited mussel surveys have been conducted on the Cache River NWR. Additional mussel surveys would provide baseline data on species occurrence and abundance and evaluation of how current land and management practices on the refuge might be impacting these species. Continued reforestation on the refuge will decrease fragmentation and potentially reduce sedimentation in water bodies occurring from agriculture and stream bank erosion.

Strategies:

- Continue to monitor Bald Eagle use of the refuge and implement appropriate protective measures during the nesting season when active nests are found.
- When Least Terns, Piping Plovers, or Wood Storks are observed on the refuge, note the conditions of the habitat being used and determine if this condition can be replicated in the future, while ensuring actions focusing on other refuge priorities are accomplished.
- Conduct surveys for listed mussel species in potentially suitable habitat, such as at Bayou DeView. If such species are found, note the condition of the habitat being used, determine if similar conditions occur elsewhere on the refuge, and in conjunction with AGFC, ensure appropriate protective measures are implemented.

Cache River NWR Objective 1-18: Ivory-billed Woodpecker

Continue to encourage organized searches for Ivory-billed Woodpeckers and implement appropriate protective measures and consultation when conducting management activities or in the event of discovering an active nest or roost tree.

Discussion: Ivory-billed Woodpeckers (IBWO) once inhabited forested habitats throughout the southeastern United States and Cuba. Although there are little specific population data available, it is likely that European settlement and forest clearing caused the species to decline in the second half of the 19th century. By the mid-20th century, the IBWO was reduced to a very small population at the Tensas River in Louisiana, where the last widely accepted IBWO sightings occurred in 1944. Since

that time there have been numerous unsubstantiated sightings throughout the historic range of the species. Many of these sightings seemed highly credible but lacked hard evidence.

In February 2004, Cornell Lab of Ornithology biologists became aware of a credible sighting of the IBWO on a portion of Bayou DeView, which is located on Cache River NWR. Subsequently, Cornell biologists and their partners documented the presence of at least one IBWO in that area. Sixteen sightings of the IBWO were reported deep within the cypress-tupelo swamp of the Bayou DeView in 2006.

Rediscovery of the IBWO in 2004 on the Cache River NWR was announced in 2005. The larger area of the Big Woods of Arkansas includes several national wildlife refuges and state wildlife management areas that are considered to have potential habitat for this species. Additionally, efforts to educate the public on the IBWO and document any potential reports of sightings are recommended.

Cornell University researchers, with assistance from personnel from TNC, AGFC, Audubon Arkansas, USFWS, and volunteers, have been searching the Big Woods of Arkansas, including the Cache River NWR, for the last several years. There have been many reported sightings, interesting audio, and other supporting data, but no additional video or still pictures have been recently recorded. The refuge has been supporting the search team. The refuge forester and wildlife biologist have been conducting IBWO habitat inventory and forest assessment to determine potential habitat.

The IBWO relies upon large forested blocks that produce sustainable amounts of forage and habitat. Key to the species occurrence is an ample food source of large beetles (e.g., cerambycids, buprestids) and larva found in recently dead and dying wood. The IBWO is the initial predator on insects that attack stressed trees and dying trees within the first few years of decay. Another element of habitat crucial to IBWO is a relatively high density of large trees. Large trees supply roosting and perching habitat, and an element of senescence that promotes development of a food source.

The IBWO relies on vegetable matter for a portion of its diet, so it is also dependent on habitats that are open to sunlight and produce soft mast. In his studies at Louisiana's Tensas River in the late 1930s, James Tanner estimated that the minimum area necessary for an IBWO pair under ideal habitat conditions was approximately 2.5 to 3 square miles (Tanner 1942), or 1,600 to 1,920 acres. This could range much higher under less desirable habitat conditions, even up to 17 square miles.

Tanner's study supports the thesis that the IBWO is dependent on large forest blocks with elements of stress or senescence. The decline in hardwood forest acreage in the MAV has had a direct adverse impact on the IBWO. Historically, the MAV contained over 24 million acres of nearly contiguous hardwood forest, but now only 8 million acres remain, approximately 600,000 acres of which occur in Arkansas. The pre-settlement forest was subject to natural disturbance from ice storms, hurricanes, tornadoes, drought, and fire, all of which maintained a sporadic cycle of stress and insect infestation, and therefore a potential food source for the IBWO.

Currently, the remaining MAV forest is heavily fragmented and primarily concentrated along large riparian corridors, so now the natural disturbance factors impacting the MAV seldom impact large amounts of forest, and these remaining forest blocks are universally relied upon more heavily by all forest-dependent wildlife. The forest's structure and composition, more so than its age class, are important factors to these species and the IBWO. While some relic baldcypress and tupelo may be as old as several hundred years, the vast majority of MAV hardwoods may live less than 150 years, and will exhibit old age class characteristics in as little as 80 years. The Cache River NWR area is very productive with an average 10-year-diameter growth rate of 3.6 inches. The flooding regime and weather patterns are such that down wood rots quickly and the occurrence of fungi is prevalent. The site conditions of the Cache River area lend themselves to the production of diverse, verdant forest.

Potentially, several forest blocks within Cache River NWR are suitable or with active management can be enhanced to develop suitable conditions for the IBWO. Forest management at Cache River NWR has followed the guidelines of the Forest Habitat Management Plan (FHMP) and has been actively improving habitat for threatened and endangered species, migratory waterfowl, migratory birds, and other resident wildlife for several years.

The FHMP directed retention of large trees, cavity trees, and other trees that provide amenities to wildlife. The physical application of a treatment also results in some senescence when trees are damaged (e.g., tops broken, boles damaged, limbs broken). However, to additionally supplement the potential food source for the IBWO, other techniques could also be employed. When there is a need for increased IBWO foraging habitat, normal habitat treatments should be used to incorporate the improvements when possible. When stand inventories indicate a deficiency in senescence, some marked trees can be designated to be killed or damaged, instead of logged, as a condition of the sale. The number of supplemental "damaged" trees will be limited and directed towards meeting suggested IBWO foraging needs as developed through ongoing research. The number of supplemental damaged trees should not be applied to the point that it presents a hindrance to market, and thus precludes the treatment overall. Commercial sales should be a suitable means to accomplish this as is the case with most large-scale refuge habitat improvements. Non-commercial treatments of this nature bring about many questions of sustainability and are problematic in terms of funding.

There are numerous ongoing studies and efforts to better understand the IBWO and its habitat needs, necessitating flexibility of management techniques within the FHMP to adapt to new information. Foremost of the pending documents is the Recovery Plan for the IBWO, the draft of which was released in August 2007 (USFWS 2007b). Several members of the refuge staff are actively involved on the Recovery Team. Cache River NWR adapted forest management techniques as appropriate based on recommendations from the Recovery Team.

Strategies:

- Continue to actively participate in IBWO partnerships that include natural resources agencies, the Cornell Lab of Ornithology, and non-governmental organizations to continue searches for the IBWO in likely habitats.
- In the event of discovering a roost or nest cavity, refuge personnel will maintain an essential role of participating in planning and managing the response to such a discovery. Immediately begin consultation with appropriate federal and state endangered species biologists to implement appropriate protective and monitoring measures.
- Ensure appropriate protection measures for IBWO when conducting management activities on the refuge.
- Implement forest management actions that add forest structure and retain snags and many larger trees, in accordance with the Desired Forest Conditions standards at a minimum, and exceed these standards where consistent with other objectives.
- Assist with outreach and education efforts as feasible.
- Continue to participate in the Corridor of Hope Team and develop and distribute educational information regarding the IBWO and bottomland hardwood forests.

Cache River NWR Objective 1-19: Wildlife Investigations, Inventorying, and Monitoring

Within 5 years of the date of this CCP, prepare and implement an Inventory and Monitoring Plan (IMP) that will improve and expand investigations, inventorying, and monitoring of the refuge's fauna to obtain sufficient baseline data to inform management decisions, determine if management objectives are met, and enable adaptive management.

Discussion: The Improvement Act formally establishes the necessity of monitoring the status and trends of fish, wildlife, and plants on national wildlife refuges. Service policy is to collect baseline information on key plants, fish, and wildlife to monitor, as resources permit, critical parameters and trends of selected species and species groups on and around Service units, and to base management on biologically and statistically sound data derived from such inventorying and monitoring (701 FW 2, Inventorying and Monitoring of Populations).

Monitoring, inventorying, and surveying (MIS) are very important means for scientifically managing trust wildlife populations and habitat, as well as meeting national, regional, and refuge goals. Before any MIS is started, the surveyor should seriously and honestly determine if: (1) Objectives, which are clear, specific, and measurable, are defined and can be practically met; (2) the results will actually be used to benefit the resource or make informed decisions; (3) quality and quantity of data needed to meet the objectives can be collected; (4) the MIS methodology is scientifically and statistically sound; (5) the costs of conducting the MIS are worth the results; (6) resources are available or will become available to complete the MIS; (7) the method of data analysis is pre-determined; and (8) MIS is prioritized so if resources become limited then more critical MIS will be conducted.

Adaptive management is a system used by refuge managers to improve results by documenting management actions, measuring and documenting biological responses, and adapting (modifying) management actions to improve desired conditions/outcomes and determine if objectives have been met. Baseline inventorying and population monitoring at regular intervals provide data essential for informed decision-making by refuge managers and are fundamental for adaptive management. Inventorying and monitoring needs can often be met with the assistance of other Service programs and cooperative efforts with state resource agencies, universities, and USGS. Proper attention must be given to experimental and monitoring design, statistical procedure, and consistency in observation and data collection.

The priority for monitoring will be directed toward obtaining baseline wildlife inventory data and monitoring trust species of special concern, such as Ivory-billed Woodpecker, King Rail, Prothonotary Warbler, Swainson's Warbler, American Woodcock, and Least Bittern. High-priority wildlife surveys include wintering waterfowl counts, waterfowl and shorebird response to moist-soil management treatments, and forest breeding bird response to forest treatments. Other valuable surveys and assessments include those conducted for secretive marshbirds, woodcock, reptiles and amphibians, bats, turkeys, black bears, furbearers, and white-tailed deer.

Strategies:

- Increase capability to conduct wildlife investigations, inventories, and monitoring by recruiting a biological technician for Cache River NWR and an ecologist and hydrologist for the Central Arkansas NWR Complex.
- Collect inventorying and monitoring data that contribute to assessment and decision-making regarding refuge wildlife management and facilitate adaptive management.
- Continue to coordinate with partners and universities, USGS, and others to conduct research, monitoring, and inventorying of wildlife resources on the refuge.

-
- Implement inventorying, surveying, and monitoring efforts for refuge wildlife resources according to the following relative priority:
 - High – wintering waterfowl use, grassland and forest breeding birds, shorebirds;
 - Medium – woodcock, secretive marshbirds, abnormal amphibians, black bear, wading birds, white-tailed deer;
 - Low – turkeys, reptiles and amphibians, bats.
 - Strive to develop data sets that are statistically robust so that analysis of monitoring results can be more useful in determining adaptive management responses if objectives are not being accomplished.
 - Maintain adequate records of inventory and survey data in EXCEL, ACCESS, Arc-GIS or other databases so that data can easily be retrieved, compiled, and statistically analyzed, when possible, with software such as SYSTAT.
 - Record survey activities and results in annual narratives or annual survey plans.
 - Recruit assistance with wildlife inventorying and monitoring projects from volunteers, such as interns, retirees, and/or skilled volunteers from universities or conservation organizations (e.g., Arkansas Audubon), when time, personnel, and expertise are lacking at the refuge.
 - In order to recruit the best volunteers and interns, provide suitable refuge housing, if possible.
 - Use Adaptive Management, subject to resources and technical restraints.
 - Coordinate with AGFC, USGS, COE, NRCS, and other organizations to design and conduct research that will provide refuge managers with information needed to improve wildlife management programs to better fulfill refuge purposes.

HABITAT MANAGEMENT

Cache River NWR Goal 2: Protect, restore, and manage the functions and values associated with diverse bottomland hardwood forests and open wetland systems in order to achieve refuge purposes, wildlife population objectives, and to benefit migratory waterfowl and other native wildlife.

Discussion: The first three goals for the LMRE, in which Cache River NWR is located, relate to conservation of habitats on behalf of wildlife:

1. Conserve, enhance, protect, and monitor migratory bird populations and their habitats in the LMRE.
2. Protect, restore, and manage the wetlands of the LMRE.
3. Protect and/or restore imperiled habitats and viable populations of all endangered, threatened, and candidate species and species of concern in the LMRE.

Cache River NWR Objective 2-1: Moist-Soil Habitat Management

Expand the current level of managed moist-soil habitat to annually provide 500 acres and increase production of desired moist-soil plants (e.g., wild millet, annual smartweed, sedges, panic grass) to > 500 pounds of seed/acre or 50 percent coverage that will provide approximately 934,000 DEDs of waterfowl foraging habitat and meet the LMVJV forage objectives.

Discussion: While the high seed production of moist-soil plants and their value as waterfowl foods have been known since at least the 1940s (Low and Bellrose 1944), managing seasonally flooded herbaceous wetland impoundments (moist-soil units) only became a widely accepted practice after many years of research in southeastern Missouri (Fredrickson and Taylor 1982, Fredrickson 1996).

Although geese sometimes use moist-soil impoundments and consume shoots of germinating plants, rhizomes, roots, or tubers, the primary emphasis of moist-soil management is to produce seeds that will provide food for ducks. Most research has focused on estimating seed production. Studies have shown that under intensive management species of barnyard grass (*Echinochloa* spp.), sprangletop (*Leptochloa* spp.), flatsedge (*Cyperus* spp.), smartweed (*Polygonum* spp.), and panicum (*Panicum* spp.) can produce more than 1,000 pounds of seed per acre (Fredrickson and Taylor 1982). However, we know far less about production that might be occurring under current conditions in the LMV. Reinecke et al. (1989) used an estimate of 400 pounds per acre of moist-soil seeds to derive an average value of about 1,386 DEDs per acre for moist-soil units.

More recently, the LMVJV Waterfowl Working Group used available moist-soil seed estimates of nearly 500 pounds per acre reported by Kross (2006) to calculate an increased value of 1,868 DEDs per acre for this habitat. Regardless of the quantity of seed produced, moist-soil impoundments are highly recommended as a means of diversifying habitat (Fredrickson and Taylor 1982; Reinecke et al. 1989) and supplying food with nutrients not generally available in agricultural grains. Moist-soil management is best conducted in impoundments that have water control structures, are relatively flat, and have an adjacent well that can be used for irrigation and/or fall flooding. Eight to ten impoundments on the refuge totaling almost 500 acres possess such characteristics. The recently distributed *Moist-Soil Management Guidelines for the U.S. Fish and Wildlife Service, Southeast Region* (Strader and Stinson 2005) should be used as a guide to manage and evaluate the refuge's moist-soil management program.

Suitable habitat for shorebirds, waterfowl, and marshbirds can be provided over time by staggering the treatment rotation among the existing moist-soil units. For example, a unit that is disked will provide mudflats for shorebirds during that first year, annual grasses and sedges for waterfowl during years two and three and perennial vegetation for marsh birds during years four and five, at which time this unit could then be treated again to set back succession. In order to set back succession, woody vegetation cannot be allowed to grow to a point where it could not be controlled by disking, or spraying.

The timing of drawdowns in waterfowl impoundments on Cache River NWR to propagate moist-soil plants have ranged from mid-March, for annual smartweed production, to late-June to maximize barnyard grass production. Drawdown dates are generally dependent on habitat objectives, adjacent impoundment habitat objectives, and the amount of water in adjacent drainage ditches. Disking, flooding, mowing, herbiciding, and rotating with Japanese millet or agriculture crops are common practices used when nuisance plants comprise > 50 percent estimated cover and moist-soil plant production is \leq 500 pounds per acre.

Strategies:

- Consult the *Moist-Soil Management Guidelines for the U.S. Fish and Wildlife Service, Southeast Region* manual for recommendations for management and evaluation of the refuge's moist-soil management program.
- Actively manage selected impoundments for moist-soil habitat on Howell, Revel, and Dark Corner WRP tracts and Dixie and Plunkett Farm Units.
- Acquire additional resources needed to manage these moist-soil units, including staff, installation of wells and gear-heads, power units, diesel fuel, water control structures, and a wide, heavy-duty disk.

-
- During the growing season, complete drawdowns, control beavers, conduct bi-weekly monitoring of vegetation to determine if treatment actions are needed, perform necessary treatments such as disking, herbiciding, fertilizing, or flooding as necessary to control nuisance plants, and produce ≥ 50 percent coverage of moist-soil plants or > 500 pounds of seeds per acre.
 - Quantitatively record moist-soil management activities and associated plant responses in terms of desirable seed production and percent coverage of moist-soil plants; use these results to fine tune management activities (i.e., adaptive management).

Cache River NWR Objective 2-2: Forest Management

Enhance the hardwood forestland complex to attain the desired forest conditions as described in the report *Forest Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat (2007)*, as appropriate to fulfill refuge purposes.

Discussion: The Comprehensive Management Plan (CMP) for the Cache River and White River National Wildlife Refuges within the Cache/Lower White Rivers Ecosystem, approved in 1994, set the stage for managing these refuges as an ecosystem. The subsequent 2001 Forest Habitat Management Plan (FHMP) for Cache River and Bald Knob National Wildlife Refuges established the following forest habitat management objectives in order to achieve refuge purposes:

1. To protect, enhance, and restore critical forest habitats for threatened and endangered species of plants and animals indigenous to the refuge.
2. To protect, enhance, and restore hardwood forest habitat for migratory waterfowl use.
3. To protect, enhance, and restore a site-appropriate, diverse range of hardwood forest habitat for migratory and resident birds.
4. To protect, enhance, and restore hardwood forest habitats with adequate cavity densities, mast-producing components, and structure for other forest-dependent wildlife.
5. To provide compatible opportunities for wildlife-dependent recreation, environmental education, and forestry and wildlife research.

The first habitat inventory of Cache River NWR began in 2000, to develop baseline information for the FHMP. In order to inventory habitat types, the refuge was compartmentalized and 5 of these 20 compartments were selected for habitat inventory based on the diversity contained therein that represented the range of habitats occurring on the refuge.

In the coming years the remaining compartments will be inventoried in a similar manner. All compartments will be inventoried on a 10-year cycle, thus providing a continuous habitat inventory that can be used to track changes in habitat over time. These original inventories were taken through the Continuous Forest Inventory (CFI) survey process and provide the basis for much of the descriptions that follow. Additional inventories have since been taken. A 15-year evaluation/prescription cycle was proposed in the FHMP and several of the compartments have received an evaluation/prescription inventory. Additionally, in 2005 and 2006, there was an extensive inventory of habitat characteristics associated with occupation and use by the Ivory-billed Woodpecker. These latter inventories refined the results of the CFI. The descriptions that follow utilize information from all of the surveys to provide an overall picture of the forest types on the refuge.

Inventory results indicate that there is a wide diversity of habitats in the forestlands of Cache River NWR, but areas can generally be divided into seven categories:

1. Forestlands with no recent silvicultural manipulation [Retention] – 5,967 acres of retention forests occur on six compartments. These forestlands vary greatly from the other management categories. Overstory species composition tends to be dominated by shade intolerant species; however, lower canopy and understory species composition favor more shade tolerant species. Regeneration is severely limited to shade tolerant shrubs and a few trees. Average height of tree crowns is 10 percent greater than that of the comparison areas. Visible cavities are relatively few per acre, as are hollow trees, and woody debris levels are less than one-tenth of those recorded on comparison areas.
2. Forestlands previously managed for timber production [Timber Production] – 16,958 acres of timber production forests occur on nine compartments. Forestlands that were previously managed for timber production exhibit different characteristics. These stands were managed for the short-term production of red oak. Overstory species composition is dominated by shade tolerant species: sugarberry and green ash, and some intolerant species, overcup oak and a few red oaks. Lower canopies are of similar composition. However, understories contain a significant amount of red oak and overcup oak regeneration. While this area exhibits the least amount of hollow trees, it contains trees with the most visible cavities (mostly in sugarberry, perhaps a species specific tendency) almost four times as many as in forestlands with no manipulation.
3. Forestlands utilized for timber revenue [Revenue] – 11,979 acres of revenue forests occur on 13 compartments. These uneven-aged forestlands were generally never managed under a professional forestry plan and, consequently, severe disturbances to habitat were introduced, resulting in yet another set of distinct conditions. A mix of sweetgum, red oak, and red maple dominate overstories. The lower canopies and the understories are diverse in species composition, but the regeneration in particular contains far less than half of the number of red oak stems that is present in the area managed for timber production. This area contains ten times the amount of hollow trees as the other areas. Also, snags comprise 20 percent of the basal area. Ground cover vegetation is dominated by miscellaneous herbs, sedges, and grasses instead of the poison ivy, trumpet creeper, and red vine that are found to dominate the comparison areas.
4. Swamps, primary composition of Baldcypress/Tupelo with no recent silvicultural manipulation [Swamp] – 4,468 acres of swamp forests occur on four compartments. Extensive swamplands warrant a separate condition more because of stand characteristics than past management. These stands have all been logged in the past, generally during the period from 1920 to 1940, and then again from 1960 to 1970. Logging was extensive and removed a large amount of old growth baldcypress; however, some baldcypress were left either because of size, infeasibility of logging, or poor grade. The cutover swamps responded with regeneration and release of tupelo stands beneath the residual trees. Currently, the swamps have a closed canopy with a basal area and stems per acre that averages almost twice that of comparison hardwood stands. The understory and midstories are diminished because of the dense overstory and standing water; shade intolerant regeneration is only around one percent. Swamps far exceed the other stands in amount of cavities, coarse woody debris, and standing dead tree volume.

-
5. Croplands now restored under refuge ownership [Reforestation] – 15,524 acres of former cropland undergoing reforestation occur on 14 compartments. This was marginal cropland being restored or reverting to forest or young hardwood plantation. After several decades of development, these habitats will be comparable to mature bottomland hardwood forests, but for now these stands are in the early stages of natural succession and therefore yield different habitat contributions than the mature forest. Long-term goals are to develop the stands into a diverse, mature forest. Mixes of suitable hardwood species were planted to fulfill objectives of site appropriate species diversity. In some cases where significant natural regeneration is present or adjacent seed sources abundant, active restoration was forgone to allow natural regeneration to take its course. Future restoration projects will concentrate on restoring new acquisitions, or other marginal cropland as determined by the forestry staff and refuge manager.
 6. Small, linear, or irregular patches of forestland adjacent to streams, sloughs, etc. including the streams themselves, roads, and other Rights-of-Way [Riparian/Other] – 5,032 acres of riparian/rights-of-way forest occur in all 20 compartments of the refuge. The riparian and other portions of the forestland are not considered stands by themselves, and while inventories have recorded data from the riparian areas, the data have not been analyzed. These areas are important because of their position in the landscape, and will be managed in concert with the larger stands that contain them. Some of these areas are large and may receive silvicultural treatment if justified, while active management may never be desirable in other areas, or is inoperable for various reasons.
 7. Lakes and other bodies of water completely open or containing only scattered trees [Open Water] – 1,010 acres of open water occur in 17 compartments. There are 87 bodies of water scattered throughout Cache River NWR. These are an integral part of the forest landscape for management considerations.

Each of the above forestland types contains desirable qualities and contributes to the forest complex. Through management prescribed in the FHMP, desirable qualities can be introduced in stands where they are lacking, and enhanced or maintained in stands where they are already present to some degree. From the FHMP, desirable qualities are:

- desirable vertical structure and levels of canopy openings,
- site appropriate species diversity,
- a sustainable proportion of desirable species in various developmental stages,
- a significant proportion of large trees with full crowns, and
- adequate numbers of cavities as well as cavity-producing trees.

It is necessary for forest managers to work with wildlife biologists to study the refuge and surrounding forests comprehensively, and then manage for appropriate target species for each block. Current research, literature review, and basic habitat modeling are essential to fully understanding the habitat needs of target species.

In order to accomplish the objectives of the refuge, the majority of refuge forests are managed under uneven-aged silvicultural systems. Uneven-aged management will promote many of the aforementioned desirable conditions. However, some shade-intolerant species and simple canopy conditions can best be promoted under even-aged systems. An emphasis is placed on designing management practices that will result in forest structure, composition, and condition that most resembles a natural system. These practices contribute to the widest diversity of indigenous wildlife

species and habitat types. A full range of management alternatives and their impacts is considered during the prescription process.

While maintaining site appropriate species diversity, a large oak component is encouraged. Red oak acorns are an important food source for wintering waterfowl (Baldassarre and Bolen 1994; Smith et al. 1989). Active management is necessary to maintain a substantial component of oak in bottomland hardwood forests (Smith et al. 1989). The oak component is perhaps the most important for the refuge's target species.

Furthermore, silvicultural operations focus on intermediate thinnings to release and promote desirable advanced regeneration. Chemical injection, non-commercial treatments, or small controlled burns may be utilized to reduce undesirable species competition, or eradicate invasive exotics. In areas with insufficient regeneration, site suitable seedlings may be under-planted.

Also, intermediate actions concentrate on stimulating vigorous trees to develop full crowns for hard and soft mast production. Structural diversity is promoted in this uneven-aged management scheme, which provides habitats for the greatest variety of neotropical migratory birds and other forest wildlife. Vines, particularly those beneficial to wildlife, are encouraged to develop to promote structural complexity. A healthy herbaceous understory is encouraged to promote seed and tuber development and a healthy leaf litter that will stimulate invertebrate reproduction. The presence of several well-developed vegetation levels produces a complex habitat structure, resulting in higher bird species diversity (Thompson et al. 1993). Cavity trees are maintained in sufficient numbers throughout the refuge to support resident wildlife and nesting neotropical migratory birds. Also, larger crowns and boles (at least 25" dbh) in the overstory, and a well-developed midstory and understory are essential to best meet the habitat requirements of the priority neotropical migratory birds and other wildlife.

Later in the forest maturation cycle, silvicultural treatments generally prescribed will be group selection harvests and shelterwood or seed tree cuts to regenerate primarily shade intolerant species. Individual tree selection is generally utilized for regeneration of shade-tolerant species.

As noted above, the FHMP for Cache River NWR was approved in 2001. Compartments were inventoried according to the FHMP, and forest treatments began in 2003 and continued through 2004. Additional treatments were approved and contracted up until the April 2005 public release of the IBWO rediscovery. The rediscovery led to a moratorium on forest product harvesting, and existing contracts were rescinded. The FHMP was amended to address the needs of the IBWO, revamp the inventory cycle, and improve the distribution of treatments in February 2006.

The *Central Arkansas Refuges Forest Habitat Management Plan Addendum* addressed habitat management implications in recognition of strong evidence for presence of the endangered IBWO. It noted that the stomach contents of IBWO included animal matter, but also 54 percent was vegetable matter, mostly soft mast. This indicates IBWO needs some amount of decadence in the forest for insect production, but also areas productive in mast. Mast production (both hard and soft) is abundant where sunlight is available, thus creating and maintaining canopy gaps fulfill a vital role in properly managing IBWO habitat.

Forest treatments resumed at Cache River NWR in August 2006, with continuation of a pre-IBWO approved removal of non-native loblolly pine and subsequent conversion to hardwoods. While there were other hardwood treatments approved prior to the IBWO re-discovery, management sought to slowly reinstate forest treatments on the refuge by beginning in an area that was judged by many to be unsuitable IBWO habitat. The refuge completed all necessary steps to ensure compliance with Service,

NEPA, and endangered species regulations. Hardwood forest improvement treatments will now resume in areas that have been thoroughly surveyed for evidence of the IBWO.

Desired Future Forest Conditions have been further refined by the 2007 Final Report of the Forest Resource Conservation Working Group formed under the LMVJV, entitled *Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat*. The report uses indicators of habitat structure for determining Desired Forest Conditions.

Strategies:

- Continue periodic forest evaluations and treatments as prescribed in the current FHMP.
- Develop and implement Annual Habitat Work Plans following the FHMP evaluation/treatment cycle to facilitate management actions focused on:
 - improving forest habitat and structure,
 - stimulating developed lower vegetation layers, and
 - regenerating shade intolerant species for the benefit of priority bird species.
- Apply silvicultural treatments to achieve the desired forest conditions of the FHMP and Addendum considering the overall needs of the refuge ecosystem, individual site characteristics, habitat conditions, geomorphology, degree of past disturbance, and hydrology.
- Conduct post-treatment monitoring to ensure that objectives are met and to increase efficiencies in obtaining desired results through adaptive management.
- Maintain the CFI system on a 10-year-cycle and develop effective methods to streamline data collection, conduct practical measurements, and analyze and track refuge habitat and site conditions over time.
- Note unique habitats such as cane, corkwood, and pondberry as encountered in CFI surveys for reference in future botanical surveys.
- Continue to restore and develop new forestlands by:
 - Restoring and planting newly acquired croplands identified for restoration within two years of acquisition;
 - Giving priority to establishing connectivity between larger forest blocks and expanding the size of existing blocks;
 - Considering individual site geomorphology, historic and desired future conditions, degree of past disturbance in regard to site alteration, and hydrology to make decisions concerning appropriate species to be planted, methods of planting, and the timing, frequency, extent, depth, and duration of hydroperiods to be restored;
 - Continuing active dialog with carbon companies, USDA, and other partners to establish adequate species diversity and stocking rates for reforestation and successful restoration;
 - Promoting appropriate areas of self-sustaining scrub-shrub habitats such as plum, deciduous holly, sumac, and other native shrubs in reforested blocks;
 - Evaluating reforestation sites through the FHMP evaluation/treatment cycle;
 - Cooperating with other refuges, AGFC, and NRCS to develop the best strategies to transition late stage plantations into the existing forest block by developing techniques to enhance vertical structure, species composition, and functions of a mature forest in these late stage plantations.
- Monitor greentree reservoirs for impacts of seasonal flooding and long-term forest health to facilitate adaptive management.
- Maintain shrubs along select, low-priority roads, ditches, and levees to discourage cowbird use and encourage use of this habitat by other resident wildlife for cover and forage.

-
- Provide a recurring supply of short-term scrub-shrub habitat to support the needs of refuge wildlife that are dependent on such habitat.
 - Encourage cane in existing forest by thinning the overstory to allow increased penetration of sunlight to the forest floor.
 - Identify areas suitable for cane restoration by considering geomorphology, hydrology, and soil characteristics.
 - Identify appropriate upland sites for restoration of scrub-shrub, oak savannah, and grassland communities by considering site geomorphology, degree of site alteration, and hydrology.
 - Develop and implement various techniques, such as mowing and prescribed burning, to restore and maintain appropriate upland sites as scrub-shrub, oak savannah, and grassland communities.
 - Continue protecting refuge habitats through wildfire suppression by relying on local fire departments, Arkansas Forestry Commission, and properly trained refuge staff. Maintain firebreaks in young hardwood plantations throughout the grassy understory stage.
 - Prepare and implement an updated Fire Management Plan that includes use of prescribed fire as a habitat management tool.
 - Administer the forest management program in compliance with 50 CFR 29.1.

Cache River NWR Objective 2-3: Cropland Habitat Management

Continue to manage 3,100 acres of croplands, primarily rice, soybeans, milo, and millet through a Cooperative Farming Agreement, and within 5 years of the CCP completion increase cropland acreage as needed to meet the forage objectives of the NAWMP as stepped-down through the LMVJV.

Discussion: Cropland management is crucial to the refuge's ability to meet its waterfowl foraging habitat objectives because it provides a concentration of high-energy foods within a relatively small area compared to a forest setting. Cache River NWR manages cropland habitats in addition to moist-soil units and bottomland hardwood forests to provide the best array of waterfowl foods possible. During the time period waterfowl are wintering in Arkansas, unharvested crops are typically not available on private lands, unless they are maintained for hunting purposes. Providing unharvested crops in a sanctuary setting allows wintering waterfowl to benefit from this high-energy food service with a minimum of caloric expenditure involved in foraging and avoiding disturbance.

Cache River NWR has utilized agricultural practices as a means of waterfowl management since its establishment in 1986. The refuge utilizes cooperative agreements with a local farmer. The refuge has two farm units, totaling 3,100 acres. The Dixie Farm Unit, which lies in Woodruff County, contains approximately 2,363 acres of cropland. The Plunkett Farm Unit, which lies in Prairie County, contains approximately 742 acres of cropland. The cooperative farmer is required to adhere to all refuge regulations and provide all necessary documentation, while conducting approved agricultural practices on the refuge.

Crops grown on the refuge include rice, milo, soybeans, corn, and Japanese millet. A joint decision between the refuge and the cooperative farmer is made to determine crop type and planting locations for the refuge's crop share. Consequently, the refuge must identify specific fields and acreages of crops to be shared with the farmer and delineate these fields on maps, in tables, and on the ground as part of each cooperative farm agreement. Cooperative farmers may grow any of the above crops as their share.

Soil erosion is not a problem on any refuge cropland. Most cropland is fairly level with minimal ridge and swale areas. The few areas classified as highly erodible by the NRCS are transitional slopes between first and second bottoms or upland terraces. These areas have been planted back to trees or allowed to revegetate naturally.

The refuge has rehabilitated, replaced, or constructed new water control structures and levees on impoundments in the farm fields, but additional impoundment work is needed to provide improved wildlife habitat. The main factors limiting improvement in cropland and moist-soil management capabilities are the lack of resources.

The original LMVJV cropland habitat objective for Cache River NWR was to provide 1,360 acres of unharvested crops as forage for wintering migratory waterfowl (Table 10). In order to achieve this ambitious target, approximately 5,440 acres would need to be actively farmed, based on the 75/25 share agreement. With the current acreage available for cropland management, the refuge is unable to meet this unharvested cropland objective. However, the potential exists to expand on available waterfowl foraging habitats, including cropland, as additional private tracts are added through refuge acquisitions.

If additional DEDs are required or refuge objectives are not being achieved in Arkansas on public lands, then recently purchased tracts of $\leq 2,000$ acres on Cache River NWR, such as a parcel that has water management infrastructure, potentially could be farmed to significantly boost DEDs with minimal effort to meet refuge DED objectives. Cooperative farming would be used to create such habitat with virtually no resources required from the Service, except for oversight. This new area potentially could be comprised of a mixture of sanctuary and hunting areas, such as the Dixie Farm Unit.

Current potential exists to create impoundments and flood typically dry agriculture fields on the western end of the Dixie Farm Unit for waterfowl, shorebirds, and wading birds. A topographic survey of these areas would be conducted and an engineer would need to draw the plans for water control structure and levee placement to create impoundments. An application could be made for a North American Wetlands Conservation Act (NAWCA) grant to complete engineering and construction activities. Partners, such as Ducks Unlimited, could assist in the engineering and construction work.

Similarly, there is a great need to create several shallow-water impoundments for moist-soil or cropland management on the Plunkett Farm Unit. Currently, there is only one water control structure, well, and impoundment on this unit, which limits control of water supply, delivery, and depth for waterfowl habitat management activities. Water depth may range from 6 feet at the control structure down to only mudflats at the upper end. This severely limits options to propagate waterfowl habitat during the growing season and create shallow water habitat during the fall and winter migration. Several impoundments could be created on this 700-acre unit to enhance waterfowl management.

Strategies:

- Provide 150 acres of unharvested rice, 500 acres of floodable unharvested milo, and 80 acres of floodable moist-soil habitat on the Dixie Farm Unit to achieve DED foraging objectives.
- Flood all unharvested crops and approximately 75 percent of the harvested crops within farming units for foraging habitat for waterfowl, shorebirds, and other water birds.
- Increase the acreage of harvested floodable crops on the Dixie and Plunkett Farm Units by adding levees and water control structures as feasible.
- Continue to prohibit fall disking by the cooperative farmer in order to retain waste grain for waterfowl, and promote availability of earthworms for woodcock.

-
- Maintain vegetation buffer strips around fields to reduce herbicide and fertilization drift and runoff.
 - Minimize soil erosion by:
 - Not allowing any fall disking;
 - Retaining rice levees over winter;
 - Using water control structures to hold a winter flood on cropland acreage;
 - Requiring a cover crop as opposed to clean tillage of any set-a-side acreage;
 - Using vegetated buffer strips adjacent to rivers, bayous, and drainage ditches.
 - Consider farming suitable new acquisitions, if feasible, to achieve refuge DED objectives.
 - Administer the cooperative farming program in compliance with 50 CFR 29.1.

Cache River NWR Objective 2-4: Water Management

Continue to restore or enhance hydrologic regimes of the refuge, utilizing low-maintenance water delivery systems and natural processes where feasible, to improve farm, moist-soil, and other wetland management units that provide critical resources for wetland-dependent species.

Discussion: Cache River NWR contains extensive lands along the Cache River corridor and includes a diversity of geomorphic, soil, topography, and hydrological conditions. Generally, management of the refuge should be directed to protecting, maintaining, and restoring the natural physical features, ecological processes, hydrological regimes, and vegetation communities endemic to the region. If this conservation can occur, management can assist restoration and provide key functions, values, and resources to plant and animal communities, especially certain species of concern and refuge establishment priority.

The long-term sustainability of bottomland hardwood communities on the refuge depends on the protection, enhancement, and restoration of natural channel and floodplain water flow patterns and regimes. This includes: (1) Physical flow patterns (both flooding and drainage); (2) timing, depth, and duration of river discharges and overbank flooding; and (3) water quality and sediment loading in the Cache River and its drainages.

A primary objective for Cache River NWR should be continued attempts to obtain, via fee-acquisition, lands within the approved refuge expansion boundary, especially lands that connect existing bottomland hardwood patches, reduce hydrological impacts from surrounding private lands, and offer opportunities for reforestation and restoration of natural flow and flooding patterns.

Many past, present, and future changes occur (or are proposed to occur) in topography, drainage, land use, and vegetation communities along the Cache River. Past and present alterations should be monitored and evaluated and proposed changes should be carefully evaluated to determine how, or if, restoration to more natural hydrology can be achieved. For example, low-water crossings should be used instead of culverts at road crossings where feasible to allow natural flows and reduce beaver impoundment problems.

A primary aim for the refuge should be to provide for, and encourage, natural patterns of overbank flooding and drainage along naturally occurring flow paths, such as sloughs, side channels, swales, and meander valley networks. Water control structures should be constructed and maintained only in sites and units where intensive management is desired and possible, such as areas with moist-soil or greentree reservoir impoundments.

Water management plans are needed for all land units, and fields/areas within each unit. These plans should promote, if possible, the vegetation community that naturally occurred in that site relative to geomorphology, soils, topography, and hydrology. Each existing water control structure should be evaluated and monitored to determine its functions and capabilities relative to management objectives. Many water control structures should be replaced, or eliminated where possible, to either intensify moist-soil management or, where desired, restore a non-manipulated water regime.

Strategies:

- Develop, enhance, or maintain water control to properly manage wetland habitats.
- Restore more natural flow and hydrological regimes in the Cache River channel and its floodplains where feasible.
- Develop and maintain water control infrastructure to assist restoration of bottomland hardwood floodplain communities and intensively manage moist-soil impoundments, agricultural fields, greentree reservoirs, and other wetland units.
- Develop a detailed water management plan for each unit of the refuge that includes purposeful water management and provision for natural overbank flooding and subsequent drainage.
- Evaluate influences of off-refuge physical and hydrological developments to hydrology on the refuge.
- In coordination with Service partners, inventory and evaluate all lands within the Cache River floodplain corridor as to: (1) Past and current habitat types; (2) past and current hydrological condition; (3) water management practices; (4) influences of flow pattern and duration on refuge lands; (5) land uses and potential contributions of sediment and contaminants; and (6) ownership issues.
- Study and carefully monitor larger, system-wide issues such as: (1) Proposed clearing of blockages; (2) diversion of river water for agriculture or other uses; (3) channelization versus restoration of formerly channeled areas; and (4) changes occurring from wetland restoration (e.g., WRP) or management (e.g., lands identified for IBWO management).
- In developing strategic plans for Cache River NWR, incorporate more holistic hydrogeomorphic analyses of community structures, functions, and values within the context of the entire White River Basin of Arkansas and Missouri.
- Recruit a hydrologist to be based at Big Lake NWR to: coordinate hydrological and water quality issues on all refuges within the Complex, coordinate hydrological research and monitoring, provide technical advice to adjacent landowners, provide liaison function with COE, and coordinate aquatic restoration projects.

Cache River NWR Objective 2-5: Habitat Investigations, Inventorying, and Monitoring

Within 5 years of the date of this CCP, prepare and implement an Inventorying and Monitoring Plan that will improve and expand investigating, inventorying, and monitoring of the refuge's wildlife habitat and use to obtain sufficient baseline data to inform management decisions, determine if management objectives are met, and enable adaptive management.

Discussion: The Improvement Act formally establishes the necessity of monitoring the status and trends of fish, wildlife, and plants on national wildlife refuges. Service policy is to collect baseline information on key plants, fish, and wildlife to monitor, as resources permit, critical parameters and trends of selected species and species groups on and around Service units, and to base management on biologically and statistically sound data derived from such inventorying and monitoring (701 FW 2, Inventorying and Monitoring of Populations).

Monitoring, inventorying, and surveying (MIS) are very important means for scientifically managing trust wildlife populations and habitats, as well as meeting national, regional, and refuge goals. Before any MIS is started, the surveyor should seriously and honestly determine if: (1) Objectives, which are clear, specific, and measurable, are defined and can be practically met; (2) the results will actually be used to benefit the resource or make informed decisions; (3) quality and quantity of data needed to meet the objectives can be collected; (4) the MIS methodology is scientifically and statistically sound; (5) the costs of conducting the MIS are worth the results; (6) resources are available or will become available to complete the MIS; (7) the method of data analysis is pre-determined; and (8) MIS is prioritized so if resources become limited then more critical MIS will be conducted.

Adaptive management is a system used by refuge managers to improve results by documenting management actions, measuring and documenting biological responses, and adapting (modifying) management actions to improve desired conditions/outcomes and determine if objectives have been met. Baseline inventorying and monitoring at regular intervals provide data essential for informed decision-making by refuge managers. Appropriate inventorying and pre- and post-treatment monitoring of refuge habitats are fundamental for adaptive management. Inventorying and monitoring needs can often be met with the assistance of other Service programs and cooperative efforts with State resource agencies, universities, and USGS. Proper attention must be given to experimental and monitoring design, statistical procedure, and consistency in observation and data collection.

Management of moist-soil sites in particular requires intensive monitoring throughout critical establishment and manipulation periods to determine whether growth and availability of waterfowl or shorebird foods are sufficient to meet habitat goals. While water gauges in each impoundment allow detailed records on water levels, data on soil moisture, plant germination, and composition also will be required to successfully manage moist-soil areas.

Strategies:

- Increase capability to conduct habitat investigations, inventories, and monitoring by recruiting a biological technician for Cache River NWR and an ecologist, hydrologist, assistant forester, and forestry technician for the Complex
- Collect and assess inventorying and monitoring data that are relevant to and contribute to decision-making regarding refuge habitat management (adaptive management).
- Continue to coordinate with partners, universities, USGS, and others to conduct monitoring and inventorying of habitat resources on the refuge.
- Implement inventorying and monitoring efforts for refuge habitat resources including moist-soil units, CFI, botanical surveys, vegetation responses to management activities, invasive plant infestations, hard mast production, success of afforestation and reforestation activities, cropland habitat production, and plant species composition of grassland, scrub-shrub, and early successional habitats.
- Maintain habitat inventory and survey data in databases that enable efficient data storage and retrieval.
- Strive to develop data sets that are statistically robust so that analysis of monitoring results can be more useful in determining adaptive management responses.
- Record survey activity and results in annual narratives or annual habitat and survey plans.
- When time, personnel, or expertise are lacking, recruit volunteers such as interns, retirees, and/or skilled volunteers from universities or conservation clubs (e.g., Arkansas Audubon) to assist with habitat inventorying and monitoring.
- If possible, provide suitable housing for volunteers and interns as a means to effectively recruit the best candidates.

-
- Continue to enhance refuge inventorying and mapping capabilities through the use of databases, such as Geographic Information Systems (GIS); use capabilities shared with other Service offices (e.g., Realty, LMVJV), whenever practical.
 - Continue to develop GIS data layers depicting occurrence/abundance of plant and animal species (e.g., roost sites, vegetation cover maps) and management activities (e.g., forest management compartments, water management units).
 - Coordinate with AGFC, USGS, COE, NRCS, and other organizations to design and conduct research that will provide refuge managers with information needed to improve habitat management programs to better fulfill refuge purposes.

RESOURCE PROTECTION

Cache River NWR Goal 3: Promote communication, cooperation, and partnerships between local, state, and federal agencies, land managers, and private citizens to minimize impacts from off-site environmental degradation and other threats to the functions and values of the refuge's associated wetland ecosystems and watersheds.

Discussion: In order to achieve its purposes and vision, Cache River NWR must address a number of issues that threaten to degrade or diminish the value of its resources. These threats include invasive plant and animal species, water quality and contaminant issues, development, and illegal activities.

Cache River NWR Objective 3-1: Invasive Plant and Nuisance Animal Control

Annually identify and eradicate or control invasive, exotic, or nuisance plants and animals, and develop and implement a database to systematically track occurrences and treatments within 2 years of the date of this CCP.

Discussion: Invasive plant species threaten refuge flora and fauna. Widespread problems include European or Chinese privet and Japanese honeysuckle along forest edges and in reforestation sites and some harvested stands; mimosa, chinaberry, and non-native pine occasionally found in restored fields; and American Lotus, although native, can present an invasive problem in refuge impoundments. Kudzu currently affects over 100 acres of refuge habitat at four separate locations. The kudzu-infected sites will require several years of treatment; however, all of the kudzu areas received initial treatment with Transline (an herbicide specific to legumes) in 2006. Additional treatments occurred in late fall 2007 and summer 2008. Control of privet and honeysuckle has not yet been implemented, but will be implemented during late fall and continue on a yearly basis. Mimosa, chinaberry, and pine have been controlled during the normal course of operations through on-the-spot eradication, using herbicides.

Although beavers are a native species, their damming activity and resulting impoundments can interfere with intended habitat management on the refuge. Historically, beaver impoundments served the function of providing wetland habitat utilized by a variety of fauna. However, the surrounding watershed has changed - it is now mostly agriculture instead of forest. Beaver impoundments have compounded the problem of altered hydrology, particularly related to increased agricultural run off in the form of continual irrigation drainage during the growing season. Considerable staff time and funds are devoted to removing impoundments and controlling beaver populations.

Currently, trapping is prohibited on the refuge, but management should have the option of implementing a nuisance animal or furbearer management trapping program if necessary in the future. Nuisance animal removal should target beaver, nutria, and muskrat that negatively impact habitat, as well as predators such as raccoons, skunks, coyotes, or bobcats, that reduce target

animal populations. Similarly, night hunting of some species may be biologically sound and necessary and therefore should never be regarded as unconditionally prohibited. These options and others for predator, parasite, or disease control should be incorporated into management plans as needed for biological and human safety concerns.

Strategies:

- Implement invasive species prevention and control programs in compliance with 50 CFR 29.1 and EO 13112.
- Supplement the invasive plant database with occurrences found during the course of normal activities. Eradicate small invasive plant infestations on the spot.
- When large invasive plant infestations are encountered, develop plans for coordinated control efforts.
- Document treatment efforts and track success to enable adaptive management.
- Document beaver dam occurrences in a database developed during the course of the normal FHMP evaluation cycle.
- Develop a database that tracks locations of problem areas, impoundment characteristics, and beaver control efforts.
- Continue to control beaver populations through dispatching, trapping, and removal of impoundments.
- Continue to pursue grants to fund prevention/control activities.
- Consider allowing commercial trapping through special use permit to control exotic, invasives, or nuisance wildlife to protect refuge infrastructure, refuge habitats, and priority wildlife species.

Cache River NWR Objective 3-2: Water Quality

Continue to implement management actions to protect and improve quality of aquatic resources on the refuge and the fish and wildlife resources that they support.

Discussion: A minor source of turbidity and siltation of watercourses on the refuge originate from land use (particularly farming and road/levee construction) on the refuge itself, while a greater share of the overall problem is erosion and runoff (e.g., non-point sources) outside refuge boundaries.

Strategies:

- Identify, assess, and treat areas prone to erosion prior to the development of sedimentation problems, especially on recent acquisitions of prior-converted farmlands.
- Avoid increased sediment transport by following BMPs in all refuge actions, such as farming, moist-soil management, construction, and road maintenance, whether performed by a contractor or by the refuge.
- Be alert to upstream activities causing problems in refuge waters (e.g., natural gas production), and develop a monitoring system to document potential water quality problems, including sampling factors such as water and sediments, fish tissues, and rapid bio-assessment techniques.
- Where and when possible, allow natural stream flow processes and stream course changes to occur; if bank stabilization is necessary, employ bioengineering techniques where feasible.

-
- Within the context of the refuge's reforestation plans, plant the appropriate species for hydrologic conditions, such as flood-tolerant shrub and tree species [e.g., common buttonbush (*Cephalanthus occidentalis*), black willow (*Salix nigra*), red maple (*Acer rubrum*), and baldcypress (*Taxodium distichum*)], in the riparian corridor of prior-converted farmlands and other areas prone to erosion to aid in soil stabilization.
 - Develop beaver population objectives on refuge lands and, as appropriate within the context of the refuge's reforestation and forest management plans, manage beaver dams to contribute to refuge water quality goals and objectives.
 - Document the location of all culverts and water control structures on the refuge, especially those repeatedly dammed by beavers. Where the structures are not necessary, replace them with rock-lined low-water crossings to maintain vehicular access, discourage dam construction by beavers, and reduce blockage of structures by debris, thus facilitating drainage.
 - Work with the Service's private lands biologists, AGFC, ANRC, ADEQ, and NRCS to develop incentives for local farmers and landowners to encourage the use of filter strips to reduce agricultural runoff.
 - Work with NRCS, state partners, and Service Private Lands Program biologists to establish acreage objectives for riparian zone buffers along Cache River, Bayou DeView and tributaries upstream of the refuge.
 - Establish vegetated streamside filter strips within 100 yards of the Cache River, Bayou DeView, and other tributaries, and encourage other landowners to do the same.
 - Recruit a hydrologist based at Big Lake NWR to coordinate hydrological and water quality issues on all refuges within the Complex, coordinate hydrological research and monitoring, provide technical advice to adjacent landowners, serve as a liaison with COE, and coordinate aquatic restoration projects.

Cache River NWR Objective 3-3: Contaminants

Determine if any contaminants exist on Cache River NWR, assess their impacts to the refuge, and appropriately mitigate these impacts.

Discussion: Level I Contaminants Surveys are conducted for each tract of land prior to acquisition. Level II surveys have been conducted for a couple of tracts that had previous petroleum products or pesticide mixing activities on-site. Level I or higher level contaminants surveys will be conducted for future acquisitions as the situation demands.

A study of potential chemical contaminant exposure and the biological effects of this exposure at 26 national wildlife refuges in the LMRE was conducted between 1995 and 2000 (Shea et al. 2001). Water, sediment, fish, and passive sampling devices were used to acquire toxicity data to characterize chemical exposure. The study also assessed the potential biological effects of this exposure. The primary focus of the study was on organochlorine pesticides, currently used pesticides, and mercury. Additional analyses were conducted for polychlorinated biphenyls and polycyclic aromatic hydrocarbons.

Organochlorine pesticides like DDT and toxaphene were widely used for many years but were banned many years ago in the United States due to their persistence and tendency to bioaccumulate and biomagnify to levels that caused documented impacts on fish-eating raptors, such as Bald Eagles, Ospreys, and Brown Pelicans. Organochlorine pesticides were detected in predator and benthic fish at 24 refuges, including Cache River NWR. The mean concentration of DDT detected at Cache River NWR exceeded 150 ng/g (parts per billion), a level more protective than the 1,000 ng/g

predator protection level. Mean toxaphene levels at Cache River NWR were below historical levels in predator fish and near the historical level in benthic fish; however, the mean for both were below the lowest biological effects value of 400 ng/g. Total DDT in sediment for Cache River NWR was less than the probable effect concentration. Toxaphene in sediment was higher at Cache River NWR than at Bald Knob NWR. Where historical data were available, both DDT and toxaphene were generally below historic levels. Total DDT in water on Cache River was below the 1 ng/L, but at least one sample equaled the Environmental Protection Agency's Water Quality Criteria for protection of aquatic life. All toxaphene levels were below the EPA aquatic life protection level.

At least two of the 50 current use pesticides measured – trifluralin and azinphos methyl – were detected at the refuge. In addition, 2, 4-D, bentazon, metolachlor, trifluralin, acifluorfen and 3, 4-dichloroaniline also were detected. Eight pesticides, including azinphos-methyl, tetrabuzin, and trifluralin, collected near the refuge, exceeded aquatic life criteria. Concentrations of PCBs in fish, water, and sediment were below known threshold levels for biological effects and water quality guidelines. Mercury was detected in fish on the refuge, but concentrations were below thresholds for fish-eating mammals, and below levels which would cause concern over human health. No fish consumption advisories for mercury or other contamination have been issued for water bodies on or flowing through Cache River NWR.

In conclusion, potential hazards for PCBs, polycyclic aromatic hydrocarbons, and mercury were unlikely at Cache River NWR, but hazard potential was uncertain for organochlorine pesticides and current use pesticides.

Strategies:

- Establish and implement contaminant protocols to monitor and evaluate contaminant issues that could affect the refuge and the fish and wildlife resources that it supports.
- Coordinate with personnel at the Service's Arkansas Ecological Services Field Office, ADEQ, and USGS to establish and maintain a contaminants and water quality monitoring program on the refuge.
- Sample water, sediments, and fish in oxbow lakes to assess contaminants and water quality.
- Coordinate with Arkansas agencies, USGS, and other partners to conduct surveys every 5 years or as appropriate to document status and trends of refuge aquatic resources and physical water quality parameters, including contaminants.

Cache River NWR Objective 3-4: Land Acquisition

Acquire lands from willing sellers within or adjacent to the approved acquisition boundary of the refuge to enhance conservation programs, achieve legislated purposes of the refuge, and fulfill the mission of the Refuge System.

Discussion: In the Cache River watershed, the natural system has been vastly altered from historic conditions. The greatest impediment to natural ecosystem function is the current hydrology, which has been modified tremendously from historic natural patterns, largely through long-term structural impacts of drainage and flood control. The alteration of natural processes, such as hydrological systems, results in lands and waters that are not sustained in the manner in which they evolved and thus are subject to ecological stressors to which they are not adapted. Conserving lands through refuge acquisition positively affects the integrity of the landscape, thus protecting and insulating existing refuge habitats from the impacts of ecological degradation.

Land acquisition is an important component of increasing net benefit to wildlife and fisheries directly through conserving, restoring, and managing additional acres of habitat, but also in increasing the elasticity or resilience of the system in absorbing the impacts of the altered environmental system of the 21st century. Strategic acquisition of lands can lead to increases in contiguous habitat block size, corridors, and availability of limited habitat types, resulting in increases in both the quantity and quality of wildlife habitat.

The current acquisition boundary is defined by the historical 10-year floodplain of the Cache River. However, the public voiced concern during the scoping process for the Draft CCP/EA that other important habitats are not eligible for acquisition by the refuge for associated conservation, restoration, and management. Less than a 10 percent expansion (minor boundary expansion) can be accomplished in the Service's Regional Office, while a major boundary expansion (more than 10 percent of the existing area) must be approved by the Service's Washington, D.C., Office. The Biological Review Team also recognized the value of expanding the acquisition boundary to enhance conservation efforts.

Currently, 5 parcels comprising 703 acres in Monroe, Prairie, and Woodruff Counties are in refuge ownership, but are situated outside the current approved acquisition boundary. These tracts need to be exchanged for lands inside the acquisition boundary for Cache River NWR. Additionally, 8 tracts totaling 1,606 acres in Arkansas and Desha Counties were purchased as a result of the Potlatch exchange agreement, using funds allocated for Cache River NWR. These tracts are located outside of the currently approved Cache River NWR acquisition boundary. These outlying tracts are administered by White River NWR, because they are located to the south of that refuge. These lands also need to be part of a land exchange agreement for Cache or White River NWRs, or as part of a multi-refuge exchange.

Strategies:

- Enable conservation, restoration, and management of additional wildlife and fisheries habitats through actively pursuing acquisition of lands from willing sellers; wetlands and other waterfowl habitats should remain the highest priority for acquisition.
- Emphasize in outreach efforts that acquisition will occur only inside or within 1 mile of the approved acquisition boundary and only from willing sellers.
- Work cooperatively with White River NWR, the Service's Division of Realty, and AGFC and other partners to exchange currently owned parcels outside the approved acquisition boundary for parcels within the approved boundary.
- Over the long term (i.e., the 15-year span of this CCP and beyond), consider expansion of the refuge acquisition boundary in response to the need for additional conservation of important wildlife habitats by considering:
 - Creating a wildlife corridor from the Cache River to Bayou DeView at Howell, which would not only connect these two forest blocks, but would also secure a range of diverse habitats (upland to bottomland) and provide secure habitat for wildlife escaping winter flooding; several properties that would help achieve this purpose are available from willing sellers;
 - Extending the acquisition boundary from Amagon to Grubbs or possibly north of Grubbs;
 - Broadening the acquisition boundary to conserve unprotected lands along the White River, particularly adjacent to Wattensaw WMA and South of I-40;

-
- Purchasing escarpment property that would serve as escape cover for resident and migratory wildlife at every opportunity (with or without a change in the acquisition boundary).

Cache River NWR Objective 3-5: Private Lands

Expand efforts to coordinate with private landowners and partner agencies to manage croplands and restore native wetlands in the watershed to complement refuge wildlife objectives and the objectives of various national and regional wildlife plans for the LMV.

Discussion: The USDA Farm Service Agency (FSA) approved the Cache River/Bayou DeView Conservation Reserve Enhancement Program (CREP) project in 2007. The proposal for this project was developed by a multi-agency/organization, the Ivory-billed Woodpecker CREP Committee, in 2005. The Cache River/Bayou DeView CREP established a 161,144-acre project area in Monroe, Prairie, and Woodruff Counties, encompassing the area in which the IBWO was rediscovered in 2004. The majority of the project area consists of agricultural land, while the remainder is covered by bottomland hardwood forests in federal, state, or private ownership. The entire project area is in close proximity to Cache River NWR.

The objective of the Cache River/Bayou DeView CREP is to restore bottomland hardwood forested wetlands, which the IBWO requires for breeding, foraging, and survival. The determination of the location for this CREP was based on evidence of the IBWO presence, as well as a biologically based decision support model for reforestation for forest breeding birds. In 2002, LMVJV biologists developed the GIS-based Forest Breeding Bird Decision Support Model (FBBDSM) for use as a planning tool to guide reforestation efforts in the MAV, by optimally positioning reforestation to increase forest “core” (defined as forest greater than 0.62 mile from a “hostile” edge) habitat based on forest bird biology.

The FBBDSM seeks to improve fragmented landscapes and increase population nesting success for forest-wetland-dependent songbirds of greatest conservation concern in the MAV by: (1) Spatially prioritizing forest restoration to reduce forest fragmentation; (2) increasing the number and area of forest patches that harbor more than 5,000 acres of forest core and those with forest cores greater than 12,500 acres; (3) emphasizing areas with little extant forest, targeting restoration within local (10 km or 6.2 miles) landscape contexts to achieve at least 60 percent or more forest cover; and (4) emphasizing high site (well-drained) bottomland hardwoods within higher priority areas due to their value for ground and shrub-nesting forest breeding birds. The project area chosen for this CREP contains a significant amount of agricultural land, which falls within the top 10 percent priority for reforestation, according to the FBBDSM.

Land eligible for enrollment under Conservation Reserve Program (CRP) requirements will be restored to forested wetlands through any of four allowed CRP practices. Enrollees will enter into 10- or 15-year CRP contracts with the FSA. However, unlike other CRPs in the United States, this CREP requires permanent conservation easements to be placed on each tract of land enrolled. The Nature Conservancy of Arkansas will fund the easements, and the AGFC will manage and monitor the easements. Enrollees will receive annual soil rental payments substantially higher than received under regular CRP, as well as a one-time payment for the easement.

The 15-year projected cost of this CREP, including federal and non-federal funding, totals \$11,618,538 (\$9,236,813 federal; \$2,381,725 non-federal), sufficient to enroll and restore approximately 6,250 acres.

Within the immediate vicinity (5 miles) of Cache River NWR, NRCS has purchased 30-year or permanent WRP easements on approximately 12,650 acres along the Cache River in three counties; 5,275 acres along Bayou DeView in two counties; and 17,150 acres along the White River in three counties. Most of these easements have been restored to a mix of bottomland hardwood forests and seasonally flooded herbaceous wetlands. WRP has helped de-fragment and enlarge contiguous forest blocks essential to forest breeding birds, including the IBWO and numerous species of neotropical migratory birds whose populations are declining. A change in the 2008 Farm Bill requires that land must be in the same ownership for 7 years before a parcel can be eligible for enrollment in WRP. Thus the number of properties eligible for WRP will be reduced along with the resultant benefits to wildlife habitat afforded by WRP.

The Service's Partners for Fish and Wildlife Program provides assistance to private landowners for habitat restoration projects and complements the USDA conservation programs (e.g., WRP). This program could be instrumental in restoration of forest lands adjacent to the refuge. It can provide resources to landowners who otherwise may not qualify for USDA resources. Refuge staff will work closely with the Service's private lands biologists to promote restoration of these lands.

AGFC's private lands biologists help deliver various conservation programs. They have contacts with private landowners and help them identify areas eligible for conservation programs, fill out program applications, plan, and construct projects. Refuge staff will work with the AGFC personnel to help identify and restore adjacent tracts.

Strategies:

- Consult with LMVJV biologists to refine the FBBDSM for use in habitat restoration in this portion of the MAV.
- Cooperate with NRCS staff in implementing the CREP.
- Ensure close communication and collaboration between the refuge and the Service's and AGFC's private lands biologists to promote assistance to private landowners in the area who have habitat restoration projects in the vicinity of the refuge.

Cache River NWR Objective 3-6: External Threats

Promote communication, cooperation, and partnerships between other agencies, land managers, and private citizens to identify and minimize impacts from external threats to the functions and values of the refuge's wetland ecosystems.

Discussion: The habitats and wildlife of Cache River NWR are threatened by a number of off-refuge actions and trends, among them the following:

- Oil and gas drilling and development that involves potential pollution and excessive water usage associated with drilling in nearby shale formations
- Pipelines
- Navigation on the White River
- Flood control on Cache River
- Irrigation – small scale adjacent landowners pumping (dewatering) and then potentially flooding the refuge during dewatering
- Grubbs blockage and potential remedies
- Habitat modification on private land adjacent to the refuge
- Closure of county roads, waterways, and access
- Minimum stream flow establishment

-
- Sedimentation
 - Invasive plant and animal species

The refuge needs to stay abreast of potential public and private projects, make recommendations, and take action to minimize their negative impacts on refuge resources. There is a critical need to establish minimum stream flow for Cache River and Bayou DeView. Public projects in the Cache and White River watersheds have the potential to drastically impact the ecological conditions of Cache River NWR. The Cache River NWR staff should participate in the project planning and permitting process at every opportunity on projects within the Cache River watershed, as these projects are very likely to affect system processes such as hydrologic function, and thereby the vegetative communities and wildlife populations of the refuge. Staff should evaluate future proposed projects to assess their implications for the refuge.

Current projects that merit awareness and engagement by refuge staff include:

- The Cache River Basin Flood Damage Reduction Project at Grubbs: The COE is conducting a study aimed at reducing flooding in the vicinity of the town of Grubbs in Jackson County. Potential negative impacts include modification to the natural river channel, release of large amounts of sediment and debris downstream, and possible reformation of a blockage downstream on the refuge.
- The White River Navigation Project: This project would enlarge the navigation channel on the White River to provide a 9-foot-deep by 125-foot-wide channel available 95 percent of the time through construction of a series of wing dikes and continued dredging. Implementation of this project could negatively impact the extent of the Cache and White River drainages.
- Restoration of the lower (7 miles) Cache River: This project would restore meanders to the previously channelized lower portion of the Cache River. Sponsored by Ducks Unlimited (DU) and AGFC, it is under study by the COE. It would benefit aquatic resources, as well as help restore hydrologic function to the landscape and the Cache/White River drainage.
- Continue to provide support and assistance to Ecological Services in review of 404 permit applications, which may potentially affect refuge resources. Provide additional biological insight on the impacts of off-refuge projects, or cumulative effects of such projects, on refuge lands.
- Highway 79 and Jackson County Road 51 Bridge Projects: Cache River NWR staff participated in the planning and design for these projects. The Arkansas Highway Transportation Department designed criteria that will improve hydrology along these roadways and right-of-way stipulations will allow the projects to meet refuge compatibility, safety, and public access needs.
- The Nature Conservancy Big Woods Project: This is an initiative by TNC to reforest 500,000 acres of land in the White/Cache River basin through agency partnerships and private landowner incentives. The reforestation of these lands would be of tremendous benefit to the landscape in which the refuge is situated, and would both increase available wildlife habitat as well as enhance existing habitat.
- Bayou DeView, Cache River, and White River Minimum Flows: The ANRC is mandated to set minimum flows for all state streams, but none have been set on the Cache River or Bayou DeView. The unregulated pumping, which therefore occurs, has had negative

impacts on these aquatic systems. The concept of minimum flows is that ecosystem health can be maintained provided streamflow does not drop below a biologically based threshold. In reality, there is significant seasonal, annual, and long-term variability in natural system flows which contribute to ecosystem function. It is in the interest of the refuge to support identification and implementation of ecologically sustainable flow parameters. The refuge should continue to work with ANRC to at least designate minimum flow rates on these waterways and preferably adopt ecologically sustainable flows. The ANRC has been working on establishing minimum flows and allocating withdrawal rates on the White River. It is recommended that refuge staff participate in this process, as flows on the White River will directly impact the up-stream Cache River NWR.

- The Grand Prairie Irrigation Project: This project will distribute water diverted from the White River to about 867 farms in the Grand Prairie area for agricultural irrigation. Potential impacts to refuge habitat, fish, and wildlife resources should be monitored.

Strategies:

- Participate in public engineering project planning processes and represent the refuge lands in assessment of potential impacts due to changes in hydrology and stream flows.
- Seek to avoid or mitigate potential negative ecological impacts of pending projects in the planning stages and maintain involvement through implementation and mitigation stages.
- Support the lower Cache River restoration initiative and the cooperative partnership of DU, AGFC, COE, and the Cache River/Bayou DeView Improvement District.
- Continue to stay engaged with AHTD regarding the Highway 79 and Jackson County Road 51 Bridge Projects, and Highway 18 expansion and realignment (Big Lake NWR) and ensure that they are implemented under the agreed-to stipulations.
- Participate in landscape level planning efforts that will directly impact the Cache River NWR lands and regional ecosystem.
- Continue to cooperate and work with other resource agencies and conservation programs to expand the natural habitat base through acquisitions, easements, conservation programs, and planning.
- Provide input and planning assistance in order to influence the effective distribution of conserved lands by emphasizing lands that serve to maximize ecological benefits by expanding blocks of existing habitat and providing corridors between existing blocks of habitat.
- Work with ANRC to establish minimum stream flows for the Cache River and Bayou DeView.

Cache River NWR Objective 3-7: Cultural Resources

Develop and implement a Cultural Resources Management Plan (CRMP) within 10 years of the date of this CCP.

Discussion: The refuge will protect refuge cultural resources in accordance with federal and state historic preservation legislation and regulations. Several cultural resources surveys and studies have been conducted at specific sites on Cache River NWR. These surveys have documented the presence of two grave sites and several American Indian mounds.

Strategies:

- Prepare a CRMP for the refuge.
- As guided by the CRMP:
 - Conduct a Phase I archaeological survey of the non-flooded areas of the refuge by qualified personnel as a necessary first step in cultural resources management;
 - Conduct a Phase II investigation if archaeological resources are identified during the Phase I survey, to determine the eligibility of identified resources for listing on the National Register of Historic Places prior to any disturbance;
 - Conduct a Phase III data recovery if the resources identified in Phases I and II are determined to be eligible in order to recover data and mitigate the adverse effects of any undertaking;
 - Follow procedures detailed in the CRMP for inadvertent discoveries of human remains;
 - Ensure archaeological and cultural values are described, identified, and taken into consideration prior to implementing undertakings.
- Follow procedures outlined in the CRMP for consultation with the Service's Regional Historic Preservation Office, the State Historic Preservation Office, and potentially interested American Indian tribes.
- Develop a step-down plan for surveying lands to identify archaeological resources and for developing a preservation program.

VISITOR SERVICES

Cache River NWR Goal 4: Develop compatible, wildlife-dependent recreation programs that lead to enjoyable experiences; a greater understanding of fish, wildlife, and habitat conservation; and a greater appreciation for the value of Cache River NWR.

Discussion: Cache River NWR provides each of the wildlife-dependent recreational uses identified as priority public uses of national wildlife refuges in the Improvement Act. These priority uses are hunting, fishing, wildlife observation, wildlife photography, and environmental education and interpretation. The primary public uses of the refuge are hunting and fishing.

Cache River NWR Objective 4-1: Visitor Services Plan and Public Use Management

Continue to promote and manage appropriate and compatible public uses, and prepare and implement a Visitor Services Plan within 6 years of the date of this CCP.

Discussion: The refuge does not have a current Visitor Services Plan. This step-down management plan will provide guidance for management efforts and programs on behalf of public visitation. This plan will improve the ability of staff to provide the visiting public with compatible opportunities to enjoy and appreciate fish, wildlife, plants, and other resources. As a result, the visiting public will develop an understanding and appreciation of each individual's role in the environment, and in particular wildlife conservation, today and into the future.

All existing visitor services activities occurring on the refuge have been evaluated for appropriateness and compatibility. All activities have also been determined to be one of the six priority public uses, to support one of the priority public uses, or otherwise support fulfillment of the purposes of the refuge or the mission of the Refuge System. The refuge is typically open for public use 24 hours a day, 7 days a week. There are no entrance fees. Visitors can gain access to refuge habitats to engage in priority public uses by using 144 miles of gravel roads, 36 boat ramps, and several miles of foot trails.

Each year, 6 waterfowl sanctuaries totaling 5,200 acres along the Cache River are closed to all public entry and use from November 15 – February 28. Access to the refuge to conduct priority public uses is allowed by automobile, ATV (hunting only), bicycle, motorized boat, canoe/kayak, and walking. Use of airboats, personal watercraft (e.g., jet skis, hovercraft) and horses/mules are prohibited.

Strategies:

- Monitor, evaluate, and modify as necessary all public uses to minimize conflicts between user groups and ensure compatibility.
- As soon as resources become available, recruit a park ranger (Visitor Services manager) to fully develop and coordinate a comprehensive visitor services program for the refuge and the Complex.
- As soon as resources become available, hire a full-time park ranger (law enforcement) to provide adequate visitor and resource protection and assist with outreach efforts.
- Develop a Visitor Services Plan (with public and partner involvement) that addresses the current and future recreational needs of refuge visitors and associated visitor services, including opportunities for mobility-impaired visitors; reflects applicable legislation, Service and NWRs missions, directives, and policies; and supports refuge goals and objectives.
- The plan will specify programs for each type of public use, propose new facilities, address maintenance, upkeep, replacement, and/or elimination of current facilities, and identify a prospective timeline for implementation.
- Continue to expand compatible opportunities for public access, when feasible, by providing additional access roads, trails, and boat ramps.
- Continue to maintain and improve, in a compatible manner, existing access areas to provide for visitor safety, accessibility, and satisfaction.
- Ensure that all compatibility determinations are re-evaluated as necessary.
- Limit ATV access to designated roads or trails only, and allow ATV access only to support hunting.
- Maintain prohibition on camping. In order to reduce conflicts with AGFC WMA regulations, better educate refuge Quota Gun Deer hunters, via pertinent information in the refuge hunt brochure and by other means, that they cannot camp (with guns) on AGFC WMAs.

Cache River NWR Objective 4-2: Visitor Welcome and Orientation

Identify and purchase (if necessary) a site for a visitor center and new headquarters, and implement visitor welcoming and orientation recommendations of the Cache River NWR Visitor Services Review Report.

Discussion: There is a main entrance sign located at the refuge headquarters and directional signs on major roads leading to main refuge access points. Seven kiosks are located and situated to obtain the best visibility. They offer hunting and fishing regulations, as well as a map of the refuge. Regulatory signs mark the seasonal waterfowl sanctuary boundaries. Seasonal “road closed” signs are used to mark flooded trails, as well as the waterfowl sanctuary. An annual hunting brochure with current regulations is available at the kiosks, headquarters, upon request by phone, and on the refuge website. The general leaflet is also available at headquarters, kiosks, upon request by phone, and on the refuge website.

The refuge has a small visitor contact station but no visitor center. The headquarters has one restroom, fully accessible, that is made available to the public during office hours. Visitor hours are posted on the website, on kiosks, and are available at the headquarters. The headquarters is closed

on weekends, evenings, and federal holidays. The refuge has a limited staff and no visitor services personnel. Various staff interact with the public and provide customer service. The public can generally reach a refuge employee when telephoning the office.

The current office at Cache River NWR is not suitable for visitor reception or any type of environmental education or interpretive activities. It also is impractical for meetings with partners or the public. This building is not fully accessible. Construction of an environmental education/visitor center is warranted to provide a suitable facility to allow for efficient public use management and administration of a comprehensive visitor services program for the Complex, including opportunities for advanced environmental education and interpretation. An environmental education/visitor center, situated within easy access to Interstate 40, between the metropolitan areas of Little Rock, Arkansas, and Memphis, Tennessee, would be available for use by literally millions of people annually.

The proposed facility would be approximately 3,500 to 4,500 square feet in size, and would include conference room, auditorium, environmental education classrooms, exhibit and display areas, break room, public restrooms, staff offices, secure law enforcement storage, utility/storage closets, fax/photocopy/file rooms, mudroom, bookstore, friends group and volunteer/receptionist offices. This facility would be fully ADA-compliant and provide adequate opportunities for visitor reception, environmental education, interpretation, and public meetings, and provide necessary administrative function. Greening features would be incorporated to lessen environmental impacts and carbon footprint to allow use of alternative energy sources, energy-conserving design and equipment, and water-conserving and recycling features.

Public roads are maintained but not marked with traffic control signs or directional signs. Parking lots are adequate for the level of use through most of the year. Some unimproved roads must be closed due to heavy rains and flooding that may occur throughout the year.

Strategies:

- Plan and design an environmental education/visitor center for Central Arkansas NWR Complex at a suitable site on existing or newly acquired refuge lands within easy access of I-40 or Highway 64, or at the existing headquarters site, whichever is deemed most feasible. This facility would be used to educate the public about the Refuge System and the Complex, to provide a setting for appropriate environmental education programs and curricula, to provide visitor services, and to enable proper administration of public use programs.
- Revise the general refuge brochure and include a 4-panel fold out map.
- Develop one public use map that can be used for all brochures and kiosks, and that identifies the location of boat ramps and other public use facilities.
- On the kiosk maps, incorporate a small complete map with an enlargement of the individual areas and include "you are here" arrow.
- Place a sign in the public parking area at the headquarters that displays office hours.
- Place signs 0.5-mile north and south of the refuge headquarters on Highway 33 to alert visitors to its location.
- Consider ways to make kiosks more inviting to the public (e.g., use a different color scheme or a banner with refuge name.)
- Ensure that refuge brochures, maps, and other visitor services products are up-to-date and readily available to the public.

Cache River NWR Objective 4-3: Hunting

Annually provide and expand quality, compatible hunting opportunities as feasible.

Discussion: Biologically sound hunting is a legitimate activity on national wildlife refuges and is one of the six priority public uses identified in the Improvement Act to be given enhanced consideration over other uses, as long as it is found to be compatible with refuge purposes. Cache River NWR is open to the public for hunting – hunters are allowed to hunt anywhere not posted as “Area Closed.” Cache River NWR has an approved (step-down management) hunting plan but a revision will be completed after CCP approval (see Chapter IV for a schedule of all the refuge’s step-down management plans). Currently, access is allowed via walking, motor vehicle, ATV (September 1 to February 28; designated roads and parking areas only), bicycle, motorboat, canoe, and kayak. All vehicles, including ATVs and bicycles, are restricted to designated roads, trails, and parking areas. Public access to hunt areas may be closed at any time necessary to protect refuge resources or visitors. Horses/mules are prohibited. Mobility-impaired hunters may apply for a special use permit, to allow specialized access by ATV. The refuge participates in an annual hunt coordination meeting with the AGFC.

Cache River NWR is best known for its waterfowl hunting opportunities and hunters enjoy relatively high success rates. Waterfowl hunting has no limits on participation, but generally is self-regulated by hunting pressure or availability of water on the refuge. Use of retriever dogs is allowed. Commercial hunting or guiding is strictly prohibited.

Archery deer hunting is permitted and is open concurrent with the state season (October 1 – February 28); hunter numbers are not limited. However, hunter numbers are limited for the Quota Gun Deer Hunt, which is held in mid-November (currently 7 days). Currently, a maximum of 2,000 permits are issued on a first come, first served basis. Muzzleloader deer hunts are conducted in mid-October and late-December for a total of 8 days; participation is not limited. A 2-day youth deer gun hunt is conducted during the statewide youth hunt the first weekend in November, and hunter numbers are not limited. Managers review participation rates and deer harvest to guide future management decisions. All hunting programs are conducted within AGFC season frameworks, but some hunts are shorter than corresponding state seasons.

Fall turkey hunting is permitted, with seasons varying by refuge unit. Small game hunting is allowed in accordance with state regulations and with the use of steel shot and rim fire rifles. Dogs are allowed for quail hunting and are required for night hunting of raccoon/opossum. Dogs are allowed for rabbit and squirrel hunting, beginning December 1.

Law enforcement is provided by one collateral-duty law enforcement officer (refuge manager) and one full-time Complex law enforcement officer, with some assistance by AGFC game wardens. Generally, law enforcement is inadequate for the number of hunters using the refuge. An additional law enforcement officer is needed to assist the four refuges within the Complex. Current staffing numbers allow for adequate administration of the hunting program.

Additional opportunities for youth turkey, waterfowl, and dove hunting could be provided without significantly increased amounts of staff time. There is also the potential to use increased deer hunting, to better achieve deer population objectives, for the general public in the form of additional quota permits during the Quota Gun Deer Hunt and/or additional hunt days.

Regulated trapping is a sound management tool that can aid the refuge in attaining habitat and wildlife management objectives and control nuisance wildlife. Beavers must be controlled to protect infrastructure and reduce damage to trees, impoundments, croplands, and other wildlife habitat. Additional problems

result from habitat and infrastructure damage by nutria and feral hogs, disease-infected furbearers, and predators impacting priority wildlife species. Trapping for commercial purposes can be a biologically sound management tool that allows the refuge to control nuisance animals and reduce associated negative impacts at minimal cost to the refuge, while providing economic and recreational benefits to the public. Commercial trapping by the general public would be conducted during state trapping seasons, administered through special use permits, and trapper numbers could be regulated by quotas.

Strategies:

- Continue to conduct annual cooperative AGFC/refuge hunt coordination meetings and standardize hunting regulations across Arkansas national wildlife refuges and wildlife management areas, where and when feasible.
- Utilize hunt administration methods, such as quotas, permits, reduction in number of hunt days, and hunt zones if warranted, to maintain quality and safety of hunting activities, or to reduce conflicts with other public uses.
- Periodically evaluate hunter satisfaction and quality of hunts.
- If waterfowl hunting quality diminishes, modify current hunting practices, in conjunction with AGFC, to improve quality of hunts through methods such as reducing number of hunt days, reducing number of hours of daily hunting, or zoning hunt areas.
- Create additional opportunities for youth waterfowl, dove, deer, and turkey hunting as feasible.
- Create additional opportunities for big game hunters by expanding modern gun deer hunting if feasible.
- Create additional opportunities for small game hunters by opening up dove, snipe, and woodcock hunting to statewide seasons, if such action does not conflict with refuge purposes or other uses.
- Consider allowing hunting dog training (not field trials) specifically for facilitating hunting if such action does not conflict with refuge purposes.
- Consider allowing commercial trapping for furbearers under special use permit to control nuisance wildlife and protect refuge infrastructure, wildlife habitat, and priority wildlife species.
- Consider allowing hunting of furbearers in accordance with AGFC regulations, subject to any additional refuge-specific regulations or restrictions necessary to ensure compatibility, safety, hunt quality, and to minimize conflicts with other users.
- Annually evaluate the number of Quota Gun Deer Hunt permits issued to determine if any adjustments are necessary.
- Revise the hunt brochure to include a quick reference chart listing hunt dates, the phone number (800/482-9262) for reporting wildlife violations, and an improved map that better delineates the hunt units.
- Allow ATV access for hunting only and restrict access to designated roads, trails, and parking areas. ATV access will be permitted only from September 1 to February 28.
- Mobility-impaired hunters may apply for a special use permit, allowing specialized access by ATV. Provide hunting opportunities for mobility-impaired hunters as feasible.
- Monitor ATV access and modify as needed to mitigate any negative impacts to refuge habitats, infrastructure, and visitors, in compliance with Executive Orders 11644 and 11989.
- Monitor hunting activities and ensure the hunt program is administered in a compatible manner; modify practices as warranted.

Cache River NWR Objective 4-4: Fishing

Annually provide and expand quality, compatible fishing opportunities as feasible.

Discussion: The Cache River, numerous adjacent oxbow lakes, and man-made Miller Pond provide fishing opportunities from a boat and/or the bank. These waters provide habitat for popular fish sought by anglers including bass, catfish, crappie, and bream. Other fish species often caught include drum, carp, smallmouth buffalo, and gar. The best fishing opportunities are from spring through early summer, then again in the fall. Each year, 6 waterfowl sanctuaries, located approximately every 10 miles along the Cache River, are closed to all public use and entry from November 15 through February 28, which are clearly marked with “Area Closed” signs.

Recreational fishing (including bow fishing and frogging) is permitted year-round in accordance with state regulations and is one of the top two public activities on the refuge. In addition to fish and frogs, visitors may also collect crawdads (crawfish) for their personal use. No special permit is required for fishing in refuge waters.

The fishing program is administered under a Fishing Plan and Environmental Assessment approved in 1995, and a compatibility determination. An updated Fishing Plan will be completed. Seven kiosks located at main access points to the refuge provide general public use information and maps. In addition, fishing regulations can be found in the annual Public Use, Hunting, and Fishing Brochure. Signs designating boundaries of the Managed Access Area were installed in 2004 to protect the re-discovered IBWO, and remain in place, but normal access is currently allowed into these areas. Commercial fishing is allowed under special use permit (\$50 fee) for rough fish to remove exotic species, reduce negative impacts of aquatic habitat, and provide economic benefits to the local community. Twenty special use permits were issued for commercial fishing in 2008. Fishing tournaments are prohibited on refuge waters. No user conflicts have been apparent with recreational or commercial fishing.

One issue that needs to be addressed is littering by bank fishermen. Due to minimal staffing, only one full-time law enforcement officer and one collateral-duty officer are available to patrol the refuge, which encompasses 70 miles of river and associated tributaries, lakes, and floodplain forests situated over four counties. Law enforcement assistance is provided by AGFC wildlife officers.

Public access for fishing is allowed via automobile, bicycle, walking, motorized boat, and canoe/kayak. The refuge provides a total of 36 boat ramps: five concrete ramps along the Cache River; 17 gravel ramps, mostly on the chain lakes; and 14 primitive ramps in more secluded areas. Directional signs for many of the ramps exist along the roadways. During high water and flood events, many refuge access roads are gated and closed to vehicles. While gated and flooded, motorized boats frequently use the roads as running lanes, which allows access to excellent fishing areas. ATVs, horses/mules, and airboats are prohibited year-round for fishing access.

A 2.5-acre former minnow pond has been converted to a catfish pond (Miller Pond) and is now used annually for the refuge youth fishing event. Just before the event, the pond is typically stocked with about 3,000 pounds of catfish to provide for a high catch success rate. The event now attracts more than 200 participants. National and local sponsors have partnered with the refuge for a very successful and well-attended community event. No facilities exist at the site and all fishing is from the bank. Due to excessive littering and other undesirable activity at this site, the refuge has closed this area to public entry and use and is planning to maintain it exclusively for fishing and other special events. In 2008, special fishing days were held at Miller Pond for McCrory Elementary School “Hooked on Fishing, Not on Drugs” program and the Woodruff

County Health Center (long-term care facility). These events were very well received by participants. Special events such as these promote fishing as a legitimate recreational activity, provide the public with a better appreciation for the role of the refuge in the community, and provide opportunities for outreach and education.

Strategies:

- Update the brochure map to increase visitors' recognition of refuge access points for fishing.
- At Miller Pond, consider improvements that would aid universal accessibility.
- Work with the Service fisheries biologists to improve the refuge's fisheries and aquatic habitats where feasible.
- Expand if feasible, special fishing events to further the accomplishment of refuge goals and Refuge System mission.
- Monitor fishing activities and ensure the fishing program is administered in a compatible manner; modify practices as warranted.
- Periodically evaluate angler satisfaction and quality of the fishing experience on the refuge.

Cache River NWR Objective 4-5: Wildlife Observation and Photography

Annually provide and expand quality, compatible wildlife observation and photography opportunities as feasible.

Discussion: Currently, there are few facilities developed specifically for wildlife observation and photography, but due to the location of the refuge, abundance and diversity of wildlife, and improved access, opportunities abound for visitors seeking to view wildlife. Access to the refuge for wildlife observation and photography is typically allowed 24 hours a day, 7 days a week. However, 6 waterfowl sanctuary areas, comprising 5,200 acres along the Cache River, are closed to all public entry and use from November 15 – February 28 annually. Visitors can use 144 miles of gravel roads for automobile access, and 36 boat ramps are located throughout the refuge that provide boat, canoe, and kayak access to the Cache River and numerous oxbow lakes. A birding trail is located on the George Tract and numerous abandoned roads, logging trails, and game trails enable visitors to view and photograph refuge habitats and wildlife on foot. Horses/mules and ATVs are prohibited year-round for wildlife observation and photography.

Much excitement was generated in the area during 2005, when the announcement was made that an IBWO had been sighted on the refuge. At that time, special public access regulations were put in place to protect the species, which had been thought to be extinct for 60 years. Informational kiosks were installed at various refuge locations to provide identification details for the IBWO. Visitors are encouraged to keep a watchful eye out for this species and report any findings to the refuge.

For visitors who make the effort to access the “back woods” of the refuge, a variety of wildlife may be spotted, including white-tailed deer, river otters, raccoons, beavers, bobcats, black bears, wild turkeys, squirrels, rabbits, quail, numerous reptiles and amphibians, egrets, herons, and many songbirds. Beginning in early November, waterfowl, including hundreds of thousands of Mallards, arrive to overwinter in what is currently considered by the NAWMP to be the most important wintering area for Mallards in North America. Refuge bottomland hardwood forests provide an excellent food source, consisting of dozens of species of invertebrates, hard mast, annual seeds, and natural vegetation for Mallards and other ducks. This high-protein and carbohydrate-rich diet prepares a

healthy broodstock, as the ducks depart for spring nesting grounds in northern parts of the continent. Managed, flooded farm fields and moist-soil units also provide good waterfowl habitat and some waterfowl viewing and photography opportunities exist along highways.

Perhaps the most noticeable wildlife during summer months are the abundant songbirds in the hardwood forests and swampy areas. Songs of dozens of species of birds are easily heard at every stop. Indigo Buntings, White-eyed Vireos, Carolina Wrens, Cardinals, Chickadees, Tufted Titmice, Eastern Wood Peewees, and a variety of woodpeckers are among the more common of the passerines.

Strategies:

- Install a trailhead kiosk at the start of the birding trail on the George Tract to provide information about the length of the trail and viewing highlights along the way.
- Improve and maintain the surface of the birding trail on the George Tract, and install wayside exhibits at points of interest along the trail.
- Develop a canoe trail on Bayou DeView or Cache River, if feasible.
- Develop observation towers at the Plunkett and Dixie Farm Units and Howell Tract.
- Develop an observation structure at Bayou DeView on Highway 17, if feasible.
- Monitor wildlife observation and photography activities and assess any potential negative impacts to refuge habitats, wildlife, or visitors to ensure compatibility, and modify activities to eliminate or minimize conflicts.

Cache River NWR Objective 4-6: Environmental Education and Outreach

Annually provide and expand quality, compatible environmental education and outreach opportunities as feasible.

Discussion: The refuge currently provides environmental education programs upon request from local schools, community groups, university classes, wildlife clubs, and garden clubs. There are several elementary, middle, and high schools in communities, such as Searcy, Brinkley, and Newport, that are all within an hour's drive of the refuge. Little Rock and Memphis are both over one hour away, which may be too far for their school groups to travel; however, the refuge could be utilized by scout groups from these cities.

Opportunities exist in the immediate local communities for educational programs involving Boy Scout groups. There are three universities within the vicinity and instructors and students display occasional interest in the refuge. No facilities are available on the refuge to support formal, on-site education programs. AGFC's Education Division has approximately 60 staff located across the state and effective partnerships could be created to support this activity.

The refuge staff has not developed outreach plans for communicating important individual resource issues to the public or for addressing long-term resource issues important to the refuge, the community, or other audiences (e.g., waterfowl and migratory bird management, wetland restoration, and endangered species such as the IBWO). Some members of the community have negative attitudes or resentment about the refuge, due to federal ownership. Conversely, a good deal of support exists as well.

The Service and Refuge System messages are incorporated into refuge programs. The key wildlife and habitat conservation messages for the refuge would include importance of wetlands (particularly bottomland hardwood ecosystems), endangered species, such as the IBWO, and the value of the refuge

as important habitat for wildlife. The importance of the refuge as a critical wintering ground for waterfowl also should be emphasized. These messages should be communicated through outreach activities, such as when the refuge manager delivers programs both on and off the refuge. The refuge also uses news releases, an internet website, and personal contacts to communicate outreach messages.

Strategies:

- Recruit a park ranger (Visitor Services manager) to plan, develop, and implement an environmental education program for the refuge.
- Develop three education programs, with assistance available from the Regional Office, to present on request, covering such topics as waterfowl, shorebirds, migratory birds, and habitat management programs.
- Partner with Boy Scout troops to enable refuge staff to serve as merit badge counselors for badges such as Bird Study, Environmental Science, Fish and Wildlife Management, Fishing, Forestry, and Mammal Study.
- Recruit and train volunteers to provide select environmental education and outreach programs/activities on and off the refuge.
- Continue to develop and maintain effective communications and information exchange with congressional staff.
- Continue to work with local TV and radio stations and newspapers to expand opportunities for outreach.
- Conduct an annual media day or open house event sometime around National Wildlife Refuge System Week or before the waterfowl sanctuary closes in November; partner with AGFC and others to implement this event.
- Evaluate whether the refuge could better accomplish outreach and promote community support by joining one of the local chambers of commerce or one or more appropriate community/civic organizations.

Cache River NWR Objective 4-7: Interpretation

Annually provide and expand quality, compatible interpretation opportunities as feasible.

Discussion: Currently, waterfowl and migratory bird management are the primary themes and messages that are interpreted on the refuge. There is no indoor space dedicated to resource interpretation for visitors. The headquarters is too small and the structure is inadequate for interpretive displays. The refuge offers a general brochure, posters, bookmarks, magnets, rulers, and stickers with general interpretive messages. A small area in the office contains animal pelts, skulls, and wildlife specimens that can be viewed by the public. The refuge also has seven kiosks in various locations that offer space for hunting, access, and regulatory information and these could be utilized for additional interpretive messages. At present, there are no portable exhibits or displays for interpreting key resources to off-site audiences. An upgrade to the interpretive birding trail at the George Tract is being planned.

Strategies:

- Develop and install interpretive panels at the porch area of the new Headquarters (whenever constructed), at the observation towers, at major access points to the refuge, and at the Interpretive Birding Trail on the George Tract, that would cover a range of interpretive themes such as: (1) Purposes and significance of Cache River NWR; (2) migration of waterfowl and shorebirds; (3) benefits of providing waterfowl sanctuary; (4)

need for reforestation; (5) managing forest habitat for migratory birds; (6) cropland and moist-soil management for waterfowl and shorebirds; and (7) priority public uses of the Refuge System.

- Maintain a portion of the Howell Tract as a demonstration/public use area, including an observation tower and an interpretive trail with signage about the various habitats and wildlife observed and associated management practices.
- Develop signage at reforestation areas that displays the dates when sites were reforested and include interpretive panels about the reforestation process at select sites.

REFUGE ADMINISTRATION

Cache River NWR Goal 5: Provide support and sufficient resources necessary to ensure that goals and objectives for habitats, fish and wildlife management, resource protection, visitor services, and refuge administration are achieved for Cache River NWR in particular and Central Arkansas NWR Complex overall.

Discussion: Both the Biological Review and the Visitor Services Review teams specified additional staffing, facilities, and equipment needed to implement the refuge's purposes, vision, goals, and objectives identified in this CCP.

Cache River NWR Objective 5-1: Staffing

As resources become available, strategically add 13 staff positions that will improve the capacity and capability of Cache River NWR and the other refuges in the Central Arkansas NWR Complex to achieve their legislated purposes and accomplish conservation and management goals and objectives.

Discussion: An additional law enforcement officer would help the refuge and the Complex protect critical wildlife and habitat resources, as well as the safety of staff and the public. This position is also necessary to accommodate proposed expansion of the refuge's visitor services program.

No visitor services staff exists on Cache River NWR or the Complex. Existing staff have neither the expertise nor the time to devote to expanded public use on the refuge. A park ranger (Visitor Services manager) must be recruited to develop and implement a visitor services plan as part of a comprehensive visitor services program for Cache River NWR. Additional responsibilities would include expanding the volunteer and intern program and coordinating the establishment of a friends group. Environmental education and outreach programs would be implemented that would promote the refuge and help connect over 1,000,000 residents with nature. Development of an on-site interpretive program would involve updating and/or creating various printed materials, such as brochures and bird, reptile, and amphibian lists. The Visitor Services manager also would coordinate planning and development of public use facilities, kiosks, information stations, nature trails, and observational towers and blinds.

A supervisory wildlife refuge specialist is needed to assist with increased administrative burdens, greater scope and complexity of refuge programs, and to supervise management projects. Enhanced biological, habitat, and land acquisition programs will require additional resource specialists and maintenance personnel to plan and implement management projects and to operate and maintain facilities, infrastructure, and equipment.

Strategies:

- Upgrade current office assistant and biologist positions on Cache River NWR to appropriately reflect the true scope, complexity, and effect of their duties and responsibilities within the individual refuges and the Complex.
- Recruit a park ranger (Visitor Services manager) to fully develop and coordinate a comprehensive visitor services program for the refuge and the Complex.
- Recruit a realty specialist to coordinate land acquisition and survey management projects on the Complex and other refuges in Arkansas and adjacent states.
- Recruit a biological technician to assist with inventoring, monitoring, moist-soil, and other biological programs on Cache River NWR and the Complex.
- Recruit an assistant forester to assist with planning, development, and implementation of the forest management program on Cache River NWR and the Complex.
- Recruit a forestry technician to assist with forest inventory, silviculture, reforestation, invasive plant and animal control, and other habitat management programs on Cache River NWR and the Complex.
- Recruit a full-time park ranger (law enforcement) to provide adequate visitor and resource protection and assist with outreach efforts on Cache River NWR and the Complex.
- Recruit an ecologist with Complex-wide responsibility to plan and implement ecosystem management and strategic habitat conservation, coordinate research projects, and coordinate with partners on landscape scale projects.
- Recruit a natural resource planner to coordinate preparation and implementation of CCP projects, step-down management plans, appropriateness and compatibility determinations, and NEPA processes on refuges in Area 1 (Arkansas, Louisiana, Kentucky, and Tennessee) and elsewhere.
- Recruit a supervisory wildlife specialist to assist with administrative needs, provide daily supervision of staff, and coordinate operations and management projects on Cache River NWR.
- Recruit an additional office assistant to assist with administrative, clerical, and data management programs on Cache River NWR and the Complex.
- Recruit a facilities operations specialist to coordinate operations and maintenance of Service-owned assets on the Complex.
- Recruit an engineering equipment operator to assist with implementation of habitat management, facilities maintenance, and visitor services facilities projects on Cache River NWR and the Complex.
- Recruit a laborer to assist with maintenance and repair of equipment, facilities, and infrastructure, and assist with implementation of habitat and biological programs on Cache River NWR.
- Recruit a hydrologist to be based at Big Lake NWR to coordinate hydrological and water quality issues on all refuges within the Complex, coordinate hydrological research and monitoring, provide technical advice to adjacent landowners, serve as a liaison with COE, and coordinate aquatic restoration projects.

Cache River NWR Objective 5-2: Volunteers, Partners, and Friends

Expand the volunteer and intern program, establish a friends group for the refuge within 5 years of the date of this CCP, and cooperate with partners to accomplish refuge goals and objectives.

Discussion: The refuge has a small number of active volunteers and seasonal interns. The majority of volunteer time spent at the annual Fishing Derby. These volunteers sign volunteer agreements and their time is recognized by “Thank You” notes and gifts, as well as recognition in local newspaper articles. The refuge does not have a friends group, but the Friends of Felsenthal help the refuge with resources for special projects on occasion. There is potential to work with local Boy Scout groups on volunteer projects. Scout troops often seek out community service activities, and individual scouts pursuing the Eagle Scout rank must conduct projects that benefit the community and nation.

Strategies:

- Recruit a park ranger (Visitor Services manager) to coordinate volunteer, friends, and partner programs.
- Develop a list and descriptions of projects that volunteers and interns can assist with to facilitate accomplishment of refuge programs.
- Periodically place articles in local papers describing volunteer opportunities at the refuge, projects volunteers have accomplished, and promoting the volunteer program.
- Recruit Boy Scout troops for assistance with specific projects that would enable them to contribute to community service activities, and offer opportunities for scouts pursuing their Eagle Scout rank to perform projects that benefit the community and nation at the refuge.
- Coordinate with universities in Arkansas and elsewhere to recruit high-quality interns to assist the refuge with operations, inventory, and management programs.
- Recruit volunteers from local universities, high schools, church groups, and civic organizations.
- Conduct a community open house on the refuge to promote volunteer opportunities and a friends group.
- Enlist volunteers and community leaders to assist with establishing a friends group for Cache River NWR and consult with other refuges that have successful friends groups to learn from their experiences in establishing such groups.
- The refuge manager and visitor services manager should attend friends group training.

Cache River NWR Objective 5-3: Facilities, Infrastructure, and Equipment

Acquire and maintain all of the facilities, infrastructure, and equipment necessary to perform habitat management, restoration, and enhancement on the refuge in addition to maintaining and improving essential infrastructure such as roads and levees.

Discussion: Although resources are not currently available to construct a facility that would adequately meet the needs of the public and the staff, a project for an environmental education/visitor center is in the Service’s 5-year construction plan for a facility estimated to cost approximately \$4 to \$6 million. The proposed facility would be approximately 3,500 to 4,500 square feet in size, and would include staff offices, conference room, auditorium, environmental classrooms, exhibit and display areas, breakroom, staff and public restrooms, secure law enforcement storage, utility/storage closets, fax/photocopy/file rooms, mudroom, bookstore, friends group office, and volunteer/receptionist office. This facility would be fully ADA-compliant and provide adequate administrative function. It would enable suitable opportunities for visitor reception, environmental education and outreach, interpretation, and public meetings. The building design would incorporate greening features, including energy-conserving lighting, HVAC and insulative qualities, water-conserving systems, and alternative energy. The building would be designed and constructed to reduce its carbon footprint and lessen environmental impacts, and also would provide a safe and comfortable environment for staff and visitors. Additionally, there would be sites for interpretive foot trails, wayside exhibits, and outdoor kiosks.

The environmental education/visitor center could be sited within approximately 5 miles of I-40, on existing or newly acquired refuge lands accessed from either the Brinkley or Biscoe exits, on refuge lands accessible from Highway 64 near Augusta/McCrory, Arkansas, or in the current location at Dixie, Arkansas, whichever area is assessed to be the most feasible, practical, and desirable. The current office and maintenance buildings would be retained for operational purposes, unless the Dixie site is selected and then the current office building would be removed and full administrative capabilities would be incorporated into the design of the environmental education/visitor center. Project funding would

include planning/design, engineering, construction, furniture, interpretive exhibits, landscaping, and parking areas.

Heavy equipment such as excavators, backhoes, road graders, dump trucks, and tractors are essential for active habitat management/manipulation and maintenance of infrastructure on national wildlife refuges. The refuge contains over 100 miles of primitive surface and gravel public access roads, boat ramps, parking areas, over 10 miles of levee systems, moist-soil impoundments, and ditches that require annual maintenance.

Strategies:

- Plan and design an environmental education/visitor center for the Central Arkansas NWR Complex at a suitable site on existing or newly acquired refuge lands within easy access of I-40 or Highway 64, or at the existing headquarters site, whichever is deemed most feasible and desirable. This facility would be used to educate the public about the Refuge System and the Complex, to provide a setting for appropriate environmental education programs, to provide visitor services, and to enable proper administrative functions.
- Keep all machinery, equipment, facilities, and infrastructure in good working order by regular upkeep and maintenance.
- Annually update and maintain the Equipment Priority Index (EPI) report to identify station heavy equipment needs.
- Expand the existing equipment storage pole shed to provide adequate storage for all refuge light and heavy equipment.
- Construct an environmentally-compliant heavy equipment washing pad area adjacent to the existing equipment storage shed.
- When feasible, share equipment with other refuges in the Complex or refuges in Arkansas and surrounding states to minimize need for additional equipment purchases.
- Replace heavy equipment within the guidelines and time frames established by the Regional Heavy Equipment Coordinator, including:
 - 1992 John Deere 410D Backhoe.
 - 1991 John Deere 4555 tractor.
 - Two 1998 John Deere 6400 tractors.
 - 1997 John Deere 770C road grader.
 - 1999 Sterling truck tractor.
- Recruit an additional engineering equipment operator and a laborer to assist with implementation of habitat management, visitor services, and maintenance projects, and maintain facilities, infrastructure, and equipment.
- Recruit a facilities operations specialist to coordinate operations and maintenance of Service-owned facilities, infrastructure, and equipment on the Complex.

WAPANOCCA NATIONAL WILDLIFE REFUGE

NOTE: All goals, objectives, and strategies described below for Wapanocca NWR are set in the time context of the 15-year planning cycle of this CCP unless otherwise indicated in individual objectives or strategies.

FISH AND WILDLIFE POPULATION MANAGEMENT

Wapanocca NWR Goal 1: Manage and protect migratory birds and native wildlife populations on Wapanocca NWR to fulfill the purpose for which it was established and to contribute to the mission of the Refuge System.

Discussion: Wapanocca NWR was set aside, as was each refuge in the Complex, to provide habitat for migrating and wintering waterfowl. Originally the site of the prestigious Wapanocca Outing Club, a hunting club formed in 1886, it has since been managed to attract waterfowl for more than a century. At least 200 species of upland and wetland birds are known to breed, winter, or migrate through the general refuge area. As such, Wapanocca NWR fulfills an important role in the bird life of the MAV. Wapanocca NWR offers a diverse mix of habitats for birds and other native wildlife, that range from mature forests to recently reforested farmlands, scrub-shrub habitats, forested swamps, moist-soil areas, and a shallow reservoir with mudflats and fringes of emergent wetland vegetation.

Wapanocca NWR Objective 1-1: Migratory Waterfowl

Within 5 years of the date of this CCP, increase DEDs from the current level of 613,193 to 1,370,000 DEDs of managed waterfowl habitat that includes moist-soil, bottomland forest, un-harvested cropland, and forested swamp habitats, flooded to a depth of two feet or less, in sanctuaries (November 1 – February 28) sufficient to meet the habitat and population goals of NAWMP as stepped-down through the LMVJV.

Discussion: Concern over waterfowl population declines in the 1980s resulted in establishment of the NAWMP, which focused the attention of federal, state, and private conservation groups on critical wintering and breeding areas. The LMVJV, which encompasses all four refuges in the Complex, was selected as one of the wintering habitat focus areas. One of the first tasks faced by the LMVJV was to develop a model or decision tool for determining how much habitat was needed, and a method for relating this objective to the population goals of the NAWMP. The solution was to consider wintering areas as responsible for contributing to the spring breeding population goals of NAWMP proportional to the percentage of ducks historically counted in wintering areas (Loesch et al. 1994; Reinecke and Loesch 1996). In order to contribute ducks to spring breeding populations, wintering areas must provide sufficient habitat to ensure adequate winter survival. To quantify winter habitat requirements, the LMVJV had to identify limiting factors and made an assumption that foraging habitat was the most likely factor to limit waterfowl populations in the LMV (Reinecke et al. 1989). The process of relating habitat objectives for individual management areas to overall habitat objectives for the LMV involved several steps (Biological Review for Bald Knob and Cache River NWRs, USFWS 2008). Step-down objectives were established for Wapanocca NWR (Table 12). DED objectives were calculated by multiplying the acreage objective by the assumed DED standard developed by the LMVJV for that habitat type.

Table 12. Wapanocca NWR - Current migrating and wintering waterfowl foraging habitat objectives established by the LMVJV

Habitat	Objective ¹ Acres (DED) ³	Current Capability ² Acres (DED) ⁴	(+ or -) Acres (DED)
Moist-soil	138 (257,784)	200 (373,600)	+62 (+115,816)
Bottomland Forest	317 (39,942)	41 (2,809)	-276 (-37,133)
Unharvested Crop	85 (1,072,870)	68 (223,470)	-17 (-849,400)
Harvested Crop	0 (0)	0 (0)	0 (0)
Forested Swamp	0 (0)	2,354 (13,314)	+2,354 (+13,314)
Total	540 (1,370,596)	2,663 (613,193)	+2,123 (-757,403)

¹Acreage and DED objective provided by the LMVJV office 2003.

²Current acreage and DED capability (has levees and water control structure, some have pumping capability) provided by refuge staff.

³DED estimates, calculated by using standard DED figures provided by LMVJV.

⁴Updated DED estimates adopted by the LMVJV Waterfowl Working Group in June 2006: moist-soil, 1,868 DEDs/ac; bottomland hardwood, 191 DEDs/ac; unharvested crop, 14,061 DEDs/ac (estimate based on actual acres of various grain crops left unharvested and flooded during the winter period); harvested crop, 287 DEDs/ac (estimate based on actual acres of various harvested grain crops flooded during the winter period).

This refuge has opportunities to provide most components of waterfowl foraging habitat (e.g., grains, browse, moist-soil, wooded swamp/bottomland forest, aquatic plants) in conjunction with necessary sanctuary. Much of the refuge's original open lands (croplands) have been planted back to hardwood forest; however, the refuge still provides some habitat for Canada Geese, White-fronted Geese, and Snow/Blue Geese. Although use by Canada Geese has declined, it is important that the refuge maintain its capability to harbor geese – a species group with high site fidelity. Current NAWMP plans for geese in the Mississippi Flyway include the objective of providing geese with suitable habitat on traditional southern wintering grounds; thus, there is a need for some open lands and agricultural crops. In order to best achieve refuge purposes given the current and expected waterfowl use patterns at Wapanocca NWR, it is necessary to re-evaluate the current cooperative farming program and implement modifications that would better enable the refuge to fulfill its purpose. Priorities for habitat management need to be adjusted to provide better habitat for other migratory birds that will use the refuge more intensively than Canada Geese. These adjustments will result in reductions in annually farmed acreages and increases in grassland/scrub-shrub habitat management adjustments in types/acreages/locations of crops grown, and intensification and expansion of moist-soil management programs. See Wapanocca NWR Objective 2-3 for specific details in modifying this program. All other farming/moist-soil strategies discussed under Objective 1-1 eventually will be dependent on the outcome of this assessment.

The refuge has 32 moist-soil units, totaling about 288 acres. Unless intensively managed, the suitability of such units to provide needs of wintering waterfowl will decline. Greater flexibility is needed to intensify moist-soil management to include rotating units into the refuge crop-share and cultivating hot foods in these units as a means to set back woody encroachment and control pest plant invasions.

Flooded bottomland forest habitats not only provide food in the form of acorns, fleshy fruits, and invertebrates, but also provide cover, sanctuary, and nesting sites. However, the quantity of actual winter and early spring flooded forests is estimated to provide only 10-15 percent of the refuge's total desired DEDs.

The refuge's 600+ acre Wapanocca Lake is a waterfowl site of major importance. It is crucial as a sanctuary, roosting, feeding, and gathering area. The lake attracts large numbers of dabbling and diving ducks, as well as geese and other non-game waterbirds. Currently, Wapanocca Lake is believed to be the major regional sanctuary site for peaks of over 150,000 ducks and geese. Much care is needed to ensure the long-term biological integrity and environmental health of this lake system.

Another refuge management practice of critical importance is maintaining a high degree of waterfowl sanctuary (area free of disturbance) in several areas within this relatively small refuge during key waterfowl and waterbird use periods - November through February/March. Extensive movements and frequent flight induced by excessive disturbance can have immediate direct and subsequent indirect negative impacts to waterfowl. During this critical period, disturbance to waterfowl must be kept to a minimum to allow them to maintain proper body weight, conserve energy, and build fat and protein levels.

Strategies:

- Minimize human disturbance to wintering waterfowl and migrating shorebirds on Wapanocca Lake by closing the lake to all public entry and use from December 1 through February 28, and limiting other activities, such as bird observation, use of observation blinds, and aerial flyovers, to those necessary for official avian surveys.
- Assess the current and expected waterfowl use of the refuge. If goose numbers of <12,000 per year are expected, then in conjunction with AGFC and the Service's Division of Migratory Birds, determine appropriate adjustments to the cooperative farming program to best achieve refuge purpose and modify the cropland management program accordingly. Proposed modifications to current waterfowl habitat management practices (see Objectives 2-3) include:
 - Adjusting the types, acreages, and/or location of crops grown as necessary to provide forage that will be extensively used by wintering waterfowl;
 - Decreasing underutilized (by waterfowl) farmed acreages by converting such croplands to areas managed in grassland/scrub-shrub habitats;
 - Intensifying and expanding moist-soil management practices in order to best accommodate waterfowl needs;
 - If additional cropland is later required to meet DED needs, return some grassland back to the farming program for use as winter green browse.
- If no adjustments are made to the current cropland management program, then the following strategies would be implemented:
 - Provide for the hot food needs of a mixture of Canada, White-fronted, and Snow Geese in open fields away from forest tree lines, using cooperative farming or force account farming to plant green browse (wheat) in September in open fields (to be available by early November) in order to meet foraging objectives for wintering geese.

-
- Establish and maintain up to 85 acres of unharvested grain crops (mix of milo, millet, corn) in several floodable portions of the wetland impoundments. Rotate such crops every 2 to 3 years in certain moist-soil areas to help set back succession.

Wapanocca NWR Objective 1-2: Wood Ducks

Annually provide approximately 1,200 acres of nesting and brood-rearing habitats to maintain or increase production and meet the Service's Wood Duck banding quotas that will contribute to monitoring the flyway population.

Discussion: In addition to providing food in the form of acorns, fleshy fruits, and invertebrates, flooded bottomland forest at Wapanocca NWR also furnishes cover, sanctuary, and nesting sites for Wood Ducks. These forests and associated swamp and scrub-shrub wetlands are preferred habitat for Wood Ducks, but additional cavity sites can be provided by managing larger, older trees, and maintaining a Wood Duck nest box program. Suitable habitats for Wood Ducks nesting or brooding, such as emergent wetlands, scrub-shrub wetlands, and green reservoirs, should be favored in habitat management activities.

Strategies:

- Use the Service's brochure, "Increasing Wood Duck Productivity," to help guide Wood Duck management activities on the refuge.
- Recognize importance of suitable natural cavities and favor those tree species most likely to develop suitable cavities, namely older trees with longer growth periods, in forest management practices.
- Maintain quantity and quality of beaver ponds, emergent wetlands, scrub-shrub wetlands, and greentree reservoirs as feasible for the benefit of Wood Ducks and other duck and waterbird species, and appropriately maintain and enhance these habitats for breeding, nesting, and brood-rearing where feasible.
- As appropriate, consider developing greentree reservoirs to provide inundation of suitable forest sites during late fall and winter periods. Mimic natural flooding regimes, and timely drawdowns to maintain vigor of trees.
- Properly install and maintain Wood Duck boxes as needed.
- Meet refuge pre-season (July 1 – September) banding quotas.

Wapanocca NWR Objective 1-3: Shorebirds and Other Wetland Bird Species

Annually provide approximately 750 acres of shorebird foraging habitat for high-priority shorebirds and other wetland bird species during nesting and migration periods to contribute to the objectives as set forth in the U.S. Shorebird Conservation Plan, Lower Mississippi Valley/West Gulf Coastal Plain Shorebird Management Plan, and by the LMVJV.

Discussion: Little Blue Heron and King Rail are high-priority focal species for the Service that occur on the refuge strictly in wetland habitats. For these and other wetland-dependent bird species, adequate water levels, including appropriate fluctuations in the lake, lake marshes, and forested wetlands will be important for these species. This suite of species, which also includes Great Blue Heron, Snowy Egret, American Bittern, and numerous shorebirds, such as Least Sandpiper, Solitary Sandpiper, and Greater Yellowlegs, requires a diversity of habitats for nesting and foraging, such as mudflats and shallow water, areas of tall, emergent marsh vegetation, and bottomland hardwood forests.

Additionally, several of the moist-soil sites should be capable of hosting numerous shorebird species that require shallow wetlands or mudflats during late summer and early fall. Management of moist-soil units for a wide range of waterbirds (herons and egrets) and shorebirds (sandpipers, plovers) should not interfere with waterfowl habitat objectives.

King Rails prefer areas with a moderate percentage of tall, emergent marsh vegetation mixed with areas of open water, areas of dry ground, and mudflats. In some cases, these conditions can also be provided in moist-soil units, although vegetation and bird response should be closely monitored to assure that refuge objectives are being met and that the unit does not succumb to encroachment of woody plant species.

Little Blue Herons prefer shallow water areas for forage sites, including lake edges, moist-soil management units, and button bush swamps. Nesting usually occurs in young trees, such as willow or cottonwoods, and herons nest in colonies, sometimes with other species, such as Snowy Egrets or Black-crowned Night Herons.

A large Great Blue Heron/Great Egret rookery is often located in cypress trees north of the lake. Such rookeries should be afforded a sanctuary setting during nesting and brood-rearing periods in early spring and summer to minimize human disturbance.

Strategies:

- Manage water levels, as feasible, in impoundments and other wetlands to provide some shorebird and marshbird habitats during late summer and fall.
- Manage at least one moist-soil impoundment annually for shorebird use (e.g., drawdowns in late summer, exposed mudflats) and rotate that unit among others over time as appropriate.
- Utilize lake drawdowns to produce mudflats for shorebird use on a periodic basis, such as on alternate years or every 3 to 4 years.
- Develop a capacity on some moist-soil units to provide for water depths of 8 to 10 inches in late summer on those sites with larger emergent vegetation, to provide habitat for King Rails if feasible.
- Identify wading and waterbird rookeries on the refuge and minimize disturbance to these areas during nesting and brood-rearing periods, using signage or other markings.

Wapanocca NWR Objective 1-4: Forest Breeding Birds

Enhance the hardwood forestland complex to attain the desired forest conditions as described in the report *Forest Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat (2007)*, as appropriate to fulfill refuge purposes.

Discussion: In many areas of the MAV, minimum forest block size, forest fragmentation, and poor stand quality are issues affecting forest breeding birds. Due to Wapanocca NWR's relatively small size and the amount of adjacent farmland, the refuge is limited in its ability to provide a large, contiguous forest block. However, forest stand quality can be improved using appropriate silvicultural treatments. Many forest birds depend upon dense understory and ground vegetation for nesting and foraging. Thus, desired future conditions in much of the existing mature forest stands would emphasize increasing structural diversity by providing a more open overstory canopy, allowing sunlight to reach the ground and stimulate increased ground and understory cover.

To provide benefits for various priority forest birds, forest stand treatments should: (1) Encourage development of emergent trees that rise above the predominant forest canopy; (2) retain large diameter class trees; (3) provide large standing, dead, or dying trees; (4) contribute coarse woody debris to the forest floor; and (5) retain small diameter cavity trees.

Overall, the refuge will aim to sustain a functioning, mature hardwood forest, with such characteristics as a canopy diverse in height and structure, containing some canopy trees greater than 50 cm dbh, and exhibiting 60-80 percent closure in the mid-story, which will allow penetration of sunlight to the forest floor to stimulate regeneration of shade-intolerant species.

The refuge's current size is insufficient to meet many of the objectives associated with area-sensitive non-game bird species. Therefore, additional land acquisition is recommended to provide a 10,000+ acre refuge that includes a forested corridor connecting with the existing forests along the Mississippi River. The refuge should initiate the acquisition of lands associated with Ditch 8 and Wapanocca Bayou, as previously identified, then pursue additional land acquisition to create a forest block of sufficient size to support area-sensitive forest birds.

Strategies:

- Develop and implement a forest management plan that incorporates guidelines found in LMVJV's report, "*Forest Restoration, Management, and Monitoring of Forest Resources in the Mississippi Alluvial Valley: Recommendations for Enhancing Wildlife Habitat*," in order to improve forest stand quality, with emphasis on providing sufficient understory and tree regeneration.
- Implement stand treatments that would produce forest openings of 1/2 to 2 acres to fully stimulate regeneration and promote understory structure.
- Encourage development of some super-dominant trees in each stand (large trees rising above the predominant forest canopy).
- Retain some dead/dying trees and maintain some cavity-forming specimens (i.e., large and small diameter cavity trees that exhibit potential to form cavities).
- Monitor bird responses to habitat treatments and adjust management actions as necessary to achieve objectives (adaptive management).

Wapanocca NWR Objective 1-5: Scrub-shrub or Early Successional Birds

Annually provide approximately 1,000 acres of suitable habitat to satisfy the annual life cycle requirements of birds designated as high priority in the MAV (Bird Conservation Region 26) associated with scrub-shrub or early successional habitats.

Discussion: Due to the amount of reforestation that has taken place at Wapanocca NWR over the past decade, a substantial acreage of early successional habitat is currently being provided that benefits priority scrub-shrub breeding species. In time, most of these reforested sites will succeed to more mature forested stands. However, buffer strips along forest edges and crop fields, as well as narrow corridor linkages between forest blocks, can be managed as scrub-shrub habitat.

Population data for non-game birds are limited for many MAV refuges. However, Wapanocca NWR has been fortunate to have had a volunteer, since 1999, that conducts breeding bird point counts each year during early summer. Survey points are located in the three refuge habitats types.

Strategies:

- Determine and provide the most beneficial combination of agricultural, grassland, scrub-shrub, and moist-soil habitats feasible to meet the needs of early successional bird species.
- Promote scrub-shrub and grassland habitats through use of mechanical, chemical, and prescribed fire techniques.
- Maintain early successional buffer strips along some forest edges and borders of crop fields to benefit bird species favoring this habitat condition.
- Maintain scrub-shrub corridor linkages between forest blocks.

Wapanocca NWR Objective 1-6: Grassland Birds

Annually provide habitat for grassland birds designated as high priority in the MAV (Bird Conservation Region 26) through management of up to 265 acres of grasslands consisting of warm season bunch grasses and native forbs.

Discussion: Although management for grassland birds is not a priority at Wapanocca NWR, some breeding species (e.g., Dickcissel, Eastern Meadowlark, Northern Bobwhite Quail) and some winter species (e.g., Henslow's Sparrow, Sedge Wren, LeConte's Sparrow, and Northern Harrier) will benefit from provision of this habitat in larger blocks (e.g., 25-100 acres). In areas where it is feasible and does not compete with reforestation efforts, agricultural areas that are underutilized by wintering waterfowl should be converted to native grasses and forbs.

Conversion should not result in weeds that characterize idle agricultural land, but should involve an intentional planting of warm season bunch grasses (e.g., little bluestem, Indian grass) and a large component of native forbs. These grass-forbs areas will require periodic disturbance (mowing or burning) to maintain vigor.

Land parcels that are isolated from existing forest habitat (e.g., some Farm Service Agency tracts) may be suitable for development and maintenance of additional grass-forbs habitat, unless implementation of these practices would create a habitat sink. These areas could be planted heavier to grasses and as a result may be more beneficial to birds breeding or wintering in grasslands.

Strategies:

- Provide up to approximately 265 acres of grassland habitats dominated by native grasses and forbs by converting underutilized croplands to grasslands.
- Manage grassland habitats by various methods, such as mowing, burning, or herbiciding, to create suitable nesting and foraging conditions for priority grassland bird species for Bird Conservation Region 26.

Wapanocca NWR Objective 1-7: Wildlife Species and Plant Communities of Concern

Conserve and protect habitats that support and sustain rare species and special plant communities, and enhance such habitats where feasible.

Discussion: Almost 80 percent of the bottomland forests of the MAV region have been converted to other uses, primarily to agriculture. Much of the region's remaining forests are scattered and fragmented into small blocks that often reduce the capacity of the landscape to support many species

of wildlife. It is important that the remaining forests are conserved and managed to allow continual regeneration of tree and plant communities supporting native wildlife species. The refuge's bottomland forests are indeed special habitats that need to be sustained, enhanced, and expanded.

The only rare plant species known to occur is the water spider orchid that requires water to be held in the Ditch 8 former channel to ensure its survival. A more in-depth botanical survey of the refuge may yield additional rare plant species. Other historical plant communities still occurring on the refuge that could be enhanced are switch cane and river cane. These cane communities are used by several bird species of concern, including Swainson's Warbler, Hooded Warbler, White-eyed Vireo, and American Woodcock.

Wapanocca NWR is used by several bat species including Rafinesque's big eared bat, southeastern bat, and the Seminole bat. Additional surveys for these mammals, plus appropriate forestry management practices, should help better document their occurrence and identify suitable habitats to be maintained. Rare avian species that use the refuge include the Interior Least Tern that prefers sandbars, and the Bald Eagle that nests in larger trees.

Extensive surveys for reptiles and amphibians have not been conducted on the refuge. Wapanocca NWR participated in the 2005-2006 survey for malformed amphibians. More than 1,000 frogs and toads were sampled and 23 were considered abnormal, mostly due to injuries. Additional surveys for reptiles and amphibians should be conducted to better understand how the refuge is being used by this wildlife component.

Strategies:

- Actively manage the refuge's bottomland hardwood forests to enhance conditions for species and communities of concern. Appropriate methods may include silvicultural harvests, reforestation, and protection from excessive flooding and siltation.
- Obtain baseline data on water quality in refuge streams and ditches, and identify any necessary restoration efforts.
- Inventory key stream, ditch, or canal areas for mussel inhabitation.
- Initiate baseline inventories for vegetative communities, reptiles and amphibians, and small mammals.
- Locate cane communities and create openings in the forest canopy to allow more sunlight to reach such sites to support and enhance these floral components.
- Investigate techniques to establish cane by plantings (if feasible, establish several cane experimental/demonstration plots).
- Monitor water spider orchid habitats and ensure the proper water conditions necessary for their survival.
- Continue locating Bald Eagle nests and primary foraging areas, and protect such sites from disturbance activities as necessary.
- Inventory bat populations and implement measures to improve or maintain favored roosting, maternal, and feeding habitats.

Wapanocca NWR Objective 1-8: Resident Game Species

Provide a mosaic of open lands (e.g., agriculture, grasslands, scrub-shrub, and reforested sites), incidental to habitat management for trust species, to complement mature forested habitats and sustain healthy populations of resident game species.

Discussion: Wapanocca NWR contains a diversity of habitat types, such as forest, open land, scrub-shrub, and farmland, that host a variety of game species. The primary game species of public interest are white-tailed deer, squirrel, rabbit, quail, doves, turkey, and several furbearers. Many of these thrive in early successional habitats interspersed with mature forests.

Strategies:

- Maintain and enhance habitat conditions that incidentally benefit resident game species by implementing the following practices:
 - Maintaining brushy borders along several large agricultural fields and/or ridge portions of some ridge-swale sites to provide additional small game habitat;
 - Conducting silvicultural operations (harvest) that enhance conditions for hard mast-producing trees;
 - As appropriate, reducing forest basal area through group selection cuts to ensure oak regeneration and to improve crown size/mast production;
 - When reforestation is undertaken, utilize a mix of species including hard and soft mast-producing trees if necessary to ensure a diverse mast supply.
- Coordinate harvest reporting with AGFC and determine if a need exists to collect additional data and what staff capabilities would be required to obtain such information.
- If in-the-field hunter checks are needed for harvested deer, consider use of university students or interns to obtain age/weight data.
- Continue deer spotlight surveys with the assistance of volunteers or local universities.
- Work with SCWDS to determine need for and perform deer herd health checks (every 4 to 7 years).

Wapanocca NWR Objective 1-9: Wildlife Investigations, Inventorying, and Monitoring

Within 5 years of the date of this CCP, prepare and implement an Inventorying and Monitoring Plan that will improve and expand investigations, inventorying, and monitoring of the refuge's fauna to obtain sufficient baseline data to inform management decisions, determine if management objectives are met, and enable adaptive management.

Discussion: The Improvement Act formally establishes the necessity of monitoring the status and trends of fish, wildlife, and plants on national wildlife refuges. Service policy is to collect baseline information on key plants, fish, and wildlife to monitor, as resources permit, critical parameters and trends of selected species and species groups on and around Service units, and to base management on biologically and statistically sound data derived from such inventorying and monitoring (701 FW 2, Inventorying and Monitoring of Populations).

Monitoring, inventorying, and surveying (MIS) are very important means for scientifically managing trust wildlife populations and habitat, as well as meeting national, regional, and refuge goals. Before any MIS is started, the surveyor should seriously and honestly determine if: (1) Objectives, which are clear, specific, and measurable, are defined and can be practically met; (2) the results will actually be used to benefit the resource or make informed decisions; (3) quality and quantity of data needed to meet the objectives can be collected; (4) the MIS methodology is scientifically and statistically sound; (5) the costs of conducting the MIS are worth the results; (6) resources are available or will become available to complete the MIS; (7) the method of data analysis is pre-determined; and (8) MIS is prioritized so if resources become limited, then more critical MIS will be conducted.

Adaptive management is a system used by refuge managers to improve results by documenting management actions, measuring and documenting biological responses, and adapting (modifying) management actions to improve desired conditions/outcomes and determine if objectives have been met. Baseline inventorying and population monitoring at regular intervals provide data essential for informed decision-making by refuge managers and are fundamental for adaptive management. Inventorying and monitoring needs can often be met with the assistance of other Service programs and cooperative efforts with state resource agencies, universities, and USGS. Proper attention must be given to experimental and monitoring design, statistical procedure, and consistency in observation and data collection.

Inventorying and monitoring efforts for adaptive management purposes should be expanded to include additional refuge resources that lack sufficient baseline data such as reptiles, amphibians, bats, and mussels.

Strategies:

- Increase the biological capability of the refuge by adding a biological technician to conduct surveys, assist with monitoring and research programs, and perform other wildlife/habitat management activities.
- Prepare and implement an Inventorying and Monitoring Plan in accordance with Service guidelines to improve basic biological information on occurrence and distribution of fauna on the refuge.
- Cooperate with AGFC, other agencies, universities, and Service offices/programs (e.g., Ecological Services, Fisheries, Migratory Birds) to initiate specific inventorying and monitoring of wildlife and associated habitats on the refuge, including priority bird species for BCR 26, American Woodcock, reptiles and amphibians, and occurrence and habitat use of bats, mussels, fish, and aquatic macroinvertebrates.
- Perform contaminant studies (fish, sediments, water, and macroinvertebrate tissue sampling), particularly in Big Creek/Ditch 8 and recommend any necessary remediation.
- Improve waterfowl inventory and survey efforts, in cooperation with AGFC, by:
 - Standardizing ground and aerial waterfowl survey routes to be performed at least monthly starting in late October through early March,
 - Reporting waterfowl species numbers by units within the refuge, using the same waterfowl routes and times of day,
 - Ensuring funds are available for contracting with AGFC to provide monthly surveys conducted in conjunction with their regular nearby surveys, and
 - Performing aerial surveys of the refuge at least once during coordinated statewide mid-winter inventory.
- Increase knowledge of priority bird species for the MAV (BCR 26) and their responses to associated management practices by:
 - Coordinating with the Service's Division of Migratory Birds and other ornithological specialists to design and implement bird monitoring procedures that provide population status and trends information and nest productivity data,
 - Conducting point counts across major habitat types on the refuge during passerine nesting season (about May – June),
 - Conducting a series of randomly located roadside counts that survey typical habitats surrounding the refuge, within a 30-mile (50 km) circle around the refuge, if feasible,
 - Conducting a series of transects or block area searches for migratory birds during non-breeding seasons,

-
- Monitoring known heron rookeries on the refuge for species composition, number of nesting birds, and nest production, and
 - Using information derived from these actions to guide management for priority species at the refuge to contribute to ecoregional, regional, and range-wide population initiatives.

HABITAT MANAGEMENT

Wapanocca NWR Goal 2: Protect, restore, and manage the functions and values associated with diverse bottomland hardwood forest and open wetland systems in order to achieve refuge purposes, wildlife population objectives, and to benefit migratory waterfowl and other native wildlife.

Discussion: Refuge habitats are no longer part of a larger natural ecosystem that was once characterized primarily by: (1) Bottomland forests which were often inundated for frequent periods of time by the Mississippi River; and (2) periodic flooding actions of adjacent creeks and streams. Today, the refuge is essentially surrounded by agricultural lands, and its major sources of water within the watershed have been modified by drainage projects and leveeing of key streams, including the Mississippi River.

Historically, the Mississippi River played a major role in the formation and function of what is currently Wapanocca Lake. The lake is now an oxbow lake formed when the Mississippi River main channel changed its course. Currently, Wapanocca Lake is essentially cut off from a watershed that is required to periodically flush and refill the lake. Today, rainfall has become a main source of lake water, but there is not enough water to flush the lake of nutrient build-up or to more closely simulate the periodic water regimes most conducive to perpetuating a diverse bottomland forest and adjacent cypress/willow swamp habitats. The role of the lake in providing critical waterfowl habitat cannot be overstated. The emphasis on water level management should be directed toward providing maximum waterfowl habitat in order to achieve refuge purposes. This will require a shift in philosophy by refuge management and the public from the past practice of managing lake levels for maximum fishing opportunity to managing for waterfowl as its first priority.

Wapanocca NWR Objective 2-1: Moist-Soil Habitat Management

Increase the current quality of managed moist-soil habitat on 200 acres to annually produce > 500 pounds of seeds/acre or > 50 percent coverage of desired moist-soil plants (e.g., wild millet, annual smartweed, sedges, panic grass) that will provide approximately 373,600 DEDs of waterfowl foraging habitat and meet the LMVJV forage objectives.

Discussion: The refuge should attempt to maintain 175-200 acres in high-quality moist-soil habitat, producing at least 500 pounds/acre of preferred seeds or at least 50 percent cover of desirable moist-soil plants. Unless intensively managed, moist-soil units will be of questionable value, dependent mostly on unpredictable and variable yearly weather conditions. The refuge should implement intensive management through timely water level manipulation to provide suitable foraging conditions for waterfowl, shorebirds, and other native wildlife, disking units at least every 3 years in a rotational system among units, use of wells (if feasible) to supply needed water, and weekly monitoring of results. Properly managed moist-soil areas will complement agricultural crops by increasing the quantity and diversity of plant and invertebrate foodsources for the benefit of a wide variety of waterfowl and other wildlife.